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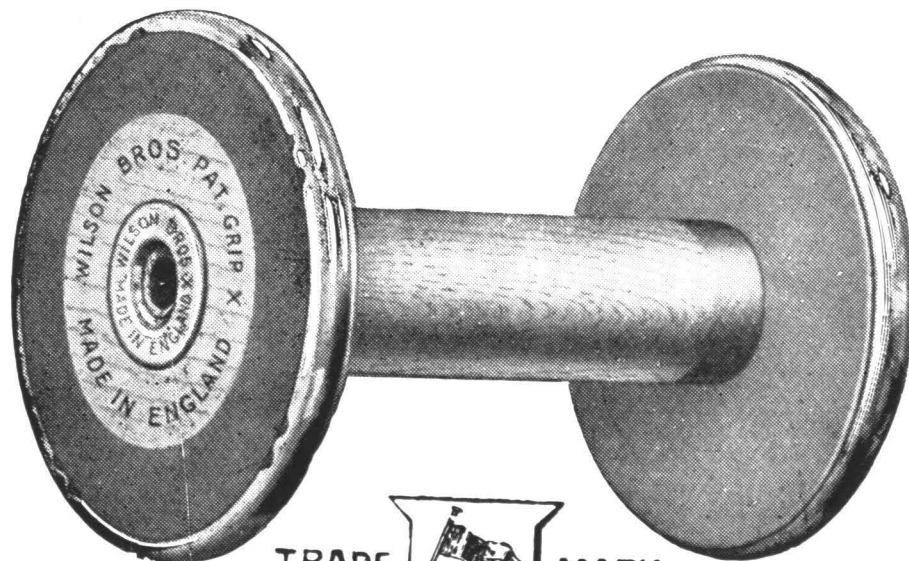
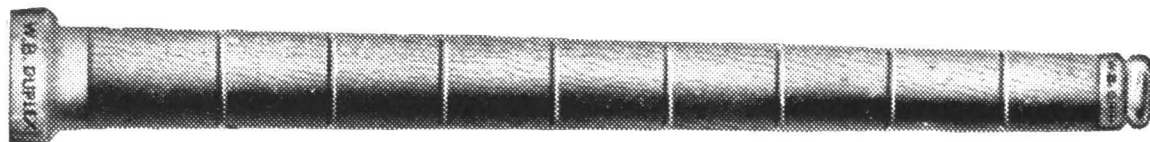
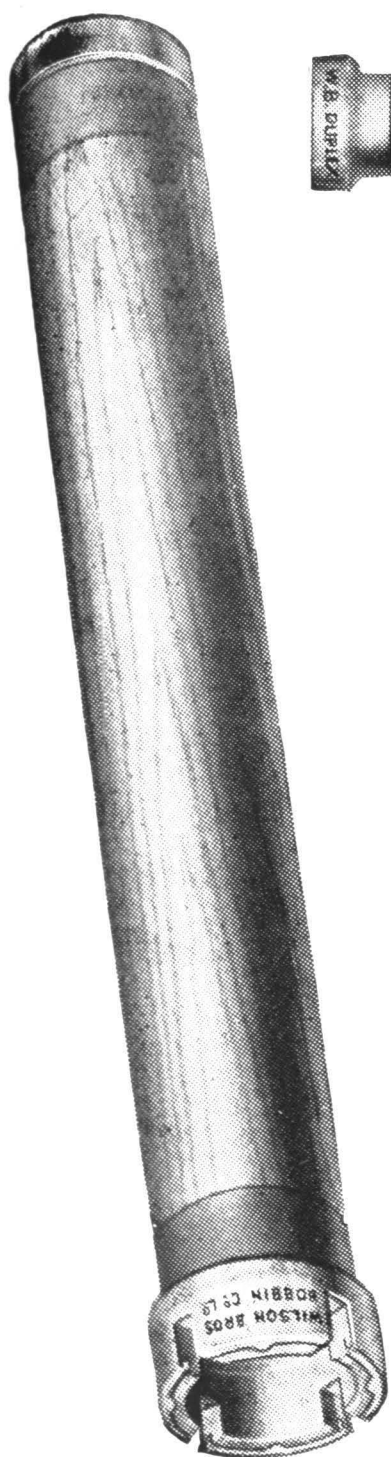
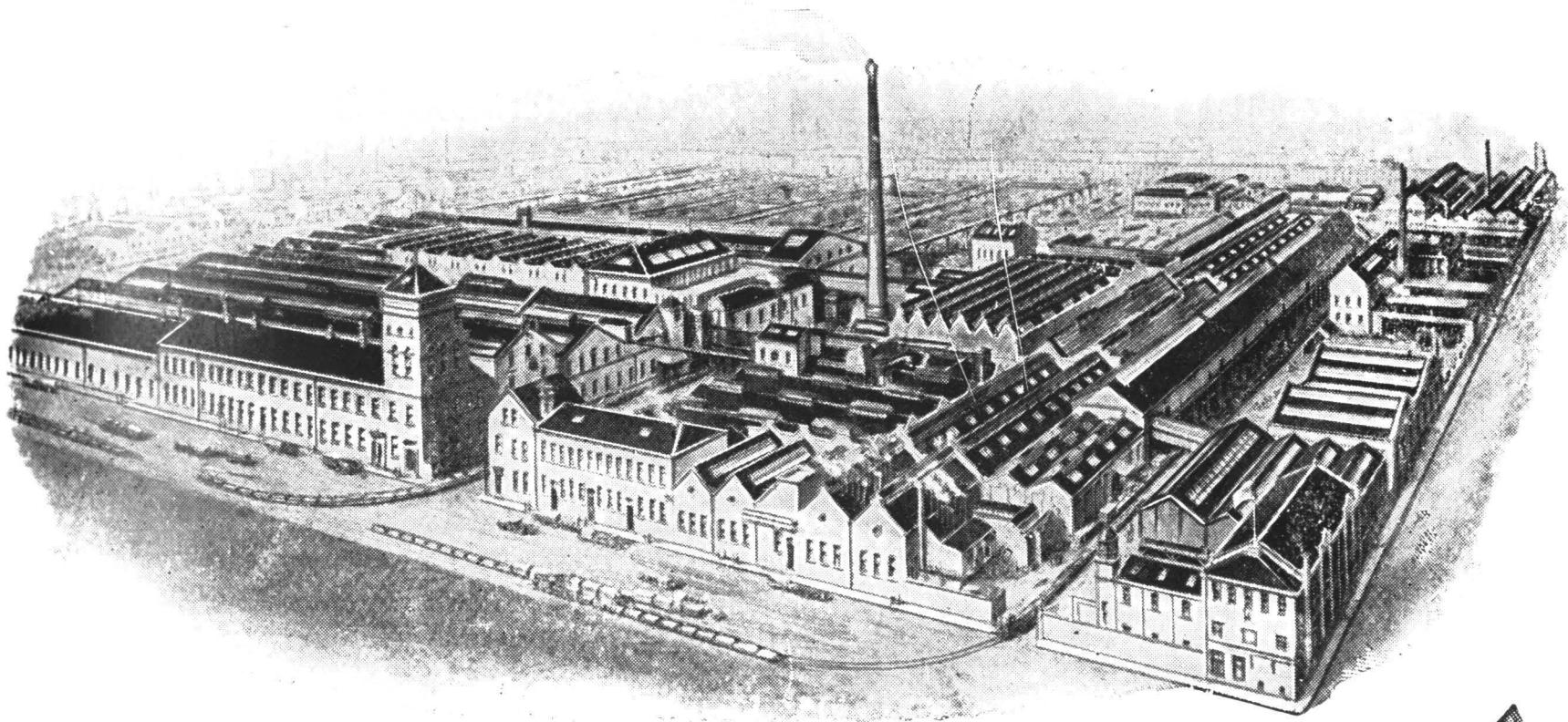
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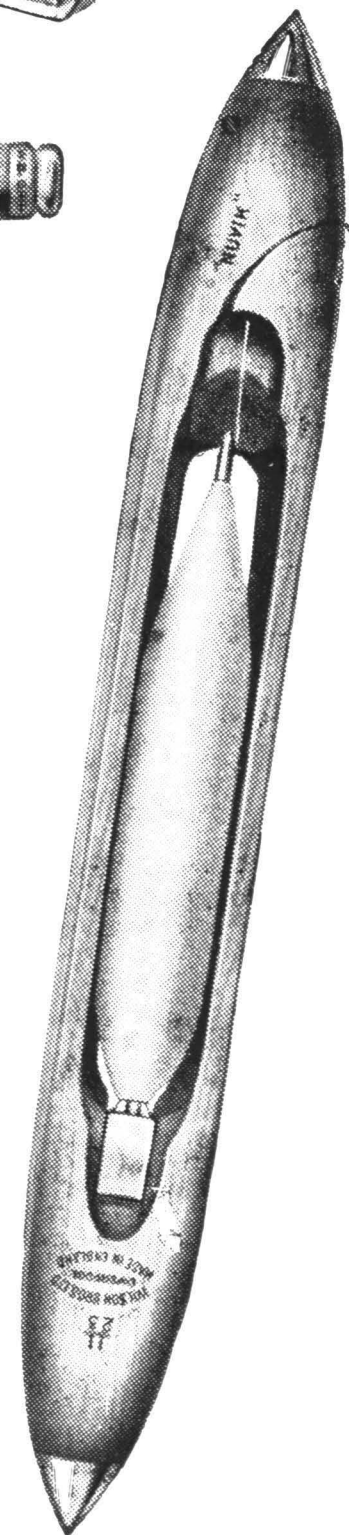
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NOTICES—INSTITUTE MEETINGS

- Tuesday 5th June *Manchester*—3 p.m. Meeting of Publications Committee, at Institute.
- Wednesday 6th June *Manchester*—3 p.m. Meeting of Selection Committee, at Institute.
- Wednesday 20th June *Bradford*—3 p.m. Meeting of Council, preceded by Finance and General Purposes Committee, at Technical College.

Institute Examination

- Wednesday 13th June Examination Part I (Auxiliary Subjects), at Manchester.
- Wednesday 20th June Examination Part II (General Textile Technology), at Manchester, Nottingham, Dunfermline, Belfast; Quebec, Canada; and Calcutta, India.

CONFERENCE REPORT

Grange-Over-Sands May 1934

The papers read at the Annual Conference will appear in full in the June issue of this Journal and no other official record has been authorised.

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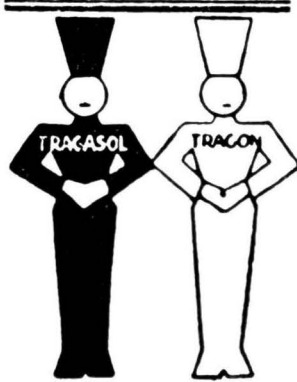
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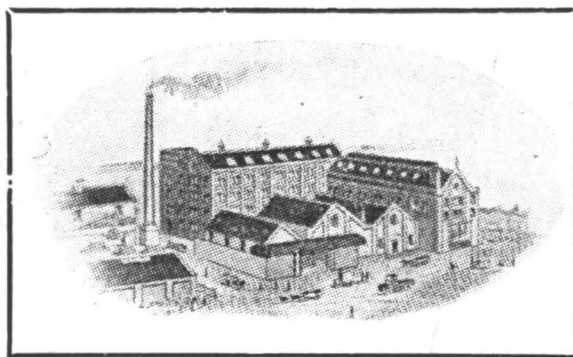
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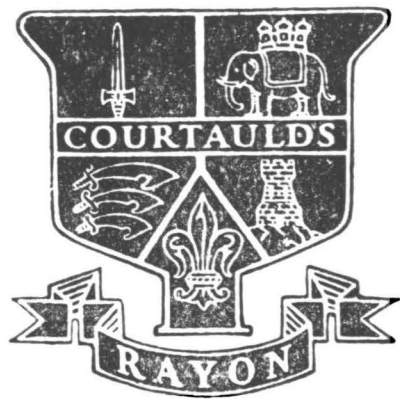
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THE JOURNAL OF THE TEXTILE INSTITUTE

Vol. XXV

MAY 1934

No. 5

PROCEEDINGS THE MATHER LECTURE

INDUSTRIAL LEADERSHIP

BY A. P. YOUNG, O.B.E., M.I.E.E., M.I.A.E., F.I.I.A.

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SECTION 1—A SURVEY OF THE PAST

1—Foreword

Life is a great adventure in which a few restless spirits are more venturesome than the many. And history seems to show that the courage and vision of the venturesome minority has made the adventure worth while for the great majority. The spirit of adventure is as old as life itself. In the dim distant past, separated from the present by æons of time—Sir James Jeans puts it at 300,000 years at least—this spirit never ceased to urge the small band of humans forward along the tortuous path of uncertain existence. Through countless generations this impelling and divine urge just enabled the human race to maintain a balance favourable to life and continuity, in an amazing combat with the forces of nature. Thus at last our progenitors brought the struggle to the point of time which marks the beginning of the era of recorded history—a mere speck on the time chart measuring the prolonged process of human evolution on this planet.

In glancing at this dim but miraculous picture of human turmoil and strife through tens of thousands of years, we can in imagination discern the slow development of the power of Leadership—that ever dominant and controlling force which influenced families, tribes and ultimately nations, to overcome all obstacles which hindered living and growth. It energised a ceaseless striving to reach a higher state of existence. The dynamic power of which I speak originated, in primitive ages, within the family circle, being embodied in the parents who fed and protected their young. The offspring obeyed mainly through fear—fear of their parents, and fear of hunger, cold, cannibals and wild beasts. H. W. Nevinson in a fascinating little book entitled “The Growth of Freedom” which was written just before the war, says—

“In the prehistoric family various forms of authority must have existed in germ, and to-day, even in the most primitive species of mankind, we cannot discover or imagine human life coming to maturity without them.”

The primitive families of that distant age naturally developed into tribes, to aid them in their struggle for food and safety. Leadership of the tribe automatically went to the member who was strongest and best able to lead the tribal forces in battle with other tribes, and to defend them from attack. When victorious, he was joyfully endowed with special honours in keeping with the primitive conditions of the age. With the passing of time the sceptre and the crown appeared, and Kingship was at last created.

Thus we can picture the growth of the power and prestige of the Leader over a time-span stretching far back into unrecorded history. Many great Leaders of whom we know much strode across the world stage of recorded history, but for the most part they were leaders of war and conquest. Because the spirit of their leadership partook of the spirit of the age in which they lived; an age characterised by two dominant forces—the force of scarcity and the force of slavery. But even so, our twentieth century civilisation owes much to these Leaders—to men like Alexander the Great, Julius Cæsar, and Charles the Great, to mention only three towering leaders of men, to illustrate this point. F. A. Wright in an entrancing life story of Alexander the Great, recently published, says—

“Alexander was the fine flower of Greek civilisation. . . . The effect of his conquests in widening the horizon of men’s minds can only be compared to the discovery of America in the fifteenth century. . . . To Aristotle he owed much, but he went far beyond his master when, casting aside the distinction between Hellene and barbarian, *he boldly proclaimed the universal brotherhood of man.* From that declaration of faith much was to follow in coming ages, and in the countries which he conquered and organised, Christianity found the soil already partly prepared.”

Be this as it may, I believe that our future civilisation will owe a greater debt to the thinkers and religious teachers of that era when the Eastern Basin of the Mediterranean was the centre of inspired thought and human activity, than to those titanic war leaders and Empire builders whose exploits form the backbone of history. The profound philosophical thinking of Plato and Aristotle still has a

message for those now living. And as we travel through this century the divine teaching of Christ must have an ever-increasing influence for good on human life and progress, if our civilisation is to endure.

2—The Growth of the Scientific Era

Now this spirit of adventure inherent in man may lead either to great achievement or to great disaster. In any event it is inseparable from great risk. When that little band of adventurers, to whom we owe so much, marched boldly forward to explore that immense and uncultivated region where the methods of scientific thinking and inquiry have their habitation, no one could have foretold of the wondrous achievements, or of the appalling disasters, or of the tremendous risks which would be encountered on the journey into the unknown.

There were great scientific thinkers in Ancient Greece, notably Archimedes, whose meditations were the genesis of the science of hydrostatics, and Thales, whose researches with amber started the science of electricity on its beneficent career. But no real scientific progress was made until the thirteenth century when Roger Bacon initiated that era of exact scientific inquiry and analysis which is now unfolding itself—after a lapse of nearly 700 years—with such astonishing and disturbing rapidity.

The banner of scientific progress once unfurled was never lowered. As the centuries rolled by many pioneer workers in many lands gave their allegiance to the great cause which it signifies. Little headway was made until the period of the Renaissance when the increased political stability and improved conditions of living created an atmosphere favourable to real and substantial progress. Thus we can picture the banner being held high by Dr. Gilbert, Francis Bacon, Galileo, and Sir Isaac Newton in the sixteenth and seventeenth centuries.

During the eighteenth century, the aspirations of those who had struggled to keep aloft and unsullied this banner of progress were fulfilled. New followers in many countries were attracted to the colours, and the few stragglers were expanded into a disciplined company—the first unit of that vast international army of scientific investigators which is now blazing the trail of human advancement. In America there was Benjamin Franklin, whose researches on the nature of electricity were of outstanding importance, whilst in Italy, Galvani and Volta were also engaged in unravelling some of the mysteries of the electrical era. In England, the great Henry Cavendish was holding aloft the scientific name of England by his pioneer work as a chemist and physicist. And nine years before the century closed the immortal Michael Faraday was born. His subsequent labours made the scientific prestige of England tower above all nations in the first half of the nineteenth century, and his major contribution opened wide the door to the electrical era.

3—The First Industrial Revolution

In the latter part of the eighteenth century, the Industrial Revolution began in England, and the members of this great Institute whom I have the honour to address, must derive stimulus and encouragement from the reflection that the hand of destiny chose Lancashire as the birth-chamber of this new era. This epoch-making occurrence resulted from the fusion of two progressive impulses—one directed to improving the machinery used in the cotton trade, and the other seeking a power unit which could drive the machines.

In 1767 James Watt invented the steam engine and made available to mankind for the first time in human history a power-machine for doing work hitherto done by man and beast. This was a great event, because his engine found immediate application in many directions; but more important still, it gave to the human race the vision of an era when power-driven machines could do the work of the world. Contemporaneously with this progressive movement in the use of mechanical power there was a flood-tide of creative thought in the Textile Industry directed towards improving the mechanisms of production. Richard Arkwright and James Hargreaves had taken out important patents in 1769 and

1770, whilst ten years later Samuel Crompton made public his invention of the spinning mule when only 27 years of age.*

Many years elapsed before this power-driven mule became absorbed in the factory system, but Arkwright was quick to perceive the significance and value of Watts' invention, and designed his machines so that they could be power driven. Richard Arkwright also organised the whole process of transforming the raw cotton into yarn, so that the use of his machine started the factory system in the cotton industry. Thus did the industrial revolution begin towards the end of the eighteenth century. Industry has never ceased to evolve and revolve during the past 150 years. Indeed the process of evolution has been so speeded up since the beginning of this century that it has produced by its reactions, within very recent times, a second industrial revolution in which we are completely engulfed.

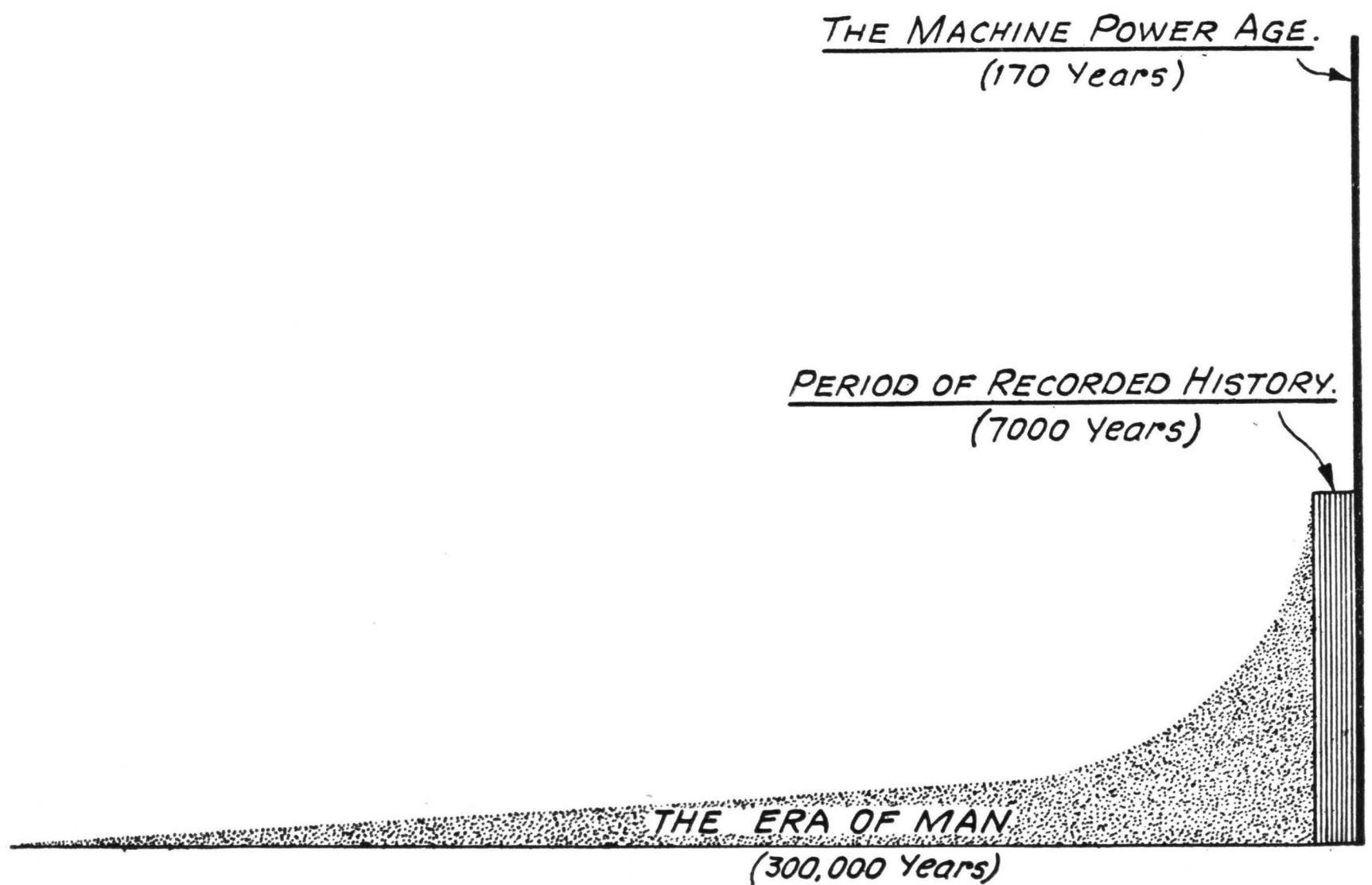


Chart showing short duration of Machine Power Age in relation to the prolonged ERA OF MAN.

FIG. 1

4—The Machine-Power Age

During the past three decades, the age of power-driven machines has received enormous impetus from the phenomenal evolution of the electrical art. In the short time-span of just over six generations, the age of power-mechanisation has produced an amazingly complex industrial structure which is now intimately interwoven into our daily lives. It is desirable, when analysing a difficult problem, to view it in right perspective. In this spirit let us glance at the diagram in Fig. 1 which shows the present machine-power age (of 167 years duration) on a time chart in proper time-relation to the period of recorded history (7,000 years) and to the much greater time span (300,000 years) measuring approximately the duration of human life on this planet. The striking fact revealed by this diagram is that the period of mechanised industry corresponds to a thin line at the end of the time chart—a line actually covering something less than $\frac{1}{2000}$ of the total time cycle !!

* See "Industrial Lancashire prior and subsequent to the invention of the mule", by G. W. Daniels, M.A., M.Com. (Mather Lecture, 1927).

It is interesting to reflect that up to the beginning of the mechanised industrial era, the chief characteristics of human life were—Scarcity, Strife, and Slavery. With the advent of the power-driven machine, democracy was born and humanity entered a new era leading ultimately—as has happened in very recent times—to the potential displacement of scarcity by plenty. Almost coincident with the birth of this new age, the slavery of man to man received its final deathblow mainly through the Methodist movement. A. N. Whitehead in his “Adventures of Ideas”—one of the greatest books of recent times—says—

“They (the Methodists) made the *conception of the brotherhood of man, and of the importance of men a vivid reality*. They had produced the final effective force which hereafter made slavery impossible among progressive races.”

Thus for a relatively brief period, there has been a wonderful transformation in the dominating characteristics of human affairs. The era of Scarcity—Strife—Slavery is being replaced by an era of Plenty—Democracy—Freedom. This transformation in the moulding forces of our civilisation illustrates the natural slowness of the fructification of progressive ideas. Again quoting A. N. Whitehead—

“So modern Democrats, in the nineteenth century, nerved themselves to face the question of slavery, explicitly and with thoroughness. . . . Two thousand years had elapsed since the foundation of Plato’s Academy, since the reforms of the Stoic lawyers, since the composition of the Gospels. The great programme of reform bequeathed by the classical civilisation was achieving another triumph.”

I dwell on this tremendous change in the conception of human values—a change which practically coincided with the beginning of the industrial machine-power era—to emphasise a vital consideration. With the termination of the era of man’s slavery to man there began a new epoch of machine-power industrialisation in which man became in large measure a slave to the machine. This condition still exists, and one of our immediate problems is to release man from this bondage, by bringing the working and control of the machine into subjection to those divine impulses of the human mind and spirit which alone can direct the faltering footsteps of humanity along the path of peace and enlightenment.

The task is hemmed in with great difficulties arising chiefly from those traditional forces which are now supporting—whether we like it or not—the present state of society. A solution can only be found by a process of evolution, hastened, maybe, by the application of stimulating but intelligent thought and action. In working out our economic salvation we shall have to project a new mental outlook on to this intangible, but highly valuable, possession which we call democratic freedom. In a phrase, it must suffer a kind of metamorphosis in sympathy with the tremendous transformation in human affairs which is now being experienced as we move, somewhat abruptly, from the prolonged age of scarcity to the new and “still-born” age of plenty.

SECTION 2—THE DAWN OF A NEW ERA

I have hastily sketched a picture of past events to provide a background, and to create an atmosphere, both in harmony with the approach I desire to make to my main theme. At this vital moment in human history all peoples are seeking to secure greater contentment of mind and spirit, and improved material conditions. The national battalions marching steadfastly along their separate paths of evolution have suddenly discovered that the magic influence of the scientific mind has caused a confluence of the many paths on to a broad highway leading to a common goal and purpose. The national battalions have now become units in an international army. It is the supreme duty and responsibility of leadership to ensure that this army can march with triumphant joy, both of body and spirit, along the ever widening road of world progress and mutual service.

Leadership has been defined as “the quality of getting things done, not by the whip of external compulsion, but by the engendering of an inner urge and willingness on the part of others to do it.” A pioneer in that vast realm of creative thought which permeates, inspires, and ultimately directs the impulse to human progress

is not necessarily a leader in the sense of this definition. He is usually a teacher, a preacher, a poet, a writer, or as has happened in more recent times, a scientific thinker and investigator. On rare occasions some of these great pioneers have possessed the faculty of leadership; but in the main, theirs has been the privileged task of creating a current of thought which others, endowed with powers of direction, could utilise to propel the ship of human progress into the ever widening reaches of contentment and service.

But the qualities demanded of leadership are rapidly changing, now that we have reached the threshold of a new era that must come as the industrial revolution passes through its second twentieth century phase. The leadership now required to direct human affairs must partake of those inspired faculties which have animated the past pioneers of creative thought, and this intangible quality must be combined with executive power which is able to generate and maintain a co-operative movement of human activity towards an enlightened goal of achievement.

The immediate task of leadership is to consolidate the position now reached; and in the process of consolidation it must give impetus to those ideas and ideals which are capable of erecting on this foundation a structure of human society that will allow the energising influence of the scientific mind full opportunity for expression and service. Thus—and only thus—can the machine-power age fulfil its great destiny, and secure for humanity a steady elevation of the material plane of existence in association with a growing recognition of spiritual and intangible values.

Make no mistake, we are on the threshold of a new area, and our individual and collective actions will in the years immediately ahead, largely determine what kind of era it is to be. It should, therefore, be helpful at this stage to examine those moulding forces, of mental and spiritual origin, that have induced the present state of seething flux, and which must inevitably influence the process of reconstruction just beginning. I would set them down as follows—

1—The Spread of Education and Scientific Thinking

The universal and rapid spread of education in conjunction with a sudden increase in world population which has practically doubled in the past hundred years. These immense changes have brought about a phenomenal increase in our knowledge of nature's laws and materials, and the wide application of scientific methods to all forms of human activity. The development of this trend is constantly being accelerated. In consequence of this the scientific research worker, the chemist, and the engineer have become key members of society. Their combined efforts have, through no fault of theirs, brought the world to the verge of chaos. It remains for leadership, in association with the steady growth of a social conscience, to adjust this wrong, and cause the untold benefits which can come from this sudden forward movement of scientific and technical progress to fructify for the full benefit of humanity.

2—Transportation and Radio

The great improvements in our methods of transportation on land, sea, and in the air, in combination with the radio art, have done much to annihilate distance and make the world a relatively small place. The closer human contacts thus engendered must ultimately create an atmosphere favourable to co-operative effort both nationally and internationally. The radio machine has opened up illimitable possibilities to the power of the human voice; a power that will ever remain the supreme and dominating influence in energising human contacts and creating mass action.

3—The Scientific Mind a Dominating Force

The emergence of the scientific mind as a dominating force in human affairs is speeding up all world activity. Mind intelligence is now quickly disseminated by the radio machine, and we are witnessing a steady acceleration of the complex process of translating thought into action.

4—The Demolition of Barriers

Barriers of all kinds are now being demolished by the on-rushing tide of scientific thought, and the result of this great unifying influence is to be seen in scientific, political, and religious spheres, but is yet to come, as it must, in economic realms.

(a) *Science*—The separate sciences—whether they relate to material things, living beings, or human aspirations and desires—are converging on to a common plane of thought and experimentation where there may well be evolved a universal science and philosophy. Some years ago Wilhelm Ostwald conceived for us a vivid picture of what he called a scientific pyramid “with logic and mathematics as the base; the energetic sciences—mechanics, physics, and chemistry—as the body; and with the sciences of life processes—biology, psychology, and sociology—as the apex.” This figure of the imagination was shrouded in a fog of ignorance for countless ages. It is now becoming bright and clear as a symbol of progress, illuminated by the morning light of mind intelligence radiating from the dawn of a new era.

(b) *Politics*—In the realms of politics, the partitions which have for so long divided political parties and creeds are being punctured by the growing impact, from without, of scientific progress. The formation of the National Government in 1931 was a manifestation of this trend. Political thought and action are being impelled to rationalise around the common purpose of securing a steady elevation of the human factor. And this great problem—in fact, the only problem—is seen to become one mainly of science, ethics, and religion.

(c) *Religion*—In the world of religion, it is significant that Christian bodies (of different denominations) are uniting in a common desire and purpose to influence the whole process of economic and industrial reconstruction which is just beginning. The purpose of this co-operative movement is to ensure that the new edifice will be erected on an enduring foundation, constructed on the basis of those eternal truths which give life, vitality, and purpose to the Christian religion. The Christian Social Movement both here and in U.S.A. is gaining in power and influence.* I am impressed by the work which the Industrial Christian Fellowship is seeking to accomplish. Regular meetings of a mixed group comprising clergy, industrialists, and economists, are being held under the able chairmanship of the Rev. A. J. Wade-Gery to give earnest consideration to those problems which are distressing the world, in an endeavour to find a balanced and Christian solution. The fact that this body is planning to hold a conference on Economic Reconstruction next year, illustrates this unifying change† in religious outlook which I desire to stress.

5—Co-operation must Replace Individualism

There is a growing realisation that intense individualism and *laissez-faire*—guiding principles of our nineteenth century history—have completely failed. Co-operation must be the dominant note in the future, and the co-operative effort must be applied, not in the selfish interests of an individual, or of a group of individuals, or of a nation, but to broad and wide human service. Freedom of thought and conscience must remain, and nothing should be done to retard the dynamic impulse to progress which comes from individual initiative and personality. But at the same time, we must recognise that the new era just beginning will demand a mental revolution from each one of us. What we proudly call Individualism and Liberty need to be transformed in harmony with an integrated impulse to progress in the direction of the common good.

A mere recital of these seemingly contradictory objectives serves to show how extraordinarily difficult the problem is, especially in this country, where our

* See “A Christian Sociology for To-day,” by Maurice B. Reckitt.

† This trend is exemplified by the recent appointment of a religious editor by a great London daily newspaper.

highly industrialised condition is largely the result of an *unnatural* form of evolution. It all means that we must proceed cautiously, as is our wont, along the clear path of evolution. But we must show courage at times to try drastic experiments, and we should not be afraid to accelerate the evolutionary forces when the path immediately ahead seems bright and clear.

The responsibility of the British people is very great. I believe profoundly that we shall, by virtue of our rare ability and capacity for leadership, win through. We can accomplish this by first integrating those progressive forces directed towards balanced progress, which are germinating in that vast arena where there is free interplay of scientific, industrial, political, and religious thought. Then enlightened leadership, guided continually by the result of this integration, will be able ultimately to evolve a new economic and political system in harmony with true progress, still retaining that freedom of the individual human unit which is one of our most cherished possessions. The world is watching; and it may well be our immediate destiny as a nation to find a solution of this grave problem which the world will gladly copy.

6—The Gold Machine Needs Reconstruction

There is a widespread feeling that the gold machine as a monetary mechanism for interchanging services is functioning inefficiently. From many quarters there has arisen an insistent demand that the mechanism should be reconstructed so that it can work to serve human needs, and not in the interests of a privileged minority, in the new age of plenty now being ushered in. The machine has become dislocated through the impact of a relatively new but disturbing factor—the phenomenal acceleration of the productivity of the human unit. A glance at Fig. 2 will make this line of thought clear. Until quite recent times, the curve portraying the rise in this factor coincided fairly closely with the curve representing the growth in the world's output of gold. Because of this accidental alignment the gold machine has worked reasonably well through many generations. But the rapidly increasing divergence between the two curves makes it necessary so to modify our monetary system that the volume of currency issued by the central banks can expand in phase with the human productivity curve. The amount of money in circulation would then conform to the dynamic requirements of mind-intelligence and not to a static process of nature.

All these evolutionary forces with which I have dealt must have a determining influence in moulding the stages of progress which will mark our advance into the new era now opening up before us. Leadership if it is to be really effective, must have knowledge of, and be inspired by, these transforming influences. Because its main function all the time is, first, to integrate into operative principles all that is best in the progressive ideas continually generated by thinking humanity, and then to formulate a policy of action based on these principles. It must create an atmosphere favourable to the policy which it is intended to pursue, and then by inspiration and directive power secure a movement of the human team along the clearly visualised path at the right speed.

Leadership must be inspired by an *ideal* which gives direction to its creative impulse, and animated by an *idea* well within the range of practical achievement. The tangible expression of the activating idea must be capable of moving humanity some distance towards the ultimate realisation of the inspirational ideal. The current idea can be expressed as “enlightened teamwork objectively controlled”, whilst the ideal has been reverberating down the ages—the brotherhood of man—descriptive of a state of society when all people will be brought together as a vast family, animated by a spirit of divine purpose, and actuated in all they do by a common interest and purpose. Despite the spirit of intense nationalism—surely a passing phase—which for the moment is corroding human aspiration and desire, the seeds of this great ideal, long since planted in the garden of human progress, now have a better chance than ever before of germinating to their full bloom of beauty and majesty.

I recollect many years ago being told by my brother, who was then engaged in clearing some of the forests in Northern New Zealand, that when the great trees had been hewn down and moved away, thus allowing the sunlight to penetrate into the soil, he found to his astonishment that new flowers which he had never seen before, unfolded themselves in all their glory. The seeds had lain dormant for hundreds of years, but at long last the latent powers of life and service found expression in the sunlight. Our immediate task is somewhat similar to this. We have to cut down and remove the lumber of bad tradition, unscientific methods, greed, pride, distrust, and selfishness. But when this is done, the divine light of wisdom, transmitted through that scientific mind-intelligence of which I have spoken, and brought into proper focus by enlightened leadership, will illuminate new regions hitherto shrouded in darkness. This penetration of an invisible but vitalising influence will germinate those latent and all-powerful forces radiating from the human spirit, so that human progress and happiness may take on a new grandeur which we can as yet but dimly perceive.

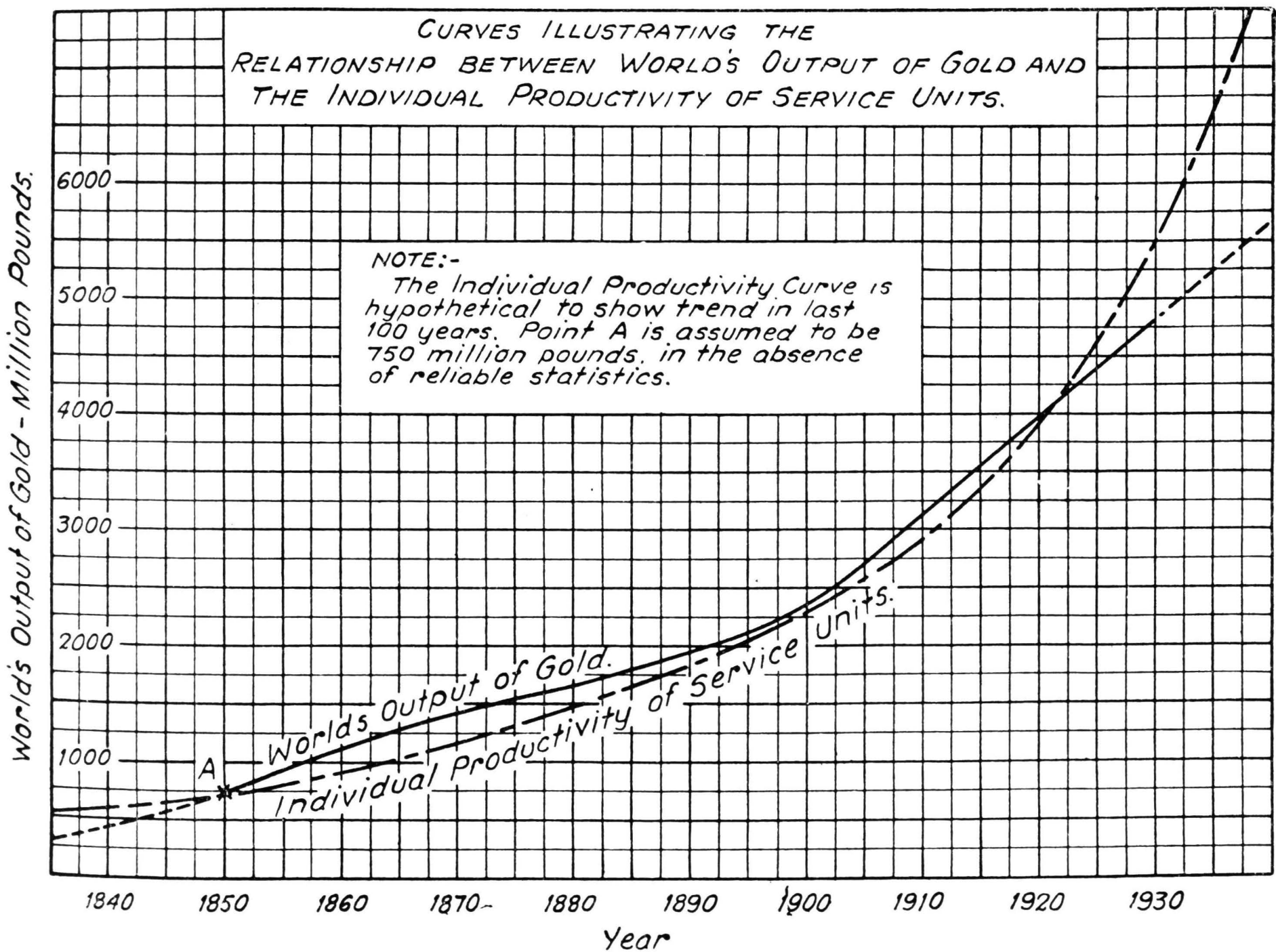


FIG. 2

SECTION 3—THE SECOND INDUSTRIAL REVOLUTION

All this is especially true of industrial leadership now that industry has become the dominating influence in human affairs. In this age of machines, industry is the dynamic and pulsating core of human activity. It is the supreme motive power within a nation, controlling the rate and direction of its progress. From this energising force radiates the wealth, prosperity, and in a large degree the happiness of the people. If this central core is right and true, then the national team can march forward triumphantly along the path of healthy progress. Should the core be diseased or suffer from mal-adjustment of its atomic structure, the retarding and evil influence radiates from it, inducing national distress, impoverishment, and ultimate decay.

But we should remember in these difficult times that industry is a very young thing. It is less than 200 years old and has hardly entered its period of childhood.

A prolonged "teething" period lies ahead, and we are now experiencing some of the growing pains inseparable from this stage of growth—an age full of wonder and inspiration to those who watch, because of the immense potentialities of good or evil which are beyond it. Our individual and collective responsibility at this critical moment is to make sure that our industrial child, pulsating as it is with life, movement, and spirit, should be so nourished, trained, and directed that it can quickly grow out of its childish ailments and with renewed vigour unfold its immense powers of human service. My main purpose in this lecture is to concentrate attention on the function of enlightened industrial leadership in relation to this beneficent work which must be speedily accomplished if our civilisation is to progress towards higher realms.

To this end let us examine the regenerative forces which industrial leadership can harness to its will and purpose so as to determine the future course of industrial evolution and reshape society in the process. These reactions can be stated thus—

1—Steady Acceleration of the Productivity of the Human Unit

The scientific mind is steadily improving the efficiency of the machine; increasing the energy consumed by it, and therefore its rate of working; and thereby producing a steady elevation in the productivity of the human unit. Fundamentally, it is the acceleration of this factor which has produced the second industrial revolution in which we are now so thoroughly immersed.

2—Steady Acceleration of the Rate of Flow in the Industrial Circuit

There is constant acceleration of the rate of flow in the industrial circuit—that circuit embracing the complete productive cycle, and stretching between mother earth and the ultimate consumer. In other words, the time interval (T) between the withdrawal of materials from mother earth and their final delivery, after being transformed into a serviceable product, such as a motor car, cotton cloth, or a radio set, is being steadily reduced.

3—The Era of Electrical Energy Supply just Beginning

There is an increasing demand for energy which is the life-blood of this mechanistic age. Because of the ease with which energy in the invisible form of an electric current can be generated and transmitted to the point of use, and then made to do useful work, great impetus is now being given to electrical developments. The electrical era is just beginning; civilisation is now advancing along an electrical path of progression. In this country the Central Electricity Board's grid system of electrical energy supply has become a potent factor in moulding our future industrial structure. Within a decade we should become the most efficiently electrified country in the world. But before this can happen, the powers of the Central Electricity Board which now only cover generation and main line transmission, must be extended to embrace distribution right up to the points of use either in our factories or in our homes, so that the wastage in the existing unco-ordinated distribution network can be eliminated.

4—Steady Reduction in the Time-lag between Discovery and its Industrial Application

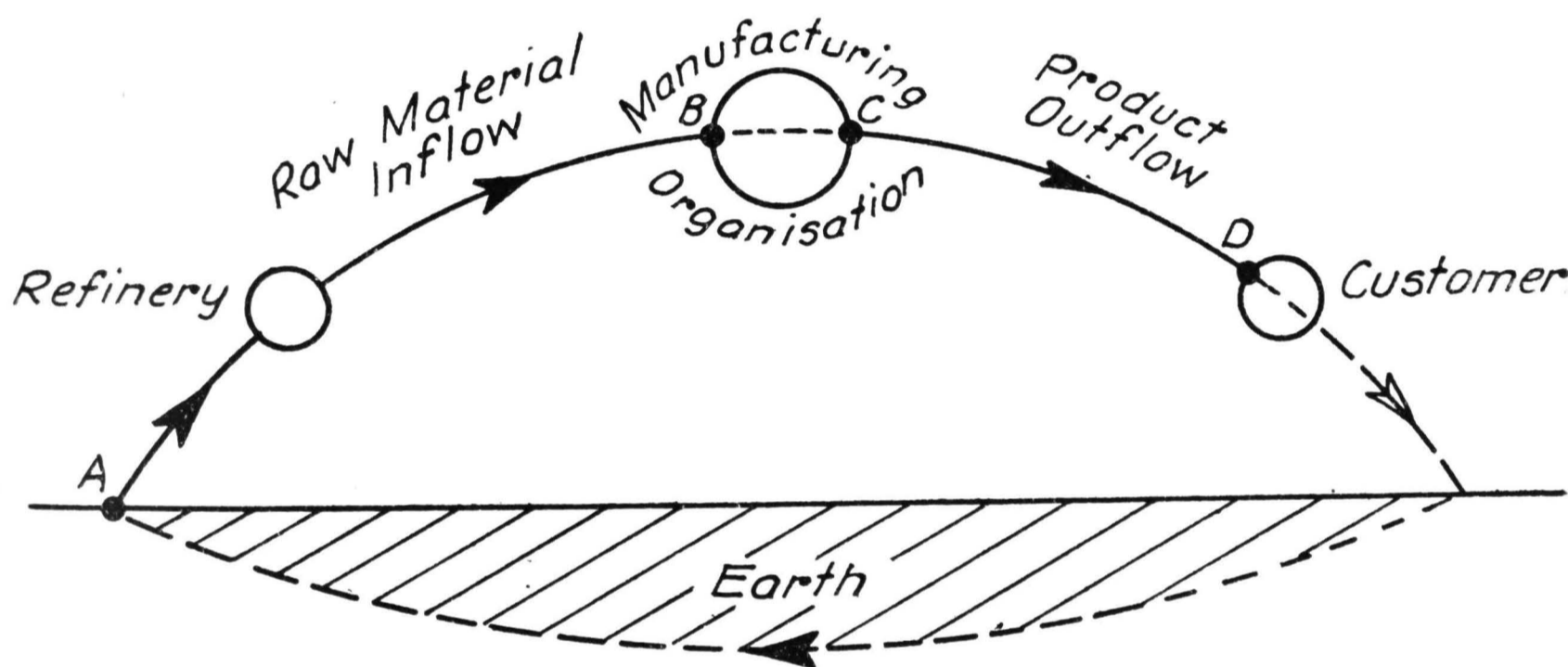
There is a steady reduction in the time interval between the discovery of a new principle, process or material, and the practical application of this new knowledge to serve human needs through industrial effort. Some 50 years elapsed between Faraday's basic discovery of electro-magnetic induction in 1831, and the inception of the electrical industry on this bedrock foundation. But now, after a lapse of only 100 years, the time-lag between the discovery of new scientific knowledge and its effective utilisation by the engineer and industrialist, is measured, not in years, but frequently in months. This striking change emphasises the important position now occupied by the research worker. His efforts in the future will transform industrial activity by creating new industries to serve human needs in diverse ways, of which we now can have little comprehension.

5—Production and Distribution Linked Together as One Industrial Problem

It is being recognised that the sequential processes in the industrial circuit are conjoined and interdependent on one another. The integration of this chain of productive operations represents the sum total of the whole industrial effort. And the rate of service flow is a function of this integration. In other words, all phases of production and all phases of distribution concerned with a particular service function are linked together as *one* industrial problem. In all our plans for industrial reconstruction we must work back to, and be guided by, this fundamental conception, if we are to secure maximum success.

6—The Function of Industry

There is a growing desire to secure a more enlightened objective for industry now that industrial leaders begin to understand that results which are economically sound can only be realised by dealing with the human units in industry on a basis that is ethically right. The primary function of industry is to render a broad human service, from which should flow, as a secondary effect, just and balanced profits. In other words, the main objective of an industry should be to improve steadily its service function.



$$\begin{aligned}
 \text{Driving Force of Manufacturing Organisation} &= P \\
 \text{Total Resistance in Industrial Circuit} &= Q \\
 \text{Rate of Product Flow} &= \frac{P}{Q} \\
 \text{Power or Status of Manufacturing Organisation} &= \frac{P^2}{Q}
 \end{aligned}$$

where, $Q = r_1 + r_2 + r_3$
 $r_1 =$ Inflow resistance between A & B.
 $r_2 =$ Manufacturing resistance between B & C.
 $r_3 =$ Outflow resistance between C & D.

Diagram Portraying Industrial Circuit.

FIG. 3

7—Planned Co-operation the Guiding Principle

There is now almost an insistent demand, coming frequently from unexpected quarters, that the guiding principle of industrial action in the future should be planned co-operation in place of disorderly and wasteful competition. This basic idea, to become effective, must be applied to groups of industrial units rendering the same kind of service. It will mean the creation of a higher control mechanism to co-ordinate and plan the activity of the associated units in a particular group, both in respect of production and distribution. And the mechanism must be so designed that it is able to maintain within the group a condition of balance, between man and the machine, as the resultant service flow is expanded through acceleration of the co-ordinated effort.

SECTION 4—THE POWER OF INDUSTRIAL LEADERSHIP

It has been my lot for the past 20 years to occupy a high executive position in one of our newest and most complex industries—the great electrical industry. When confronted with a difficult industrial problem I have found it helpful to carry at the back of my mind a picture of the complete industrial circuit, to which I have already alluded. It enables one to view in broad perspective those fundamental forces which lie at the foundation of all forms of industrial action. The industries of the world can be viewed as a complex network comprising myriads of imaginary industrial circuits all interconnected to provide our civilisation with an industrial grid capable of supplying services of all kinds in abundance.

1—Principles Governing Industrial Flow

We are beginning to understand more clearly that the rate of service flow in an industrial circuit is dependent on two main factors, just as in the analogous case of the simple electric circuit the rate of electricity flow varies directly as the driving force of the electric generator (E) and inversely as the total resistance (R). In the industrial circuit depicted in Fig. 3, the industrial organisation interposed therein provides the motive power; it is, in fact, the industrial generator. The driving force (P) is dependent mainly on the efficiency of the management factor; that is, on the management's power of leadership to guide and control the future destiny of the whole organisation as a productive and serviceable unit. The resistance (Q) on the other hand, is made up of three main components—

r_1 = The resistance interposed between mother earth and the industrial generator. This may result from enhanced and uneconomic raw material prices resulting possibly from "ring" prices, or from the efforts of an inefficient buying department. Or it may result from inefficient transportation, which is too slow and costly in its operation.

r_2 = The wasteful internal resistance in the industrial generator. Lack of directive force, complexity of routine, lack of team spirit and insufficient planning frequently combine to increase this resistance unduly.

r_3 = The resistance in the distribution portion of the circuit; that is, between the industrial generator and the ultimate customer. Resistance may here be interposed by undue selling charges; enhanced advertising expense; and discounts to a middleman which are uneconomic—anything, in fact,

which tends to increase unduly the ratio $\frac{\text{selling price}}{\text{basic manufacturing cost}}$.

The total resistance in the circuit can be expressed thus—

$$Q = r_1 + r_2 + r_3$$

I believe there is good ground for completing the analogy with the electrical case already cited by stating that—

$$\text{Rate of service flow} = \frac{P}{Q} = \frac{P}{r_1 + r_2 + r_3}$$

and

Power or status of industrial organisation as a service generator =

$$\frac{P^2}{Q} = \frac{P^2}{r_1 + r_2 + r_3}$$

Just as the engineer must base his creative work on well-established laws and principles, so it is necessary for an industrial leader to be guided in his fundamental thinking by the laws and principles which govern industrial flow. Newton's classical "Laws of Motion" lie at the foundation of all sound engineering. I have attempted on analogous lines to formulate three laws appertaining to the industrial circuit.

(a) *The Law of Inertia*—Every industrial organisation continues in a state of quiescence or uniform movement, except in so far as it may be impelled to change its power of service through the energising pressure of the industrial team acting upon it.

(b) *The Law of Force and Motion*—The rate of change of service flow in the industrial circuit is a direct function of the *degree* to which the *spirit of service* animates, at all parts of the circuit, the efforts of the industrial team.

(c) *The Law of Stress*—When *pressure from customers* acts on an industrial organisation, it is the function of industrial leadership to ensure that the *reactionary force* generated is directed to stimulating the industrial team to expand its power of service so that a condition of equilibrium beneficial to the customer may be maintained.

2—Industrial Leadership must Function through Teamwork

I stated earlier in this lecture that leadership is concerned with the problem of securing tangible results by engendering an inner urge and willingness on the part of others to do it. In a phrase, it can only fulfil its primary function through teamwork. The team must be wisely chosen, each member being carefully selected to shoulder the responsibility demanded of him. Co-operation and service must be the watchwords, and the united efforts of the team must be constantly directed towards an attainable goal which industrial leadership should clarify and ever keep before the vision of the team. A path leading to this goal, which is best suited to the personality and ability of the team, should be determined, and the rate of movement along this path then controlled by a series of scientifically graded objectives.

Leadership must radiate infinite patience and courage in guiding and directing the progress of the team; and all the members must be made to feel that so long as the *direction* and *rate of movement* are right, it is mathematically certain that the visualised goal, which is the inspiration of the effort, will finally be reached. And as difficulties, trials, and disappointments are encountered on the journey, the kind of industrial leadership I am endeavouring to portray will jealously watch the psychological atmosphere in which the team works, and use every means in its power to elevate the spirit of the team to those exalted heights which must be reached before great achievement is possible. Only in this way can each member of the team derive from the achievement that inner satisfaction of body, mind, and spirit which is his lawful right, and absorb these tangible gains into his spiritual and cultural well-being.

Many years ago Sir Alfred Ewing formulated a theory of magnetism which still helps us to understand what happens when a bar of steel is magnetised by an electric current flowing in a coil wound around the bar. Ewing pictured the myriads of molecules in the bar as infinitesimal magnets, each with a north and south pole, but arranged higgledy-piggledy, with the north pole of one molecule attracted to the south pole of an adjacent molecule, when the bar was in the unmagnetised state. In other words, the countless numbers of molecules formed closed magnetic circuits amongst themselves, and there was no resultant magnetic force radiating from the poles. But just so soon as the energising effect of an electric current acted on the bar, this disorderly molecular condition of quiescence was instantly changed. The millions of magnetic molecules aligned themselves in orderly procession as a molecular team objectively controlled, all the north magnetic poles pointing to one end of the bar and all the south poles to the other end. In consequence, the bar now became a strong magnet, its poles exhibited definite magnetic power, and it could be used in diverse ways to render magnetic service.

I give you this picture of what happens in the domain of electro-magnetism because it affords a rather beautiful analogy to the way in which enlightened industrial leadership can energise a group of workers and so convert their quiescent condition into one of dynamic team power and service (see Fig. 4). The human team within an industrial organisation—each member possessing a distinctive personality and definite powers of service—can be likened to the molecular team of which the bar of steel in our analogy is made. The coil of wire wound around the bar could be likened to the higher managerial control which becomes an

energising and directive force, through its power of leadership—that intangible influence which truly corresponds to the mysterious and potent force wielded by the invisible electric current energising the coil. Clearly this figment of the imagination can be equally well applied to the associated working of a large group of industrial organisations such as we have in an industry; or to the co-ordination of the wide range of industries within a nation.

3—The Function of Industrial Leadership

The function of industrial leadership is allied to, and dependent on, the function of industry. I have already stressed the view that the main purpose of industry is to improve its service function. Moving from the general to the particular, this conception means that the team of workers within an industrial

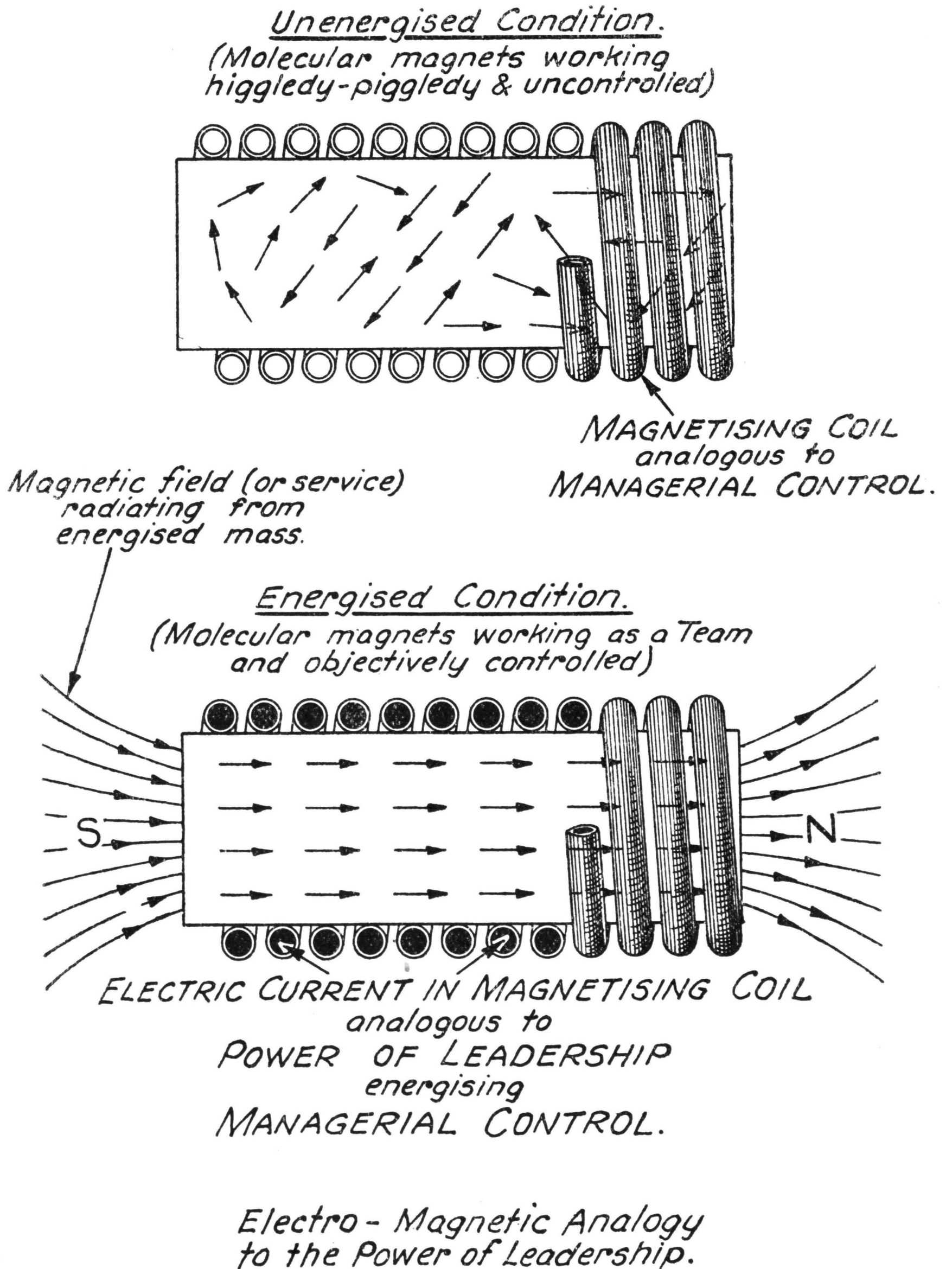


FIG. 4

organisation should be striving continually to improve the service which the products of the organisation give to the team of customers. In other words, "service to customers" will be the main inspiration of the team effort, and enlightened industrial leadership will never cease to embody this vitalising objective in all its plans, programmes, and policies.

In my experience, the foundation for substantial progress is laid once all sections of an organisation are permeated with an attitude of mind which elevates the customer to a position of dominating importance. Whilst we know that the customer is not always right, the *mentality* which *assumes he is right* until an impartial and unbiased investigation of all the circumstances of the case may prove him to be in error, should be wisely encouraged. This attitude of mind, wisely directed and controlled by industrial leadership, will do much to dispel sectional interests and prejudices, by substituting for these disturbing forces a *team interest* in a vital, common, and impersonal objective—the *customer*. Furthermore, in such a mental atmosphere the stimulating and vitalising influence that can come from a customer is allowed to flow freely into the organisation, thereby stifling, by its inductive effect, the greatest enemy of healthy progress—*complacency*.

4—The Main Components of Industrial Service

Now this service which an organisation renders to its customers depends on three fundamental factors—quality, price, and timing. They represent the main components of industrial service, and must ever be uppermost in the minds of the industrial team responsible for their steady improvement. Industrial leadership should use its great powers to focus the outlook and vision of the team on to these primary essentials, and thereby cause a steady acceleration of the service flow in the industrial circuit which it controls, to benefit all the team members, from the highest to the lowest. And in accomplishing this, leadership will find that it is necessary to create, by a process of education, three team senses—a "quality-sense"; a "money-sense"; and a "time-sense". These considerations are of such tremendous importance to those within industry and without that it is desirable to analyse at some length the implications arising from them.

(a) *The Quality of the Product*—The quality of the product is the foundation stone upon which the superstructure, representing price and timing, can be erected, in building an organisation dedicated to industrial service. This quality factor is made up of three main components—

- (i) The efficiency of the design.
- (ii) The quality of the materials used in its construction or fabrication.
- (iii) The quality and accuracy of the workmanship applied to these materials in changing their shape and then combining them in accordance with the co-ordinated plan embraced by the design. Craftsmanship has an important influence on this component of quality; and above all there must be considered that intangible team sense of responsibility which is only truly satisfied in knowing and feeling that a superlative result has been accomplished.

(b) *The Price of the Product*—The price of the product is controlled by the basic manufacturing cost—ever an important consideration—and the efficiency of the distributing machine. Reverting to the analysis of the rate of service flow in an industrial circuit already given, it is easy to understand that $(r_1 + r_2)$ influence the manufacturing cost, whilst (r_3) is a measure of the efficiency of distribution. The objective all the time should be to reduce the total resistance $(r_1 + r_2 + r_3)$ to an absolute minimum. Enlightened industrial leadership will recognise this by striving incessantly to improve the quality factor, in association with a reduction both in the manufacturing cost and the ratio between the selling price and this cost; this demands a constant effort to simplify and standardise. And it will determine to secure these results by a steady elevation of human values in all parts of the industrial circuit coming under its control.

It can be stated that—

$$\text{Basic manufacturing cost} = M + (K + 1)L + K_1 + K_2$$

Where M = Value of the materials used in course of manufacture.

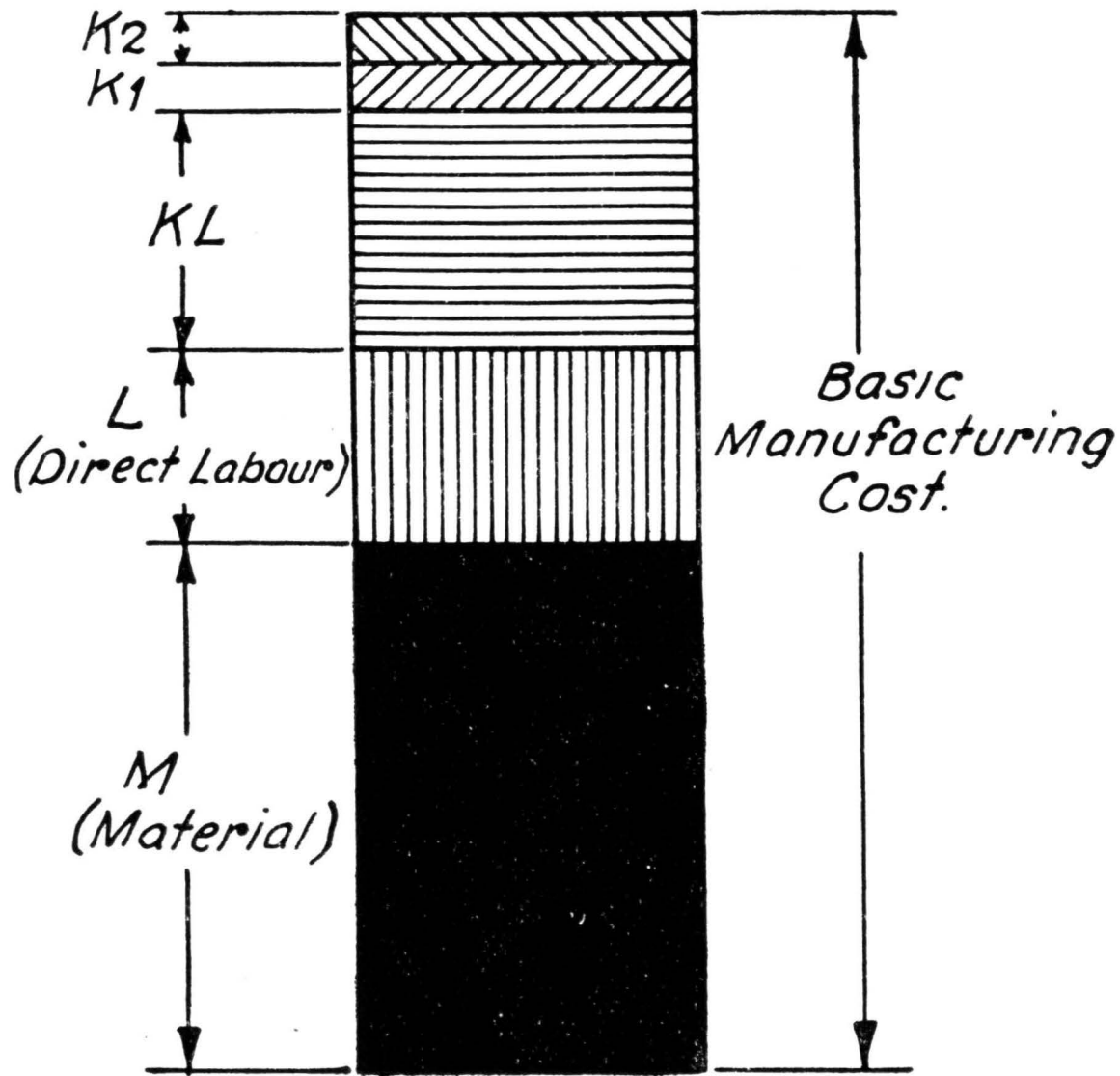
L = Value of *direct labour* applied to these materials.

K = Value of establishment or overhead charge.

K₁ = Value of wastage.

K₂ = Cost of engineering, draughting, and research.

The chart shown in Fig. 5 should make this clear.



$$\text{Basic Manufacturing Cost} = M + (K + 1)L + K_1 + K_2:$$

M = Value of Materials.

L = Value of Direct Labour.

K = Overhead Charge = $\frac{\text{Manufacturing Expense}}{\text{Direct Labour}}$

K₁ = Value of Wastage.

K₂ = Value of Engineering, Draughting & Research.

Chart showing make-up of Manufacturing Cost.

FIG. 5

The important factor K is the ratio between the total manufacturing expense and the direct labour in a given period of time. The manufacturing expense is the cost of operating a unit of production, apart from the expenditure of direct labour, and neglecting the sales and distribution costs. In the electrical industry, approximately 60% of the manufacturing expense is incurred as indirect labour—that is, wages paid to superintendents, foreman, chargehands, inspectors, labourers, cranemen, wiremen, millwrights, etc. The value of K may vary over a wide range—from 2.5 to 1.0—depending on the type of product being manufactured. It naturally varies with the productive load, but in general we can state—

$$\text{Manufacturing expense} = KL = K_3 + K_4L$$

$$\text{or, } K = \frac{K_3}{L} + K_4$$

Where, K_3 = Fixed charges such as depreciation, rent, rates and taxes, which are independent of L.

K = A constant dependent on the type of manufacturing unit.

It is true of the electrical industry that over a wide range of products the value of M (that is, money paid by a unit of production to outside suppliers of raw materials) is almost exactly 50% of the manufacturing cost.

Now when we come to consider the increment which has to be added to the basic manufacturing cost—that is the cost of the serviceable product up to the point where it is waiting in the warehouse ready to be moved to the ultimate customer—a somewhat curious state of affairs arises as depicted in Fig. 6. It is unfortunately true under present conditions that with many types of capital goods requiring superlative technical skill both in design and manufacture, the selling price is actually less than the manufacturing cost as shown by diagram (a). A healthy condition is portrayed in diagram (b). For a wide range of products, generally classed as consumers' goods, we now have the conditions exhibited by diagrams (c), (d), (e), and (f). In such cases the ratio

$\frac{\text{selling price}}{\text{manufacturing cost}}$ may vary from 1.5 to as high as 5.0, depending on the type of commodity and its service function. Such high ratios are brought about by abnormal resistance (r_3) in the distribution circuit.

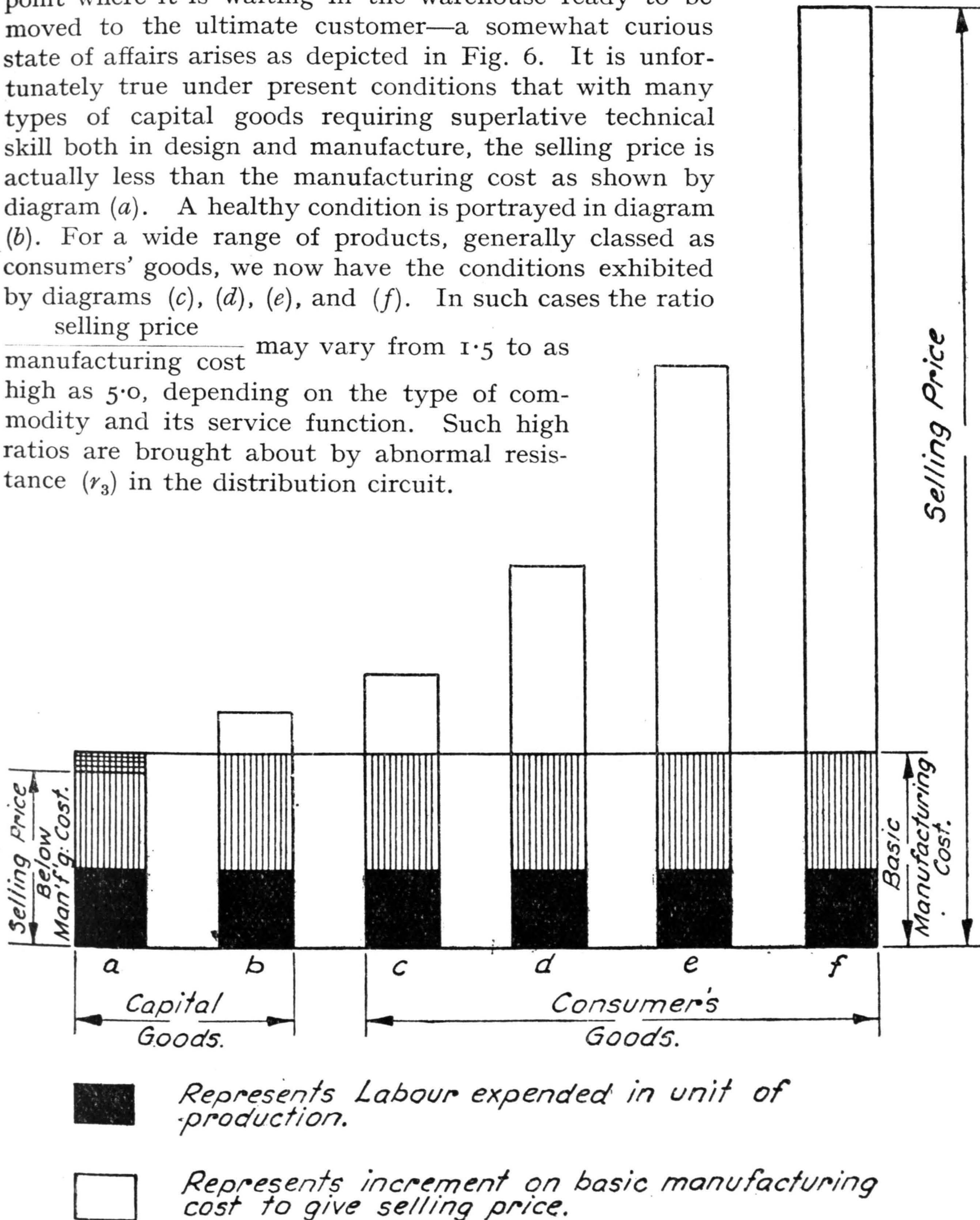


Chart to illustrate how the ratio $\frac{\text{Selling Price}}{\text{Manufacturing Cost}}$ rises rapidly as we move from the Sphere of Capital Goods to the Sphere of Consumers Goods.

FIG. 6

I refer to this vitally important question at this stage because it is clear that industrial leadership must in the immediate future give concentrated attention to the problem of reducing the distribution resistance (r_3). The growth of marketing schemes is symptomatic of this trend. The root cause of the trouble is that during the past two decades, when the efficiency of our methods of production have been improved beyond all recognition, there has not been the same advance in the technique of distribution. This lag in the application of scientific methods to improve the distribution mechanism is about to be adjusted. But a satisfactory solution of the problem can only be found by the effective co-ordination of production and distribution, so that the complete industrial effort can be unified in the interests of the customer.

(c) *The Timing of the Product*—Finally, we must consider the third component of industrial service which I have called “timing”. This recognises the growing importance of the “time-factor” in this second industrial revolution when the complex processes of thought and action are being constantly accelerated. A customer not only requires a high quality article at the right price, but he must receive it at the right time if his wants are to be completely satisfied. This consideration has for long been sadly neglected in all industries, but there has been a change of viewpoint in recent years, and industry is moving towards a state when the “timing requirements” of a customer will be viewed in proper relationship to those other elements, quality and price.

The whole question is one of vital importance to industry now that the delivery times associated with new business are getting shorter and shorter. This is but a reflection of that general “speeding-up” process referred to earlier in this lecture. Industry can only meet these increasingly difficult conditions by planning the production flow throughout the three main stages in the industrial circuit—the inflow to the unit of production; the production flow within this unit; and the outflow through the distribution mechanism to a customer. And the total time-cycle embraced by these interconnected processes must be in conformity with the specified requirements of some particular customer. Planning production flow is an immense subject in itself and can only be touched upon here. It involves a scheme of time charting in association with a system of budgetary control if the best results are to be secured. By such means leadership is able to steer the industrial ship along a predetermined course at the right speed.

5—The Qualities of Industrial Leadership

Industrial leadership is made effective through management, which has now become the hub of the industrial wheel. In this simple analogy the spokes of the wheel correspond to labour, whether by hand or brain; the rim to capital; and the track on which the wheel smoothly runs, to the customers. We thus see in proper relationship the four industrial partners, neither one of which is in a dominating position, but all necessary members of the combined industrial team which through a planned effort can secure successful results. Ownership—in the form of capital—is now widely spread. Except in rare cases it is quite impersonal and has no direct human contacts with the industrial undertaking. It should no longer have special privileges, but rather respond to its grave responsibilities by relying entirely on enlightened leadership, in the form of efficient management, to direct the progress of the undertaking along a path of planned industrial service.

You may well ask, what are the qualities demanded of a manager called upon to carry such high responsibility in industry? I would set them down as follows, arranging them in the order of their importance—

- (a) Power of leadership as measured by his ability to foster teamwork and direct it towards an enlightened goal of achievement.
- (b) Creative imagination.
- (c) Intellectual sincerity and moral courage.
- (d) Power to co-operate with others.
- (e) Knowledge of administrative principles.

- (f) Capacity for delegating authority.
- (g) Scientific and technical knowledge.

There are many other essential characteristics for the most part embraced by "power of leadership" which naturally heads the list, such as—

- (a) Reliability.
- (b) Knowledge of the personal characteristics of his associates.
- (c) Willingness to receive suggestions.
- (d) Ability to criticise without antagonising.
- (e) Ability to make just decisions at all times.
- (f) The possession of a character and personality which is unanimously respected for its justness and honesty of purpose—but not necessarily liked.

The manager's chief duty is to engender, by teamwork, a group power rather than express a personal one. In all his fundamental thinking he will visualise the activity of the team, and so formulate his plans and policies that the team effort will be utilised to secure the objective in view. His link with the team will ever be very human but impersonal, and he will continually stress the view that the results secured come from the team effort and not because of any direct or indirect influence he may have had on this effort. This demands a high degree of unselfishness and humility—perhaps the greatest of virtues—but it is an essential condition if the power of the team is to be expanded. *Because this expansion will only come if every member of the team is made to feel that he has made a real contribution to the visible results which have come from the co-operative effort of the team.* The late Mary P. Follett, who had very enlightened views on industrial leadership, well expressed this conception of the power of the team or group when she said—

"We get power through effective relations. This means that some people are beginning to conceive of the leader not as the man in the group who is able to assert his individual will and get others to follow him, but as the one who knows how to relate these different wills so that they will have a driving force."

In brief, successful management means the objective control of human thinking and action along a planned path of industrial service. The manager of the future has got to be a teacher, a preacher, and in large degree he must possess the intangible qualities of the artist. He must also be an educationalist, and in this capacity he will encourage the wise development of apprentice training schemes, recognising fully that the future growth of the organisation controlled by him is fundamentally dependent on the action taken to expand and strengthen the human structure. Silently and alone in that valley of loneliness inseparable from true leadership, he will wield his power, not in any obvious or fussy fashion, but imperceptibly and intangibly in the spirit of the truth that "Whosoever would become *great* among you shall be your *servant*, and whosoever would be *first* among you shall be the *bond servant* of all".

No problem is of greater importance to industry than that of training and directing the stream of young human material flowing into it from our educational institutions, so that future industrial leaders can thus be created who will do the job of work better than those now occupying the high positions in industry. There is a science as well as an art of management. Education for management is one of our greatest national needs. The status and dignity of the managerial function must be elevated, and it is a happy sign that recently there has been formed a confederation of associations concerned with different phases of management, such as buying, producing, and selling. Those interested in this movement feel that this effort at rationalisation within the field of managerial technique may soon result in the creation of a British Management Institute now long overdue.

Enlightened management will ever view the human structure of industry as an organic growth; as a living and soulful thing vitalised by the aspiration and desire welling up for serviceable expression in every human unit. Those entering the various stratas of directive responsibility must be carefully chosen, but there

must be free opportunity afforded to every human unit to move from a lower stratum to a higher, as his powers of service grow, and the highest position of leadership should be open to each and every member of the team. In a sentence, the organisation must be democratic to the core, the growth possible to any member being dependent only on his personal characteristics and ability as a human unit to wield successfully greater and greater responsibility.

6—The Education and Training of Supervisors

I am now touching on a problem of vital importance to the whole future of industry. Industrial leadership must give it primary attention, because it is not only concerned with the training and evolution of future managers, but also with the provision of that much larger team of executives needed to direct and control industrial effort in conformity with the higher managerial policy—I refer specifically to assistant managers, superintendents, foremen, assistant foremen, charge-hands, and the like. Because we must never forget that the “atmosphere” in which the great body of workers perform their allotted tasks; the spirit of their endeavour; the degree of happiness reached in their daily toil, and their mental picture of the “worth” of the firm which employs them—all these vital reactions are determined, very largely, by the functional ability of that stratum of control composed of a team of foremen or supervisors.

An enlightened managerial policy will continually direct its attention to the question of securing the right kind of industrial atmosphere, in which the whole team of workers will be able to give maximum service. Clearly, under such conditions the individual foreman’s task should become easier, but on the other hand it always remains the function of management to see that the foreman and other departmental heads are radiating an atmosphere in the particular sections coming under their control, which is of the same quality and texture as that which the higher managerial control desires to see permeating the whole organisation.

This is a vital consideration. A single foreman controlling perhaps a very small proportion of the total number of workers within an organisation can, through lack of leadership, inability to interpret the managerial policy, and failure to give the workers under his control a square deal, do incalculable harm to the whole human structure. The evil forces spread out from the small section where the inefficient foreman is failing in his duty. If the higher managerial control is not extraordinarily alert, these forces can gradually poison the team spirit of the organisation—that intangible factor of dominating importance.

If I had to set down in order of importance those characteristics which a foreman or supervisor should possess, I would give them as follows—

- (a) Power of leadership.
- (b) Reliability.
- (c) Initiative.
- (d) Tact.
- (e) Technical and manipulative skill.

In other words, he must first be a leader of men and able to secure results through effective teamwork. Mr. L. Urwick very rightly says in his excellent book “Management of To-morrow” recently published, when discussing this question—

“Leadership and Co-operation. These are the two—and the only two—ends of importance towards which systems of Foremen’s education should be directed.”

He then goes on to say—

“Co-operation is a state of mind. Men can be taught to co-operate on one basis and one basis only; enthusiasm for a common object which they understand and appreciate.”

Clearly the problem of training foremen or supervisors is extraordinarily difficult, because the necessary qualities of which I speak are more closely allied to matters of the spirit than to intellectual ability. The educational training which has been given to those entering industry in the past has had far too strong a technical bias. Forces are now at work which, in combination, should bring about a gradual change, but until this happens we shall not be in sight of an adequate

supply of men having the qualities prescribed, for filling these positions in industry. Dr. J. A. Bowie in his enlightened book "Education for Business Management" says—

"Technical executives, as a class, tend to concentrate on routine problems, the side of good management that has to do with plant, equipment, and quality of product, and they are prone to neglect the inexact "art" of handling human beings for the sake of problems more intellectually fascinating to them. In other words, a narrow technical training, limited to the quantitative sciences, does not fit a man to assume the leadership of men."

And then, in another illuminating passage he says—

"A workshop is as full of feelings as it is of machines, and no man whose training has left him with a dislike for, and inability to deal with, the imponderables of ethical and psychological considerations is qualified to assume control."

This great question which must be solved by industrial leadership if industry is to progress in the right direction, is fundamentally one of education. And because this is so, the roots of the problem run deep. Whilst industry can do much, and much more than is now being done—especially in our older basic industries such as coal, textiles, shipbuilding and steel—to find a solution, it is clear that ultimate success can only be realised by the wise and purposeful co-operation of industry and education. The responsibility for evolving a satisfactory process of training and selection must be shared by both, with the common aim of giving communal and national service.

Industry has suffered in the past, and still suffers, from the erection of an artificial barrier between the preliminary educational stage and the subsequent and more prolonged, industrial educational stage. These barriers must be broken down, and the complete cycle of education viewed in unified and broad perspective. Progressive educational thought is moving in this direction. Lord Eustace Percy, a late Minister of Education, has said—

"We have to inform industry of the structure of education as it exists, indicating the reform we are endeavouring to carry out and the objects we are seeking to attain; and we have to devise *new* machinery for working out plans for further development in harmony with the requirements of trade and industry."

I desire to stress the paramount need of the common alignment of the forces operating within our educational and industrial institutions, because this need permeates the very core of the problem now under review. Industry and education no longer connote two separate worlds of human thought and action. The rapid and continuous changes in industry are having an inductive effect of tremendous importance on education. Our educational methods must respond to this influence, so that the national team can move forward along a more enlightened plane of endeavour and achievement.

To illustrate this line of thought, just visualise a future industrial state when the material plane of existence has been greatly elevated with an enormous reduction in the hours of daily toil—say to 20 hours per week. This is no wild visionary forecast but a practical achievement which must inevitably come from the steady development of the scientific mind. But do our educationalists realise fully that this tremendous change may mean that within two generations our whole educational objective will have to be swung through half a circle, and the system so modified that education in the preliminary and all important stage, is for leisure and not for labour?

SECTION 5—WHITHER INDUSTRIAL LEADERSHIP?

WITH SPECIAL REFERENCE TO THE TEXTILE INDUSTRY

Industrial leadership will, in the future, only be effective in so far as it successfully combines two primary impulses—the making of things and the making of men. The organic and dynamic structure which it controls must not only produce in growing abundance serviceable goods of the right quality, sold at the right price, and delivered at the right time, but the performance of this function must be accompanied by the development of better and still better men, within industry and without. The realisation of this great truth is already bringing about a

rebuilding of the whole national industrial machine. We are all part of this machine, and in greater or lesser degree responsible for the task of reconstruction now facing us. You may well ask, what kind of plan should industrial leadership keep before the industrial team as it directs the work of rebuilding just beginning.

1—Industry Strives to Plan

I stated earlier in this lecture that “planned co-operation” must be the guiding principle in the future. It is obvious that the basic idea of planning production flow within a unit of production can always, within limits, improve the efficiency of that unit. But it is abundantly clear that the optimum benefit can only accrue when similar and co-ordinated action is taken in the tens of thousands of other units, both large and small, which go to make up the nation’s industry.

The importance of planning industrial action is beginning to be appreciated in this country by those within industry and without. We have already begun to travel this industrial path as exemplified by the B.B.C., the C.E.B., the London Transport Board, and more recently the Milk Marketing Board. But we have yet to travel a long way before a National Planning Control mechanism for maintaining the National Industrial Generator in proper balance, is within sight of achievement. It is good, however, that a beginning has been made, and I venture the prediction that the pressure of economic events in this and other countries—notably U.S.A., Russia, Germany, and Italy—will accelerate the movement we must inevitably make along this path leading to a more enlightened and balanced industrial future.

The proper application of this simple and commonsense idea—and all great ideas are fundamentally of simple origin—can bring untold good to the nation. But the magnitude of the communal benefits which should result will depend on four important things.

- 1—The degree to which the human unit is trained to develop his thinking and action along a planned path, having service and not self as its ultimate goal.
- 2—The degree to which the human unit is educated to the conception that “individualism”, connoting as it does freedom of thought and conscience, must be applied in a spirit of co-operation to the common good—“We are all members, one of another”.
- 3—The degree to which a group of workers concerned with a common industrial purpose can be made to work together as a team, towards the goal of expanding the service which comes from their united effort. The team spirit—the intangible factor which more than any other controls this result—will inevitably depend on (1) and (2).
- 4—The degree to which teams of workers concerned with a common industrial purpose can be made to co-operate as a complete national team for the purpose of expanding the service function of the industry of which they form the constituent and all important human parts.

Education must play a great part in solving the human and psychological problems suggested in (1) and (2). But the change in mental outlook which I have thus indicated is beginning to fructify, and great impetus could be given to the movement by enlightened leadership from above.

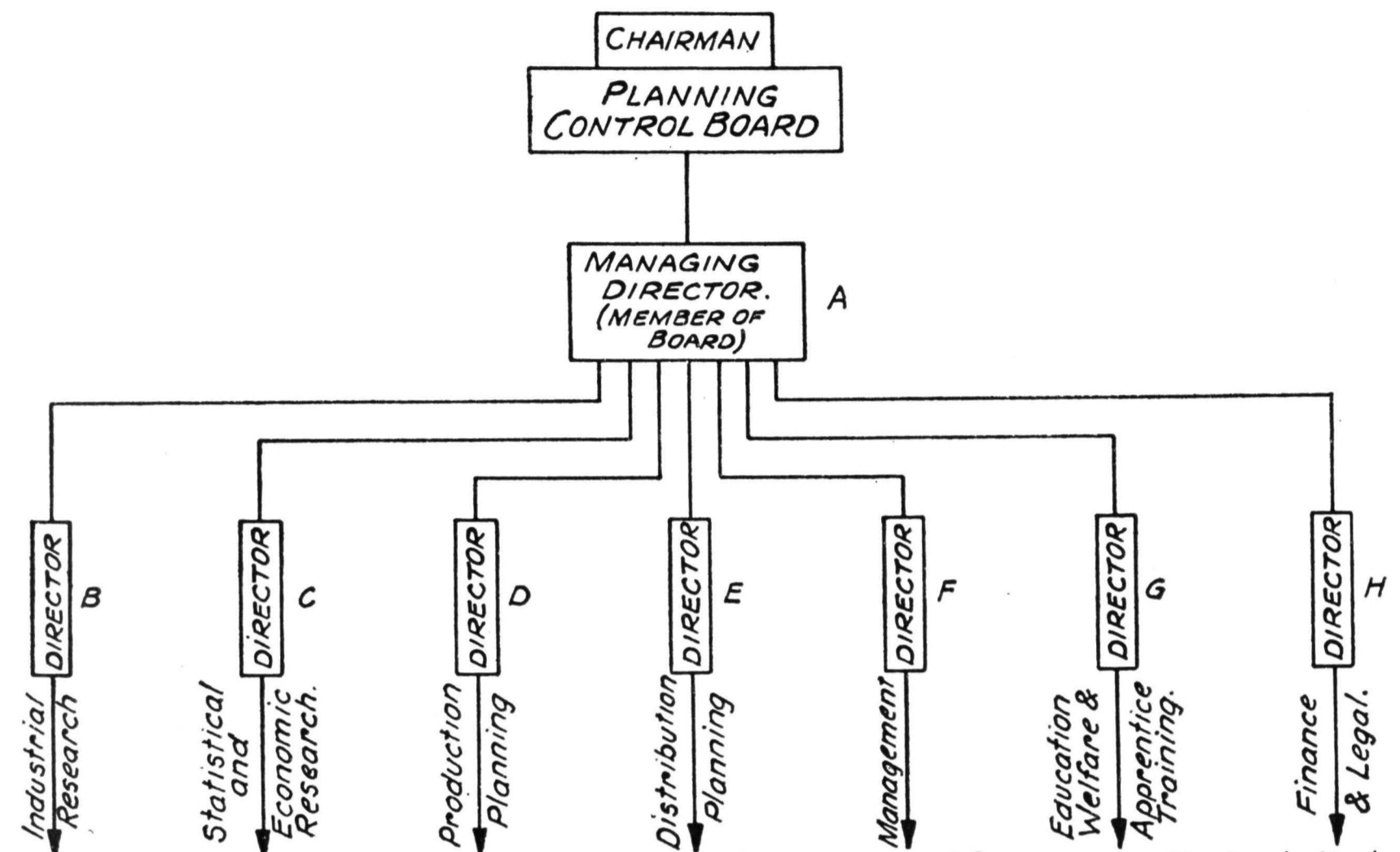
2—An Industrial Parliament Visualised

In my book* published towards the middle of 1933, I took as my main theme “Plan to Serve”. I tried to show how the application of this principle to individual and collective industrial effort must logically lead to the final creation of an industrial Parliament. I visualised 12 basic industries—one of which was textiles—each made up of numerous industrial units, but all aligned in respect of their common service function. Each of these industries would be co-ordinated and controlled by a Planning Control Board, democratically elected by the

* “Forward from Chaos,” by A. P. Young, O.B.E.

See also “Reconstruction”, by Harold Macmillan, M.P.

industry, to represent in balanced proportion the four industrial partners portrayed in my earlier analogy of the industrial wheel (see Fig. 7). Each Planning Control Board would be served by a permanent executive team of functional experts, to do the work of co-ordination in conformity with the over-ruling policy and direction of the Board. The Board would be elected for a period of five years, so that its composition could be changed at the end of this period if the industry so desired. In this scheme of control, production and distribution would be linked together as one industrial problem. An Industrial Planning Control Board would, in effect, control all the forces operating within the complete productive cycle as embraced by my conception of an industrial circuit.



Planning Control Board elected by the Industry for a period of five years on the basis that:-
 6 Members represent Labour
 6 Members represent Management.
 6 Members represent Capital.
 6 Members represent Customers.
 A, B, C, D, E, F, G & H are the leading functional members of a permanent executive team, controlled by the Board and therefore by the Industry.

COMPOSITION OF PLANNING CONTROL BOARD FOR AN INDUSTRY CONCERNED WITH A PARTICULAR SERVICE.

FIG. 7

There would be, in addition, a National Planning Control Board comprising the 12 chairmen of the Industrial Planning Control Boards; the heads of certain government departments now concerned directly with industrial functions; and three independent members elected by the Prime Minister of the day—a total of 25 members including a chairman, who would be a Minister of Industry with a seat in the political cabinet (see Fig. 8). Thus there would be an Industrial Parliament of 288 members, and an Industrial Cabinet of 25 members. The chairman of the latter, by being a Minister of Industry, would form a simple but effective link between the existing political control mechanism, and the new industrial self-governing control mechanism that is visualised.

3—Leadership and the Textile Industry

In concluding this lecture it is appropriate that I seek to determine how those principles of leadership which I have sought to establish, might be applied to the inner working and higher control of the textile industry. I approach this problem with diffidence, but with sympathy, and in a spirit of optimism so necessary to purify the deadly atmosphere created by prolonged pessimism and despair. The position at the moment is that the great textile industry of this country

employs just over 1,000,000 insured workers. Roughly 400,000 of these are in the cotton trades, and 200,000 in the woollen and worsted trades. The unemployed register carries roughly 200,000 insured workers, and almost exactly one half of these are in the cotton trades.

It was inevitable that the steady deceleration of world trade which characterised the economic cataclysm of 1929-1933 should have dislocated an industry which had been built up mainly on its export trade. In 1929 the cotton and woollen industries, which absorb about 60% of the workers in the whole textile industry, exported £187,000,000 worth of goods representing no less than 26% of the total export trade of this country. By 1932, our export trade had been reduced to almost exactly one half the 1929 figure, and the cotton and woollen industries had lost £100,000,000 worth of business.

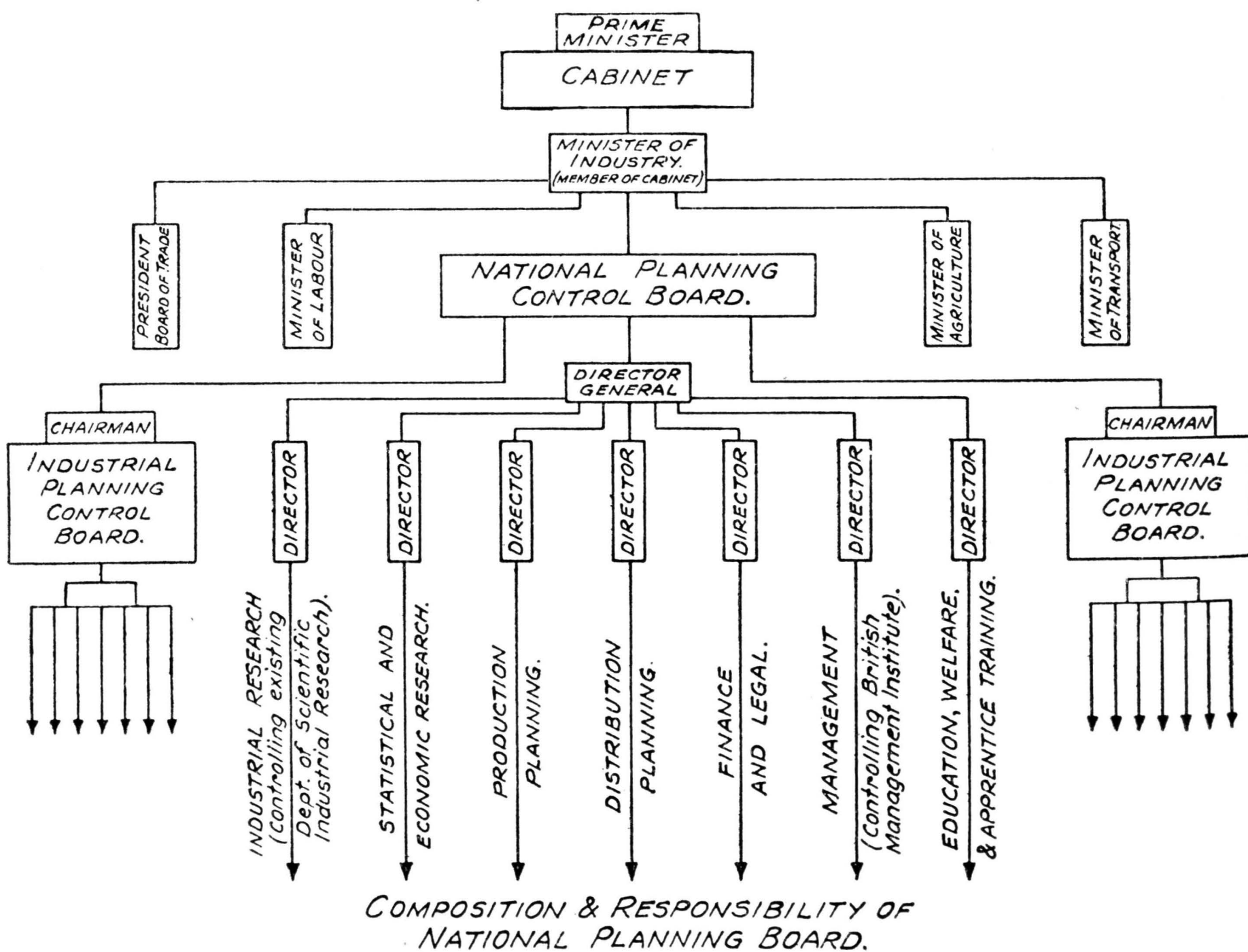


FIG. 8

There has been some recovery during the past 12 months as shown by the unemployment figures. At the end of last March the total unemployed insured persons in the cotton and woollen industries stood at 132,000, representing a reduction of 41,000 on the corresponding figures for the end of March 1933. This improvement was proportionately greater in the case of woollens than with cotton. Because of the magnitude of the cotton industry in relation to the whole textile industry, and the distressing nature of the economic and psychological forces which are operating to prevent a quick recovery, it has long been recognised that the core of the textile problem is in the cotton trade. In actual fact the jute industry is relatively worse off and is faced with a similar problem but of lesser national magnitude owing to the smaller size of this industry. At the moment approximately 25,000 insured workers are employed in the jute industry, which at the end of last March had an unemployed percentage figure of 28.1 as compared with 21.1 for cottons.

(a) *The Cotton Industry*—Now what are the forces which are preventing recovery in the great cotton industry? They can be simply stated thus—

- (i) *External*—Loss of export markets, notably in India, brought about by the establishment of mills there to manufacture the cloth previously bought from Lancashire. It should be noted that this is the logical outcome of that spirit of intense nationalism which has been abroad throughout the world since the war. The situation has been aggravated by the rapid growth of Japanese competition in recent years, and the depreciation of silver currency.

It is estimated* that Indian and Japanese production has each increased by about 1,300,000,000 yards of cloth since the war, and that in consequence of this, Lancashire has permanently lost this market for nearly 3,000,000,000 yards of cloth. The present manufacturing equipment in Lancashire embraces 54,000,000 spindles and 680,000 looms; and it is estimated that 8,000,000,000 yards of cloth must be sold in the home and export markets to keep this equipment fully employed. Approximately one-third of this equipment has become redundant unless new markets can be created, either at home or abroad, to make good this enormous loss.

- (ii) *Internal*—Failure to grapple courageously with the internal problem of reorganising, revitalising, and realigning the industry to deal with the rapidly changing world conditions. This central problem still remains and can only be solved by enlightened leadership. It demands a new attitude of mind which in the great majority amounts to a mental revolution; a spirit of co-operation; a co-operative plan based on an *unshatterable faith* in the future great destiny of the industry; new leaders with a scientific outlook, some of whom might well be drawn from our younger industries; and the clarion call of exalted leadership to make the plan real and effective.

(b) *A Cotton Planning Control Board*—The three golden keys unlocking the door to balanced progress in the cotton industry, or indeed in any other industry are—planning, teamwork, and service. And an enlightened management factor, operating on the principles already enunciated, affords the means by which these keys can be used to some good purpose. Once the door is opened, and the inner desire created for co-operative effort objectively controlled, it becomes possible to construct a planning control mechanism for governing the activity of the whole industry with its multiplicity of sections and sub-divisions, so that it may steadily improve its service function. I am impressed with the plan for a control board put forward by the Trade Union Congress in November 1933, which is strikingly similar to the type of Industrial Planning Control Board already discussed. The scheme is based on sound fundamental thinking, so much so, that I venture to predict that some such plan of higher control for the whole industry will eventually be adopted. There is no other adequate solution of the tremendous problem now confronting the industry, but a greater spirit of co-operative effort must first be engendered before any plan of this kind can be made to work.

One of the great difficulties arises from the fact that the industry is old in body, and having grown through the whole period of the first industrial revolution it is still encumbered with wasteful growths and bad traditional thinking which are not found in some of our newer industries. And being old in body there is danger of the mental machine failing unless drastic action is taken to rejuvenate the human structure of the industry by infusing new blood into it. The industry must rediscover its soul.

Wise industrial leadership would first create an atmosphere favourable to balanced and healthy progress by inducing a mental outlook which is directed away from the wonders of the past and the demoralising conditions of the present, to the *illimitable opportunities which lie ahead*. It would then focus attention on the great and common objective of the industry—co-operative service to the ultimate customer in the form of the highest quality cotton cloth, sold at the

* See article "Present and Future of the Cotton Trade", by S. S. Hammersley, M.P., *Manchester Guardian Commercial*, 13th August, 1932.

lowest possible price and made available in the quickest time. On this mental and spiritual foundation it would, in my judgment, be relatively easy to erect the type of planning control mechanism which I have in mind, for giving self-government to the unified and co-ordinated industry, on the basic principle that management, labour, capital and customers would be equitably represented on this higher control board. Unless such action is taken quickly by the industry itself, of its own volition, it is inevitable that Government pressure will ultimately force through a reconstruction plan, because it cannot for ever allow such a powerful industry to flounder in the trough of inefficiency and despair.*

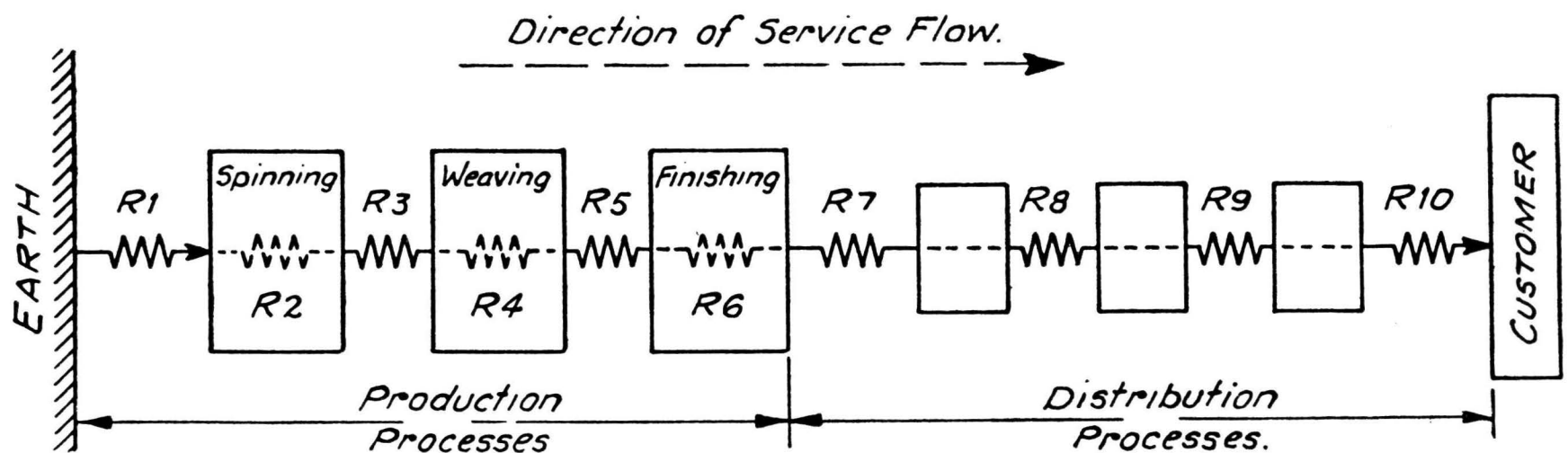


Chart showing production flow in Industrial Circuit of the Cotton Industry.

FIG. 9

Just glance at Fig. 9, which shows by means of a simple diagram the course of the service flow in this industry, from mother earth to ultimate customer. There are broadly three production processes—spinning, weaving, and finishing. Each of these is an enormous industry in itself, permeated with bad traditions, unscientific thinking, selfishness, jealousy, class distinction, and lack of faith in its power and purpose as a unit of industrial service. Running through the complete industrial circuit there is too little appreciation of the dominating influence of the human factor, and too frequently there is to be found that disturbing element which always arises when the function of ownership is confused with the function of management. And nothing like enough attention and encouragement is given to research—upon which the future well-being of every industry is so vitally dependent. Lastly, there is no adequate provision in the form of well-conceived apprentice training schemes for attracting into the industry from our schools, technical colleges and universities a steadily expanding stream of young human material such as we find in some of our newer industries—notably the electrical industry.

The integration of these bad influences manifests itself as *resistance* at all points in the circuit shown in Fig. 9. I have shown *ten* resistances to illustrate this argument, each of which is capable of reduction, through improved organisation, methods, and processes. They can be divided into three main groups as follows—

*The report presented to Parliament in July 1930 by the Committee on the cotton industry says—

“We are confident that the organised operatives and employees of Lancashire will embark forthwith upon the serious consideration of the measures essential to the recovery of their trade. If, however, this hope is disappointed, or if any section proves recalcitrant, we think it right to place on record our considered view that it would be the duty of His Majesty’s Government themselves to consider inviting Parliament to confer upon them any necessary powers.”

1—($R_1 + R_3 + R_5$)—Resistances interposed in the productive part of the circuit, external to the producing units. R_1 is related to the flow of raw cotton from U.S.A., Egypt, Australia, and other cotton-growing countries to the spinning mills in Lancashire. This resistance can be reduced by using successfully cheaper raw cotton, such as the short-stapled Indian cotton, used extensively by the competitors of Lancashire in supplying cheap standard lines to the Eastern markets. The great possibility of expanding the growth of cotton within the Empire, which work is being fostered by the British Cotton Growing Association, has direct bearing on this problem.

R_3 and R_5 relate to the passage of the spun thread to the weaving sheds and from thence to the finishing mills. These parts of the circuit should be as short and direct as possible. Everything should be done to reduce ($R_3 + R_5$), because any wasteful increase in either simply inflates the ultimate selling price and retards the rate of flow in the complete circuit.

2—($R_2 + R_4 + R_6$)—Represents the total resistance in the series of productive units through which the cotton has to pass before it is transformed into cloth capable of rendering a specific service. The problem of reducing this total resistance is primarily one of management. The development of a team spirit; the scrapping of obsolete plant and equipment, and its replacement by modern automatic or semi-automatic machinery,* a big forward move in the direction of electrical mechanisation; the introduction of scientific methods of planning and controlling the production flow; an impetus given to research objective to improving the product and reducing the cost in association with an improved wage level—all these forces would be blended by efficient management to secure a steady reduction in this total resistance. The formation of a Producers' Association to co-ordinate and align all the processes from raw cotton to finished cloth, could open the way for a revolutionary improvement.

3—($R_7 + R_8 + R_9 + R_{10}$) are concerned with the grave problem of distribution and marketing. Viewing the problem as I do from some distance, it is obvious that this part of the circuit, linking as it does the production unit responsible for the finished article with the ultimate customer, needs to be drastically simplified. There would seem to be a wonderful opportunity for a Marketing Corporation to simplify, co-ordinate, and control the process of distribution.

This picture of the situation brings out one cardinal fact which cannot be overstressed. It is simply this. The team of half-a-million or so people working in the cotton industry—from the Managing Director in his boardroom, right down the serried line to the humblest mill girl—are all concerned with the common problem of producing cotton cloth to give maximum service to the vast multitudes who purchase it. Once the outlook of the team can be elevated to the common and determining objective—maximum service to customers—I feel convinced that an inner urge will develop, impelling the whole industrial team to remove at all costs the present inefficiencies, so that it can with robust confidence face the future, inspired by a glowing faith in its great destiny.

The formation† of a Producers' Association to control all phases of production, and a Marketing Corporation to control all phases of distribution, would pave the way for the creation of a Planning Control Board on the lines already suggested,

* H. T. Tizard, C.B., F.R.S., in his excellent 1929 Mather Lecture, "Science and the New Industrial Revolution", says—

"All the machines used in the textile industries are out of date. None of them has really received the close scientific study and analysis which the provision of scientific instruments to-day permits to be carried out with the greatest accuracy."

† Suggested in a broadsheet issued by P.E.P. for 30th January, 1934, which deals with "Cotton Reconstruction".

to direct the future destiny of the industry. Such a Control Board would provide an effective and indispensable link between production and distribution, maintaining a proper co-ordination of effort in the interests of the whole industry and the great community served by it. To this end it would provide self-government for the industry on an enlightened plane, by ever maintaining a just and harmonious balance between those three fundamental factors—wage level, price level, and dividend level.

(c) *The Textile Industry*—The cotton industry is the major unit, but still a unit, in a larger industrial structure—the textile industry—which gives employment to at least one-and-a-quarter-million people. This great industry is fundamentally concerned with producing a multitudinous array of fabrics designed for ministering to our individual and collective needs, as well as for industrial purposes. In performing this service function it uses seven basic fibrous materials—

Cotton	Hemp
Wool	Silk
Flax	Rayon
Jute	

To these might be added rubber threads and asbestos—both of which find increasing application in the industrial sphere.

All the production processes in the textile industry are concerned with spinning, weaving, finishing, and colouring these fibres, either as distinctive groups or as a combination of one group of fibres with other groups. The finished fabric is used mainly for clothing; but there are many other applications directed to rendering service in the home. *A relatively new growth with enormous potentialities* is the use of fabric for industrial purposes such as canvases, belting, aeroplane wings, filter cloths, insulating tape, the covering of wires for the electrical industry, tyre cords and moulded gear wheels having noiseless characteristics. In the latter case we are witnessing an invasion of the mineral kingdom by the recurrent products of the vegetable kingdom—cotton cloth treated with synthetic varnish and then moulded at a high temperature under great pressure to give a resultant material which can be used in place of steel, cast-iron, and other non-ferrous metals. True, a small beginning as yet, but what an alluring vision of future possibilities is presented to the mind of the creative worker by this relatively small step along an entirely new path of textile development!

The common aim and purpose running through the complicated network of manufacturing processes in the textile industry is the ultimate production of a fabric which will serve some particular human need. It is this common fabric service objective which provides a basis for aligning and co-ordinating the production and distribution phases of the whole industry in conformity with a scientifically regulated plan of advancement. Clearly, the woollen, jute, linen and rayon industries could become self-governed industrial units, by each creating from within a planning control mechanism on the lines of that suggested for the cotton industry. Once this was done, the next step would be for the self-governed industrial units to establish, in association, a higher control and governing mechanism for the whole industry, in the form of a Textile Planning Control Board. This may strike many of you as a somewhat revolutionary conception, but the steady application of the indisputable principle of planned co-operation on the basis of an aligned service objective must, as I see it, finally lead to the reconstruction of the textile industry on these lines.

Nobody can foretell exactly what the future holds in store. But it can be safely predicted that the *textile industry possesses at this critical moment in its history enormous and untold potentiality for further growth and human service*. Why do I say this? Because, its service function deals broadly with three groups of human needs, each of which can be made to surpass our wildest dreams once humanity begins to move forward as a world team along a more enlightened and unfettered path of progress. These three main groups are—

- (a) Adorning and beautifying the human body—clothing.
- (b) Adorning and beautifying the home.
- (c) Industrial purposes.

Now during the next 50 years it is certain that the efficiency of industry will be improved to a degree well beyond our present comprehension. The hours of labour will be steadily reduced; the hours of leisure increased and intelligently utilised; and this immense change in the lives of all civilised peoples will be associated with a gradual uplifting of the material plane of existence. These radical changes in our daily lives will produce many reactions, one of which is that all people will give greater attention to their own personal adornment and also to the comfort and artistry of their homes. What boundless opportunities such a vision of the future should present to those of you who are so intimately concerned with the working of the textile industry! Just visualise a condition when it is possible for every woman to buy a new dress every month, and for a man to purchase just as frequently a new suit of clothes!! The output demanded of your industry to deal with such a condition would have to be increased many times and you would then not be inclined to worry about the loss of big markets mainly concerned with low grade fabrics used for clothing many millions who are unfortunately not so well placed as ourselves.

Make no mistake. The present phase of intense nationalism will pass. A new era of internationalism will then unfold itself, and as we advance as a co-operative world team, the material conditions in all countries will steadily improve. The day is past when one country can forge ahead more rapidly than another. The process of unification is spreading to world evolution; and the rate of progress made in a highly industrialised country like our own will be influenced and to some extent controlled by the rate of economic advance, say, in India, Japan, and China. As I see it, the progress of the whole world towards a higher material plane of existence, which is the one good thing that must be extracted from this scientific era, will be in stages as portrayed by the charts in Fig. 10.

I refer to this question because I cannot escape the conclusion that this trend which is already manifesting itself, is of deep concern to your industry. It should fill you with immense optimism, and stimulate an inner desire to reconstruct its human and material mechanism, so that this industry can worthily meet the increasing demand which the human race will make upon its service function. There are great psychological forces on your side, because as the material plane on which we humans live is raised, I think there is good ground for believing that an expanding proportion of the national income will be spent on beautifying the person and the home. By the quick translation of right thinking into right action, your industry can attract to itself a large portion of this potential expansion in home purchasing power.

With such a vision of the future ever before you, to encourage and inspire, the work of reconstruction on the general lines indicated should become purposeful and joyful. As I judge the position, one of your immediate tasks is to organise a planned thrust on the evolution of high-grade fabrics, to meet present needs and others yet to be created. Concentration on the high quality market, making and maintaining it at the highest quality level in the world, should be your primary objective. This can be done by utilising to the full, in your industry, that superb scientific, engineering, manufacturing, and marketing skill which this country possesses in abundance. Such a policy would leave the industry free to exploit the distinctive ability and skill of our people, leaving to others who have not these inherent advantages the markets in low grade cloths, which you once held. At first sight this may appear to be a policy of defeatism. But this is not so, because it is well within the bounds of possibility that with improved mass production methods applied under a system of "planned control", the lost markets could be recaptured with a high grade cloth sold at a Ford price; that is, by giving the ultimate customer superlative and unapproachable service.

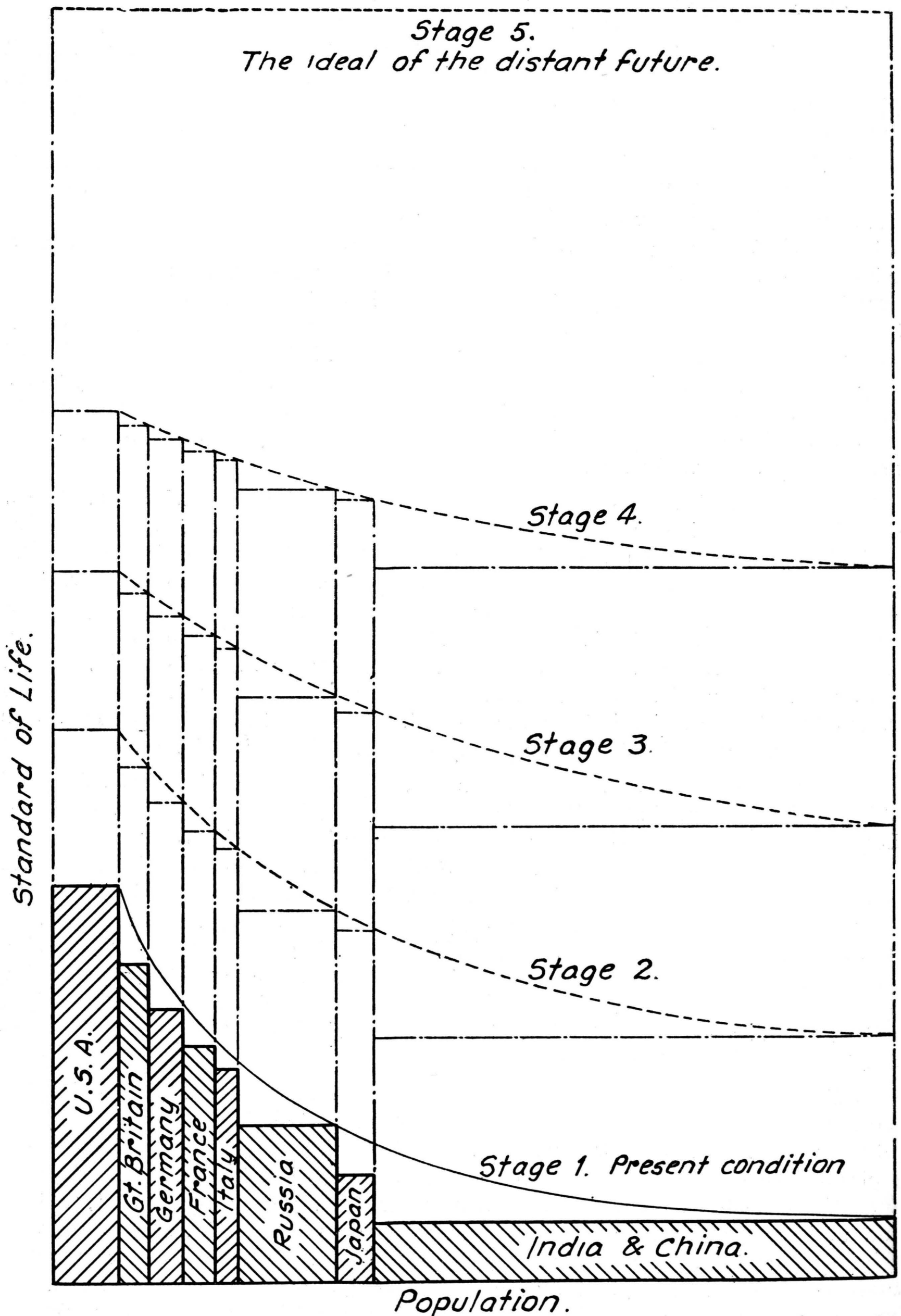


Chart showing how Standard of Life in all countries will move towards unification now that world progress is closely interconnected.

FIG. 10

This brings me to the vital question of research. There are at present five research associations dealing with fabrics.

The British Cotton Industry Research Association.

The Wool Industries Research Association.

The British Silk Research Association.

The Linen Industry Research Association.

The British Launderers' Research Association.

I venture to suggest that the formation of a co-ordinating body to control and unify the activities of these five research associations, so that the research effort is objective all the time to producing a balanced growth in the textile industry, would be of inestimable benefit. I do not know the total sum of money being spent annually in these research associations, but I can say without fear of contradiction that it is not enough. Of course, many of the larger industrial units have their own research departments, but the total expenditure on research throughout the whole textile industry is probably less than one-tenth of 1% of the total turnover of this industry.

The whole of British industry suffers from the paucity of our present rate of expenditure on research. Some industries are in a better position than others, and I would judge that the situation in the textile industry is especially bad. I believe industry has already reached a stage of evolution where the total annual expenditure on research should be at least 1% of the total annual turnover, and in some of our highly efficient and progressive industrial units this condition is fulfilled. There is good ground for stating that only by the pursuance of such a policy can industry maintain the right rate of progress.

Industrial leadership in the textile industry could with great wisdom do four things quickly—

- (a) Co-ordinate the activity of the five research associations now existing.
- (b) Stimulate the establishment of industrial research departments within those units of production wherein the "research sense" has not yet developed.
- (c) Secure close co-operation between the work of the co-ordinated research associations, and the work done in the various industrial research departments.
- (d) Inaugurate a campaign to encourage and expand the whole research activity of the industry, by planning to increase the present rate of expenditure by at least five times within the next five years. If wisely and purposefully spent—on machines as well as materials—this increased disbursement would be returned to the industry many times over within a relatively short period.

Research work on textile fabrics is concerned with developing new fibres, new processes, new and improved machines, and new and hitherto unimagined fabric applications. The creative and adventurous mind of the research worker is needed to grapple successfully with these complex problems. The task is ever widening, and spreads out into the realms of physics, chemistry, electricity, and engineering. It goes deep down into the very structure of the atom itself. As Dr. R. H. Pickard has said—

"There is another, very modern, branch of physics now being developed which *may one day be of practical application in the textile world*. I refer to the so far but little used technique of molecular rays."

The research worker, given his head and opportunity to use the growing and prolific store of scientific knowledge and technique ever available to him, may well evolve new synthetic fibres, and combinations of the present known fibres, which will give a sudden impetus to the growth of the textile industry. By this and other means already touched upon, your industry can forge ahead along that certain path of evolution already visualised, with exalted courage and abiding faith in its great destiny to give in growing abundance to humanity that delectable service to which it is dedicated.

BIBLIOGRAPHY

I give below a very limited selection of publications—mostly of recent origin—from that vast and ever expanding store of literature which treats in great detail many of the problems lightly touched upon in my lecture.

The Scientific Era

- "The Scientific Outlook", by Bertrand Russell.
- "Science and the Modern World", by A. N. Whitehead.
- "Science and the New Industrial Revolution", by H. T. Tizard, C.B., F.R.S. The Mather Lecture (1929).
- "Science To-day", planned and arranged by the late Sir J. Arthur Thomson, M.A., LL.D.
- "The Progress of Science", by J. G. Crowther.
- "The Birth of the Future", by Ritchie Calder.

Philosophy and the New Era

- "Mind in the Making", by J. H. Robinson.
- "Adventure of Ideas", by A. N. Whitehead.
- "Process and Reality", by A. N. Whitehead.
- "Essays in Common Sense Philosophy", by C. E. M. Joad.

Christianity and the Crisis

- "Industry and Property", C.O.P.E.C. Commission Report, Vol. IX.
- "Whither?" by the Rev. the Hon. Edward Lyttelton, D.D.
- "Can Christ Save Society?" by A. E. Garvie, D.D.
- "A Christian Sociology for To-day", by Maurice B. Reckitt.
- "Christianity and the Crisis", edited by Dr. Percy Dearmer.
- "Christianity and Economics", by A. D. Lindsay, LL.D.

Money and Currency

- "Money versus Man", by Professor F. Soddy.
- "Lasting Prosperity", by A. G. McGregor, B.Sc.
- "Planned Money", by Sir Basil P. Blackett.

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- "Onward Industry", by James D. Mooney and Alan C. Reiley.
- "Towards Industrial Recovery", by Hugh Quigley.
- "Rationalisation of Industry", by A. P. Young, O.B.E. (Lecture to Rugby Engineering Society, 1929).
- "Looking Forward", by Franklin D. Roosevelt.
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- "Socialisation and Transport", by the Rt. Hon. Herbert Morrison.
- "Government in Transition", by Lord Eustace Percy.
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- "Forward from Chaos", by A. P. Young, O.B.E.
- "Reconstruction", by Harold Macmillan, M.P.
- "Plan or no Plan", by Barbara Wootton.
- "Industrial Control Tendencies", by Sir Felix J. C. Pole. (Address to Manchester Luncheon Club, 29th November 1933.)
- "A Policy of Prosperity", by Israel M. Sieff. (Series of five articles in *Morning Post*, 16th to 20th April 1934.)

Industrial Leadership and Education

- "Business Leadership", by Henry C. Metcalf.
- "Education for Business Management", by Dr. J. A. Bowie.
- "Management of To-morrow", by L. Urwick.
- "Fundamentals of Industrial Administration", by E. T. Elbourne, M.B.E.
- "Education for Industry and Commerce in England", by A. Abbott, C.B.E.

TWENTY-FOURTH ANNUAL GENERAL MEETING AT MANCHESTER

The Annual General Meeting of members was held at the Institute, 16 St. Mary's Parsonage, Manchester, at 3.0 o'clock on Wednesday, May 16th. The President, Sir William Clare Lees, O.B.E., J.P., occupied the chair, supported by other officers and members of Council. There was a representative gathering of members.

The minutes of the previous meeting having been submitted and approved, the President said that he proposed to proceed to the election of President, as the President-elect, Sir Thomas Robinson, O.B.E., J.P., had another engagement and would be glad to be able to leave as soon as possible. Proposing the election of Sir Thomas Robinson, Sir William said he did so with pleasure as the President-elect was not only a textile man but had a very wide and intimate acquaintance with wool, cotton, and rayon. He was well known as a man to whom the Institute could confidently look as a worthy occupant of the office of President. He expressed the hope that Sir Thomas's year of office would be more effective than his own. He need scarcely remind them that his services had been in demand in connection with other duties which he thought were performed in the interests of all.

Mr. Frank Wright (Fellow), Chairman of the Council, seconded the proposal and said he did so not only because of Sir Thomas's standing and ability in textiles but because of his noteworthy services in Parliamentary and Municipal work. It was a fortunate thing for Stretford that such a man as Sir Thomas Robinson was available as first Mayor of the newly-chartered borough. Mr. Wright said he wished to remind Members present, this being one of the rare occasions on which it was possible to speak to them, that the Institute's Charter had imposed upon the Institute a duty and a responsibility. That duty lay in the matter of the award of Diplomas (Fellowships and Associateships) and the standard set for these was high though not, in his opinion, too high. It was fitting, therefore, continued Mr. Wright, that the Institute should look to the top in seeking the services of a President, as this was but the due of all those who, by self-sacrificing work, had founded and developed the Textile Institute on such a high plane. He was satisfied that, in Sir Thomas Robinson, the Institute had found a President upon whose appointment they might be congratulated.

The election was then declared carried unanimously, and the Presidential badge of office handed to the newly-elected President.

Sir Thomas Robinson, after apologising for the circumstances of other engagements which made it necessary for him to disarrange the programme, said that he had all his life had connection with and an interest in textile technical education. He was, therefore, proud to be associated with an Institute charged with such important work in this connection. On looking over the Institute's Charter and history, he felt bound to add that the objects the founders had set before them seem to have been always kept to the forefront, and, so far as possible, achieved to a noteworthy extent. He could and did assure all members that he was honoured to be elected President of this Institute.

The Council's Annual Report and Balance Sheet—which appeared in this *Journal* in the March issue—was proposed, seconded and adopted.

The Hon. Treasurer, Mr. W. W. L. Lishman, reporting on the financial position of the Institute, said—"The Finance Committee have given careful consideration to the balance sheet and accounts and concluded that in all the circumstances the records are satisfactory. A small adverse balance appears on the revenue account for the year, which increases the total of the accumulated amount of excess expenditure over income. Fortunately, the whole of the amount is provided for by a reserve investment due to excellent foresight of the Committee in conserving the finance. Obviously, the continuance of an adverse balance on the revenue account cannot proceed indefinitely. The position is improving, however, and I am hoping that even the small loss of last year may not recur in the current year



Photo

Sir THOMAS ROBINSON O.B.E. J.P.
Elected President of the Textile Institute, May 1934

[Carl Eccles

and that our reserve investment may be fully retained. The accounts are presented in detail for the information of all members and I need not comment further upon them."

This report, together with the Auditor's report, balance sheet and accounts, was adopted and a record of thanks to all members of the Institute's staff was made.

Mr. John Crompton (Fellow and Vice-President) proposed and Mr. S. Watson (Fellow) seconded that the best thanks of the Institute be accorded to the retiring President, Sir William Clare Lees. This was accorded with hearty acclamation.

In response, Sir William said he regarded it as a great honour that his name should be enrolled on the list of distinguished men who had previously held the presidential office, because he was convinced that the Institute would continue to rise in strength and influence. When in India recently, he was very much struck with the enormous progress in technical ability since a previous visit eight or nine years ago. In Ahmedabad, this was particularly noticeable by the use of finer counts and the work performed in dyeing and bleaching. That step forward meant that we had to go still further. As transitional periods arose, we had to adapt our industry to new requirements and specially train and educate those who were to be responsible for the direction of technical skill. The work of the Textile Institute, done quietly and unostentatiously, was carried on both well and efficiently, and the industry should be grateful to all those officers and members who devoted so much time and thought towards deeper insight into the technical and scientific problems concerning textile manufacture.

Messrs. W. Frost (Fellow), E. Midgley (Fellow) were re-elected and Mr. T. Morley elected, Vice-Presidents.

The General Secretary having read the result of the ballot for the election of ordinary members of Council and presented the scrutineers' report thereon, the Chairman declared the following elected for the ensuing three years—Messrs. Wm. Wilkinson (Blackburn), Wm. Davis (Nottingham), H. C. Barnes (Manchester), F. Wright (Bolton), H. Nisbet (Manchester), A. W. Stevenson (Gala-shiels), W. W. L. Lishman (Todmorden), Wm. Howarth (Bolton), J. H. Strong (Blackburn), and Fletcher Chadwick (Preston).

Messrs. Arthur E. Piggott, Son & Southworth were re-elected Auditors.

NOTES AND NOTICES

Institute Scholarship Holder

The second scholarship holder of the Institute, Mr. Wm. Graham, has now reached the concluding stage of his three years of technical training and special works experience in weaving departments. As reported to the May meeting of the Finance and General Purposes Committee, this scholarship holder is now pursuing three months of voluntary engagement in the linen industry at Belfast, having previously spent three months in worsted and other weaving in Yorkshire and six months in works concerned with the silk industry in France. On award of the scholarship, Mr. Graham was engaged in a special course of training at Manchester College of Technology for two years, which period was attended with highly satisfactory examination results. That training with subsequent experience and also pre-scholarship occupation as an automatic loom weaver, should make him well-fitted for a post of responsibility in the weaving industry. The scholarship period will terminate at the end of July. Meanwhile, the Institute would be glad to hear of any proposal for the engagement of his services—particularly in the Lancashire cotton industry.

Institute Membership

At the May meeting of the Council, the following were elected to Membership of the Institute—*Ordinary*—M. E. Haskell, A.M.I.Mech.E., M.A.S.Mech.E., M.A.I.E.E., Department of Industries, Old Custom House, Bombay, India (Industrial Engineer to Government in Department of Industries); T. E. Thompson, Hons. B.Sc., M.Sc., "Linton", Westwood Crescent, Grange Park, Bingley.

(Works Chemist, Airedale Combing Co. Ltd.); *Junior*—R. M. Gimson, Wandale, Knighton Road, Leicester (in charge of testing room, B. Russell & Sons Ltd., Leicester); K. N. J. Loveless, Devonia, Friern-Watch Avenue, North Finchley, London N12 (Salesman, Austin Reed Ltd.); K. Taylor, 7 Primula Street, Bolton (Assistant Textile Designer, Walter Mather & Co. Ltd.); G. A. White, "Colwyth", Montserrat, Bolton (Cotton Doubling Overlooker, Wm. Heaton & Sons Ltd.).

Inquiries

We have received an inquiry as to the existence of (by whom made, patented, etc.) a machine for pulling or drawing horsehair. Any member who can supply particulars is asked to send these to the Institute in the first instance

REVIEW

A History of British Carpets ; from the introduction of the craft until the present day.

By C. E. C. Tattersall (Department of Textiles, the Victoria and Albert Museum, London). Published by F. Lewis Limited. (Pp. 182. Price 2 gns.) This book deals extensively with a subject that has, so far, only received a section in more general works, and the excellence of the illustrations alone makes it extremely valuable to the student. As might be expected from his other work, Mr. Tattersall's history is delightfully written, and the book is admirably produced; in particular must be mentioned the very pleasing line drawings and diagrams in the text, and the fine layout of the page.

Although this pictorial excellence gives the book a sort of unity, the subject matter divides itself sharply into two parts. The first and greater section starts with a broad outline of the development of carpet making in the East, and the social conditions which led to the importation of carpets into England. The wealth of detail that follows in the history of the English-made carpet renders these chapters fascinating, not only for the vast amount of information collected and supplied in a most readable form, but for the glimpses they give of life in England in the sixteenth and succeeding centuries. The technical side of carpet making both by hand and by machine, is also presented, and a brief statistical survey made of present conditions in the industry.

The other part of the book, nearly a third, is given over to the history of present-day carpet-making firms, with illustrations in colour of their products. While the pictures of reproductions of Persian and other Eastern carpets show that the British manufacturer is still unsurpassed in this direction, it is regrettable that much of the original design shown is sharply at variance with the principles of design so well set out in the first chapter. In the carpets of contemporary design there is, for instance, a frequent imitation of natural form, particularly landscape, almost always unpleasant in a thing made to be walked upon. Colour too is sometimes flacid, and often lifeless and heavy; and the designs labelled "modern" or "modernistic" show a borrowing of mannerism from the Continent, rather than an understanding of present-day thought in creative work. As an exception to this criticism must be mentioned the design of the carpet in plate LX (Messrs. John Crossley & Sons Ltd.) a pattern which suffers somewhat in effect through reduction, and is in reality much more satisfactory; and the rug in Plate LXXXIV (Messrs. Alexander Morton, Sons & Co.) though this latter is of course handwoven on the tapestry method.

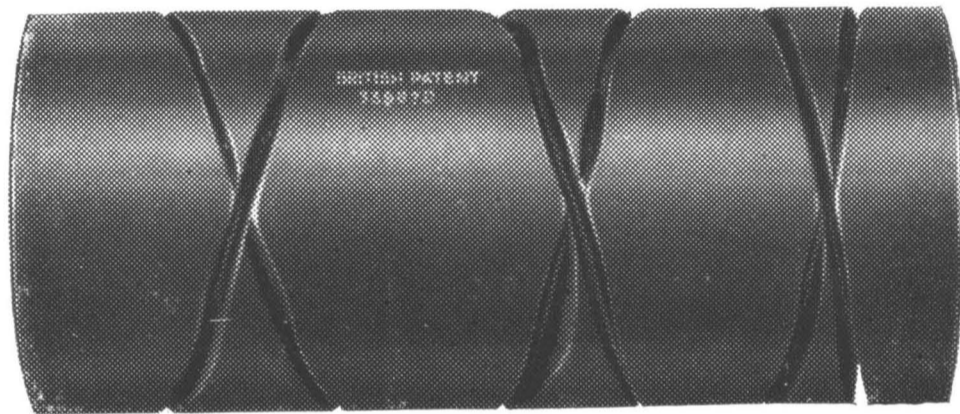
It seems a pity that so little should be shown of our progressive contemporary design in hand-tufted rugs, which in time may be expected to have a considerable influence on the design of the machine-made product. One would have liked to see included, for example—to name only two groups—illustrations of the interesting Dorn monochrome designs, or the pleasant Scotch hand-tufted rugs, with their carefully chosen tones and good colour. For anyone becoming acquainted with the British carpet through the medium of this book, the inclusion of such illustrations would have helped to balance the picture of what is being done by designers in present-day Britain, and to suggest that the intelligent use of modern forms can yet result in designs which are in keeping with our national taste and tradition.

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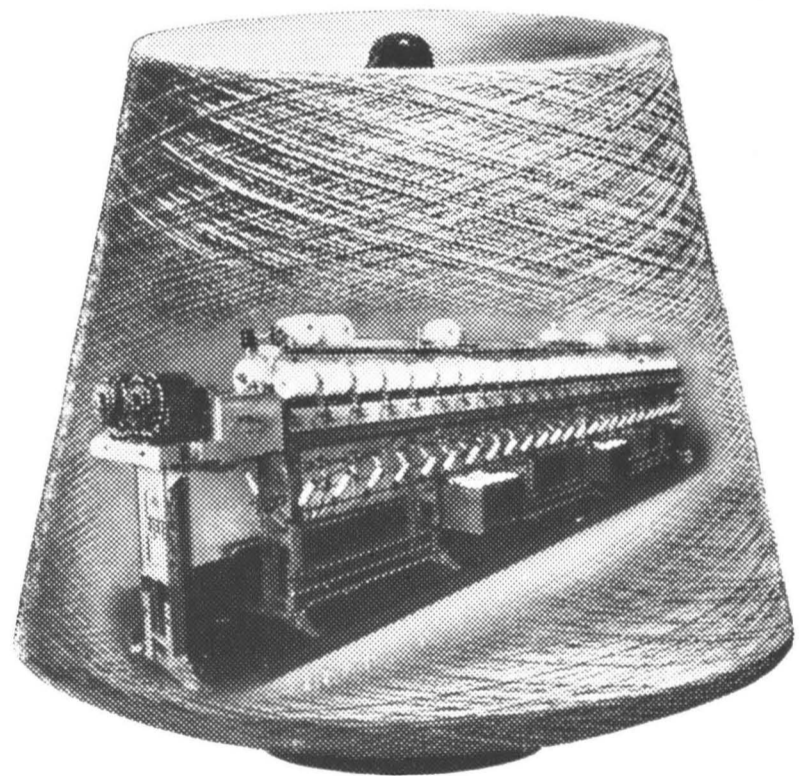
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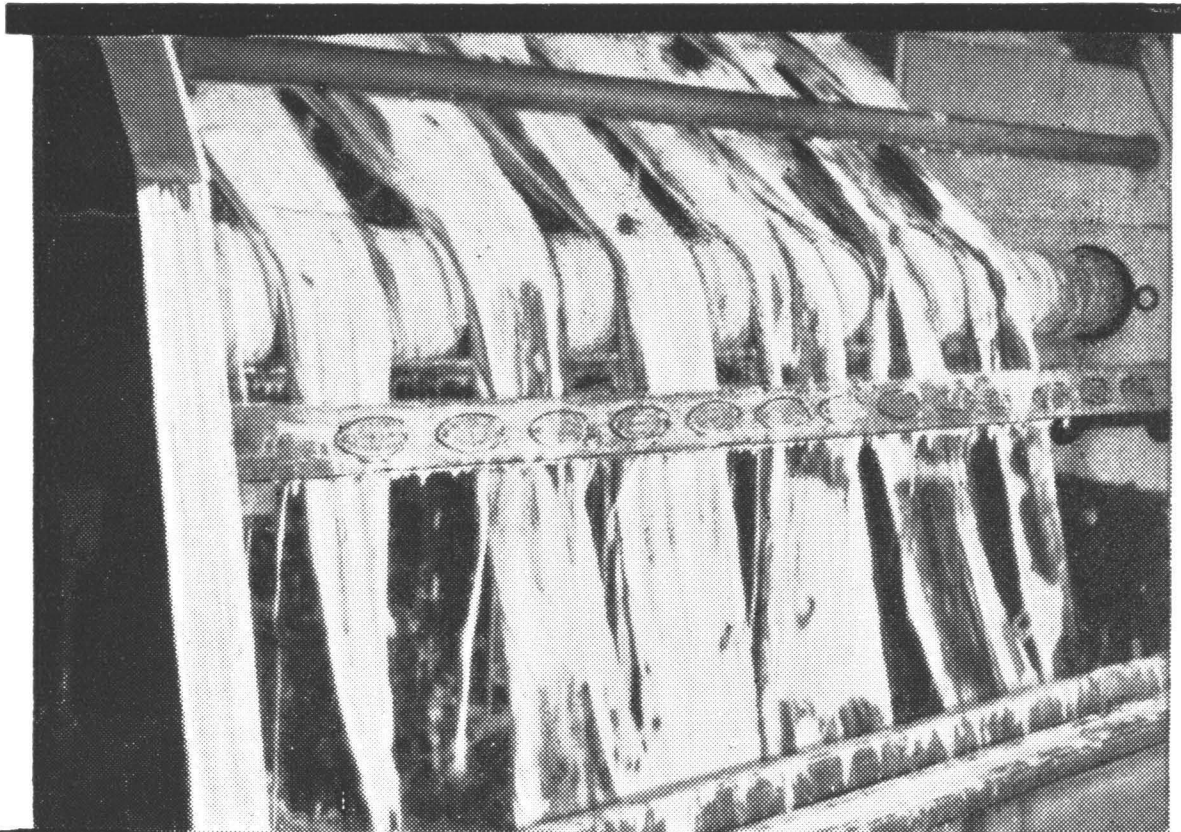
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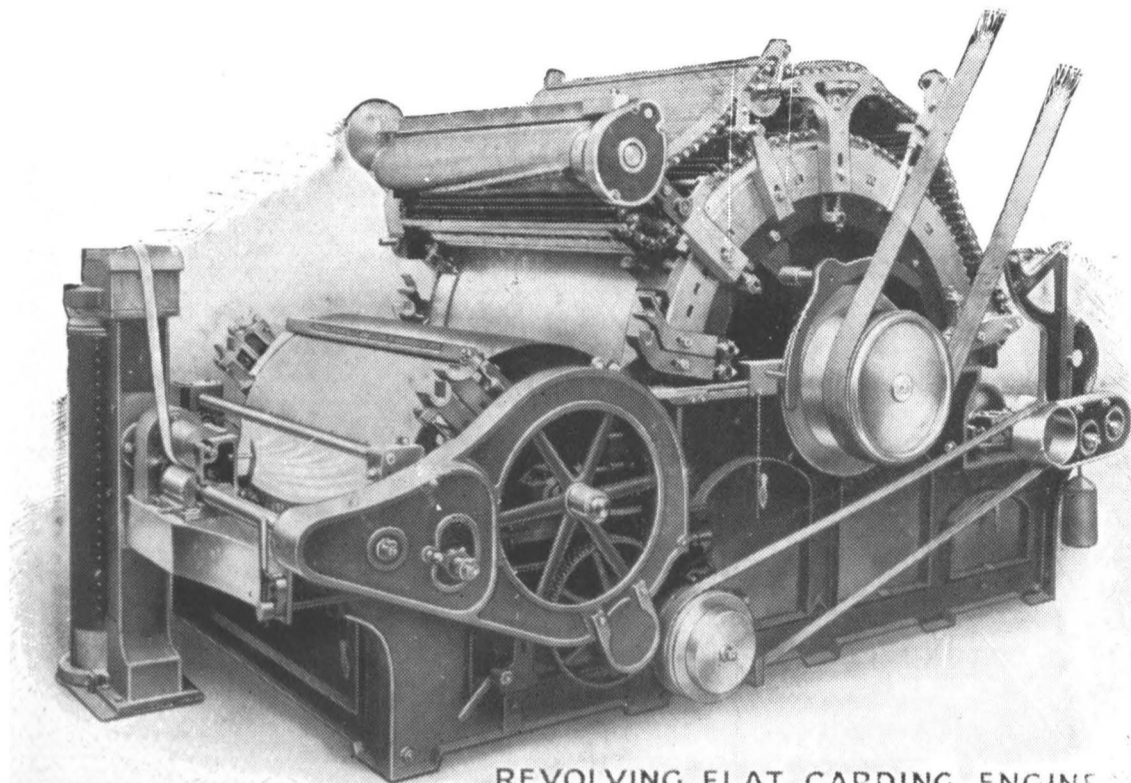
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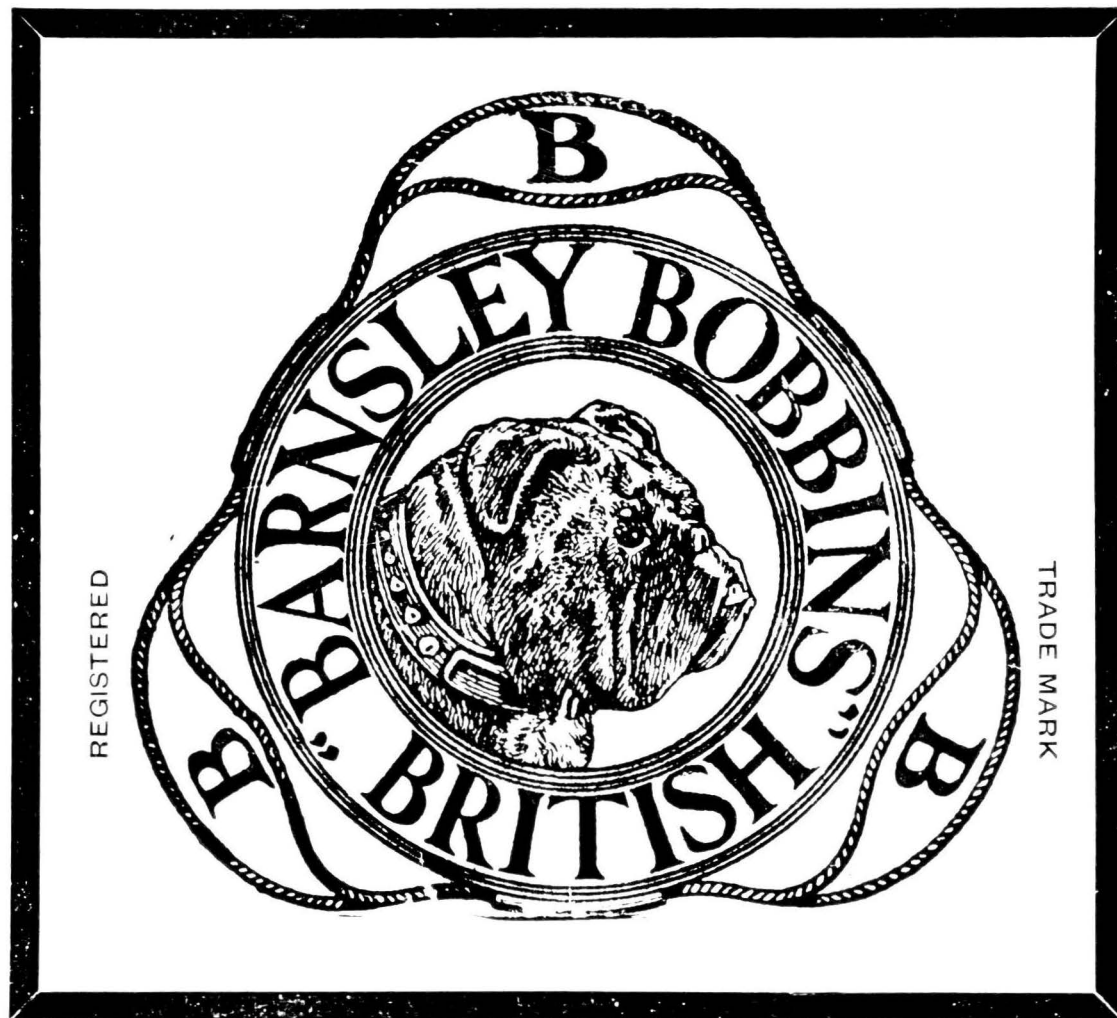
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THE JOURNAL OF THE TEXTILE INSTITUTE TRANSACTIONS

11—A TACTILE COMPARISON OF THE CLOTH QUALITIES OF CONTINENTAL AND NOBLE COMBED MATERIALS

By HENRY BINNS, F.T.I.

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INTRODUCTION

In a previous paper* some of the results suggested that a further series of tests on the "handle" of cloths by the sense of Touch was desirable. Information as to the stability of the individual judgments, the magnitude of any fluctuations recorded, and the influence of touch would seem to be valuable and it would be helpful to ascertain what effect ill-health, worry, or other conditions had upon sound touch judgment. Such records would appear to have definite educational value.

The Samples Employed

The ranges of samples used were those designated R₄, R₅, and R₆ in the previous paper where full details of the cloths are given (pp. 190 and 195) and this ensured results strictly comparable with those already recorded. Each sample was weighed and the average thickness (20 tests) was recorded by means of an Ashcroft thickness gauge. These are given in column 6 of Table I.

The Judges

These consisted of the two following groups—

- (a) 22 Manufacturers and buyers of Botany dress goods similar to those used for the tests. Each had had a wide experience and held a responsible position in the trade.
- (b) 6 Boys (15-18 years of age). One had previously matriculated but continued his studies. Two were intellectually inclined and the other three were more skilled in the direction of handwork at which one was "almost excellent" and the last "distinctly poor".
- (c) The Experimenter himself.

The Instructions Given

To secure an adequate basis for the measurement of fluctuation it was decided to request each judge to grade each range five times by the sense of Touch alone, placing the samples in the order of his own preference. After each grading, which was recorded by the experimenter, the cloths were mixed by the experimenter before regrading. Every precaution was taken to ensure that not even a casual glance at the cloths was secured and that the influence of "suggestion" (see page 195, previous paper), was entirely absent.

Methods of Calculation

The methods previously employed (p. 191) were again used and the probable errors for the ranges in this investigation were R₄ and R₅ \pm 0.18, R₆ \pm 0.20.

* Psychological Investigations of the Influence of the various methods of manufacturing Worsted yarns on single and two-fold twist-warp cloths—(a) Clear finished, (b) Milled finished. H. Binns. *J.T.I.*, 1934, 25, 189-1105.

COMPARISON OF THE GRADINGS BY "FULL"* JUDGMENT WITH THOSE BY "TOUCH" ALONE

Table I—Range R4, Milled Finish

Cloth	Combing	Drawing	Spin- ning	Weight oz. drms.	Thickness inches	Full	Touch		Experi- menter
						Judg- ment 50 Jdgs.	22 Adults	6 Boys	
R (B)	Noble	Cone	Cap	4.8½ (1.5)	.0270 (2)	100 (1)	77 (3)	6 (4.5)	100 (1)
T (B)	Noble	Cone	Ring	4.7 (4)	.0266 (4)	82 (2)	92 (2)	100 (1)	95 (2)
U (B)	French	French	Mule	4.5 (6)	.0251 (6)	58 (3)	100 (1)	50 (2)	0 (6)
V (B)	Noble	French	Cap	4.6½ (5)	.0257 (5)	35 (4)	46 (4)	6 (4.5)	10 (5)
W(B)	French	French	Cap	4.8 (3)	.0267 (3)	5 (5)	0 (6)	0 (6)	15 (4)
X	French	(B)French	Cap	4.8½ (1.5)	.0271 (1)	0 (6)	8 (5)	14 (3)	85 (3)

(B) = When backwashed.

The correlation co-efficients of agreement (or disagreement) are given in Table I (a).

Table I (a)—R4 Milled Finish

	Weight	Thickness	Full	Touch		Experi- menter	Average
				Adults	Boys		
Weight ...	—	1.00	-.13	-.65	-.46	.82	.12
Thickness ...	1.00	—	-.26	-.65	-.46	.73	.07
Full Judgment...	-.13	-.26	—	.73	.29	.53	.23
Touch (Adults)...	-.65	-.65	.73	—	.73	.00	.03
(Boys) ...	-.46	-.46	.29	.73	—	.16	.05
Experimenter ...	.82	.73	.53	.00	.16	—	.45
				Average	...	...	.16

Weight and Thickness

When the samples were prepared all of them were laid full out, flat, upon each other and then the whole lay was cut at one time on a 36-in. gimping machine. The differences in area between one cloth and another must therefore have been exceedingly small and yet there is a variation in weight of 3½ drams.

Group Agreements

The most striking feature of Table I (a) is the agreement between the experimenter and weight +.82: and with thickness +.73, and with the full judgments +.53. At the same time there is no agreement with Touch (Adults) at +.00. This points definitely to judgment being recorded by weight and thickness. This may be due to the fact that the writer's experience was mainly on Yorkshire union shirtings, which are relatively weighty and thick and are of a lofty milled finish—all characteristics of this range (R4) of Botany cloths. The other groups definitely reverse this preference, the Touch (Adults) group liking the lighter weights—and also, of course, the thinner cloths. Another point of interest is that the Full Judgment and the Touch (Adults) agree at +.73, suggesting that Touch is the dominant factor in the Full Judgment. As the Touch (Boys) agree with Touch (Adults) at +.73 some natural (as against trained) feature of touch is indicated. It will be noted that the weight and thickness factors are in agreement at 1.00.

Tables II and II (a) record similar results for Range R5.

Table II—Range R5, Clear Finish

Cloth	Combing	Drawing	Spin- ning	Weight oz. drams.	Thickness inches	Full	Touch		Experi- menter
						Judg- ment	Adults	Boys	
R (B)	Noble	Cone	Cap	4.4 (1.5)	.0225 (1)	100 (1)	100 (1.5)	90 (2)	100 (1)
T (B)	Noble	Cone	Ring	4.4 (1.5)	.0221 (4)	66 (2)	74 (3)	100 (1)	76 (2)
U (B)	French	French	Mule	4.1 (6)	.0220 (6)	64 (3)	100 (1.5)	67 (3)	0 (6)
V (B)	Noble	French	Cap	4.2 (5)	.0225 (2)	8 (5)	47 (5)	32 (4)	21 (5)
W(B)	French	French	Cap	4.3 (4)	.0220 (5)	24 (4)	58 (4)	26 (5)	43 (4)
X	French	(B)French	Cap	4.3½ (3)	.0223 (3)	0 (6)	0 (6)	0 (6)	57 (3)

(B) = When backwashed

* See previous paper, Table IV, p. 195.

Table II(a)—R5 Clear Finish

	Weight	Thickness	Full	Touch		Experimenter	Average
				Adults	Boys		
Weight ...	—	.64	.64	.41	.41	1.00	.62
Thickness ...	.64	—	.00	-.13	.00	.73	.25
Full Judgment	.64	.00	—	.95	.89	.73	.64
Touch Adults	.41	-.13	.95	—	.73	.41	.59
Boys ...	.41	.00	.89	.73	—	.29	.46
Experimenter...	1.00	.73	.73	.41	.29	—	.63
Average ... ..							.53

Weight and Thickness

Though not so pronounced as in the milled range, the agreement between weight and thickness is +.64. All groups are influenced by weight and especially the experimenter whose decision is absolutely agreed at +1.00. On thickness the experimenter is again influenced to the extent of +.73 yet he can honestly say that in all judgments the general feeling of quality was the uppermost in his mind. There is no denying the fact that weight and thickness are significant.

Group Agreements

The Full Judgment is practically agreed with the Touch (Adults) and (Boys) and the Experimenter, rather suggesting that a natural and untrained touch, biased by weight but not by thickness, is at the base of Full Judgment. In the milled range the final average of +.16 shows that opinions are pretty nearly balanced; some persons decide in one direction, others in the opposite. But in this clear range, all are fairly agreed if the thickness factor be excepted. For training purposes, therefore, the clear finish is much more suitable for beginners and the milled for advanced students.

In the following tables the third range, R6 (see previous paper p. 195), is recorded.

Table III—R6 Mid. Finish

Cloth Combing	Draw- ing	Spin- ning	Weight oz. drams.	Thickness inches	Sugges- tion	Touch		Experi- menter
						Adults	Boys	
R (B) Noble	Cone	Cap	4.10½ (1.5)	.0272 (1)	100 (1)	100 (1)	41 (3.5)	78 (2)
S (B) Noble	Cone	Cap	4.10½ (1.5)	.0267 (2)	0 (5)	71 (3)	55 (2)	100 (1)
V (B) Noble	French	Cap	4.9 (5)	.0262 (4)	4 (4)	0 (5)	0 (5)	60 (4)
W (B) French	French	Cap	4.10 (3.5)	.0254 (5)	15 (3)	88 (2)	100 (1)	0 (5)
X French(B)	French	Cap	4.10 (3.5)	.0263 (3)	72 (2)	30 (4)	41 (3.5)	61 (3)

(B) = When backwashed

Table III(a)—R6 Mid. Finish

	Weight	Thickness	Full	Touch		Experi- menter	Average
				Adults	Boys		
Weight ...	—	.75	.27	.75	.62	.75	.63
Thickness ...	.75	—	.46	.46	.00	.94	.52
Suggestion ...	.27	.46	—	.46	-.48	.00	.33
Touch (Adults)...	.75	.46	.46	—	.62	.00	.46
(Boys) ...	.62	.00	-.48	.62	—	-.48	.06
Experimenter ...	.75	.94	.00	.00	-.48	—	.20
Average ... ..							.37

This range was originally employed in connection with the Personal Suggestion tests and must be regarded as biased on that account. Numbers R and S were cut from the same piece of material and might be assumed to be of equal quality. Under suggestion, R took first place S and the last place.

Weight and Thickness

Weight and thickness are again closely associated at $+0.75$. The Experimenter's Touch is determined by thickness and not much by weight; the Touch (Adults) being influenced by both and the Touch (Boys) only by weight. Thickness has a stronger influence in this range than in the others, due probably to the "lofty" handle described by some as "flannelly".

Group Agreements

The Touch (Adults and Boys) are agreed at $+0.62$, weight being a common factor but not thickness. The experimenter disagrees with both, probably because the flannelly feel has more influence with him as indicated by the thickness $+0.75$. The finish of this range was a medium between the milled and clear finishes and in the general average of $+0.33$ also shows a mid-position between $+0.16$ and $+0.53$ respectively.

THE BASIS OF JUDGMENT BY TOUCH**Yarn Construction**

In the previous inquiry it was shown that the final mass gradings of the fifty judges, on a full judgment correlated to the milled and clear finishes gave an agreement of $+0.99$. This indicates that the method of yarn construction was the fundamental point of agreement between the two ranges. The question now arises whether the Adult judges, the Boys, and the Experimenter, by Touch alone, give a similar agreement. These results are—

22 Adults	...	...	...	+ .64
6 Boys	...	...	...	+ .53
Experimenter	...	...	...	+ 1.00

This shows that the method of yarn construction is again the deciding factor. It is noteworthy that the Experimenter should have placed the two ranges after averaging 100 trials of each by Touch in absolutely the same order. Yet there is a striking difference between all the groups in their order of preference for yarn types—broadly represented by British, Continental, or Mixed.

Choice	1st	2nd	3rd	4th	5th	6th
50 Judges	Br.	Br.	Con.	Mix.	Mix.	Mix.
22 Judges	Con.	Br.	Br.	Mix.	Mix.	Mix.
6 Boys	Br.	Con.	Br.	Mix.	Mix.	Mix.
Experimenter	Br.	Br.	Mix.	Mix.	Mix.	Con.

Weight and Thickness

The weight of the samples might influence the groups, especially as there is an agreement of $+0.82$ between the two ranges by weight. Both having been cut in separate lots in purely a chance order, it would appear that the weight of the cloths per unit area by reason of their yarn construction, is decisive and not the actual size and weight of the samples themselves. The Experimenter's Touch grading of the two ranges is in absolute agreement at 1.00, showing an emphatic bias by Touch. The fifty judges on a full judgment averaged $+0.99$; the twenty-two Adults on Touch $+0.64$; and the Boys on Touch $+0.53$, showing only a tendency to be influenced by weight. Is weight, thickness, or "handle" the cause of these agreements? The averages of the two range agreements are given in Table IV.

Table IV

	Weight	Thickness	Adults Trained Touch	Boys Untrained Touch	Experimenter Biassed Touch
Full Judgment	... .25	... -.13	.83	.59	.63
Touch (Adults)	... -.12	... -.39	—	.73	.20
(Boys)	... -.20	... -.23	.73	—	.22
Experimenter	... .91	... .73	.20	.22	—

Bias of Judgment

It has already been noticed that thickness and weight have opposing effects on judgment in the milled and clear ranges, yet there is an agreement on yarn construction of +.99. That these factors do not play an important part is shown by the small disagreements on weight and thickness; though the biased Touch of the Experimenter in this direction is well defined on both finishes. This biased Touch is only in slight agreement with Touch (Adults) at +.20 and Touch (Boys) at +.22, showing that weight and thickness are not the bases of judgments. As, however, the agreements are very high, first between the full judgment and the Touch (Adults) at .83 both groups being composed of experts and secondly between the Touch (Adults) and the Touch (Boys) (untrained technically but well trained educationally) at +.73 it seems that the basis of highly-skilled judgment is some delicate natural Touch for which there is yet no absolute physical measure. Further experiments point clearly to the possibility of measuring the sense of touch. A paper, "A Measure of Tactile Sense" is now in course of preparation.

THE FLUCTUATION IN PERSONAL JUDGMENT

Throughout the grading, mass judgment is seen to have stable results. The dominant ideas in a judge's mind by repeated trials or in the minds of a number of judges with one trial each, gives a fairly sound judgment. The mass judgment of a number of trained or experienced persons might well be termed the "trade opinion" of the cloths, whilst numerous experiments by one person might equally be termed a "personal judgment". The degree of reliability of both is recorded by averaging the agreements and comparing them with the probable effect of chance.

"Standard" and "Personal" Touch

This "trade opinion" of the Adult judges may for convenience be here called the "Standard Touch"; the repeated judgments in individuals as "Personal Touch". Assuming that the gradings arrived at on the three ranges are a fair trade judgment (on the sense of Touch alone), the averages of five opinions of one individual may be usefully compared with it. The same average also indicates the stability of the personal judgment of each person. It may be well first to examine the reliability of the individual's opinion before dealing with his comparison with others.

"Personal" Touch

The "Personal Touch" arrived at by averaging five trials of three ranges, of the twenty-two judges, ranges from +.88 to +.41, the average being +.63.

Table V shows the variation in the gradings by Touch alone of the three ranges by the first five and the last five judges.

Table V

First Judges					Last Judges				
	R4	R5	R6	Average		R4	R5	R6	Average
H ...	1.00	.87	.78	.88	A ...	.46	.26	.52	.41
C ...	.85	.99	.76	.87	Q ...	.25	.64	.33	.41
D ...	.92	.75	.80	.82	J ...	.54	.27	.46	.42
G ...	.79	.76	.82	.79	Y ...	.39	.71	.21	.44
B ...	.81	.92	.57	.77	T ...	.51	.64	.22	.46
Average for 5 judges ...									
	.87	.86	.77	.83		.43	.50	.35	.43
Average for 22 Judges									
	.62	.68	.60	.63		.62	.68	.60	.63

The stability of individual judgment is noteworthy in the high figure of agreement between judges H and C which is in contrast with that for A and Q. When new conditions are presented by a new finish, such as that of R5 and R6 following R4, the figures of the sound judges still remain stable. Whereas in Q and Y there are much wider variations under the new conditions. It will be noted also, that on average, the twenty-two judges graded the three ranges with about equal solidity—another indication of the value of mass judgment.

The six boys, totally unacquainted with textiles, give the results set out in Table VI.

Table VI

No:	Age		Headmaster's Report	R4	R5	R6	Average
	Y.	M.					
BH ₅	15	10	"Very good, almost excellent" ... ..	.86	.70	.84	.80
BI ₂	15	2	"Intellectually inclined" ... ..	.61	.65	.54	.60
BH ₄	14	11	"Distinctly poor" ... ..	.41	.85	.44	.57
BI ₃	15	8	"Intellectually inclined" ... ..	.47	.41	.67	.52
BI ₁	18	0	"Matriculated: concentrated mental effort three years ... ..	.46	.56	.48	.50
BH ₆	15	5	"Moderate" ... ..	.09	.26	.37	.24
Average ... ..				.48	.57	.55	.54
Average for 22 Adults ... ..				.62	.68	.60	.63

In BH₅ is represented the all-round excellent boy, who would probably make good, if sufficiently interested, in any industry or profession into which he might enter. It is suggested that a boy who can repeat, by Touch alone, such difficult tests, is worthy of the best technical training available, so as to use his natural ability. The last boy, BH₆, was "moderate" at school, and good in manual work, but his appreciation of small differences of this kind was low. BH₄, though "distinctly poor" at schoolwork, was selected because of his handwork; his sense of Touch proving high, he might well be placed where more delicate manual work was required.

The three boys, BI₁, BI₂, and BI₃, were obviously considered better than the handwork boys, BH₄, BH₅, and BH₆, at school, but on average they proved about equal in these tests. These six selected individuals do not probably represent boys in general of the same ages.

An analysis of the fluctuation of judgment by the experimenter will be dealt with later (see p. TI67) but for comparative purposes the best set and the worst set of five judgments with the average of 100 trials are presented.

	R4	R5	R6	Average
Best set of five	.91	.91	.68	.83
Worst set of five ...	.46	.23	.05	.25
Average of 100 trials	.67	.57	.48	.57

Weight and thickness have been shown to bias the judgment of the experimenter. By averaging these two factors and comparing this average with the 100 trials above, the bias is again given—R4 milled = +.91; R5 clear = +.82; R6 milled = +.52.

THE DEVIATION OF PERSONAL JUDGMENT FROM MASS JUDGMENT

"Standard Touch" should fairly represent a "trade opinion" on Touch. Comparison (see Table VII) with the gradings of individual judges indicates how far these judges are individually able to assess this "trade opinion".

Table VII

First					Last				
5 Judges	R4	R5	R6	Average	5 Judges	R4	R5	R6	Average
C ...	.64	.87	.52	.68	V ...	.03	-.14	.04	-.05
R ...	.79	.60	.58	.66	M ...	.11	.15	-.38	-.04
B ...	.69	.74	.42	.62	A ...	.16	.20	-.45	.03
D ...	.28	.77	.77	.61	L ...	.03	.35	-.22	.05
E ...	.48	.65	.15	.43	T ...	.20	.28	-.15	.11
Average ...	.58	.73	.50	.60		.11	.17	-.23	.02
Average for 22 Judges	.32	.39	.12	.28		.32	.39	.12	.28

The ability to make a decisive judgment which at the same time agrees closely with "trade opinion" has definite commercial value. Judge C for example recorded an opinion on three ranges of +.87 (see Table V) which agreed with the "trade opinion" as closely as +.68—both above the average. D and B have also sound and similar judgments. It is significant that the best judges are good all-round technical and practical men.

The last five were characterised by—declining ability due to age; only a few years' training at middle age; lack of fixed responsibility; preference for lower grade goods denoting less desire for fine differences.

Taking the "Standard Touch" as a basis comparison the boys, ranked in the order of personal stability, show the following results, Table VIII.

Table VIII

Boy	Personal Rank	Trade Rank	R4	R5	R6	Average
BH ₅	1	1	.26	.50	.59	.45
BI ₂	2	3	.21	.63	.10	.31
BH ₄	3	4	.00	.37	.53	.30
BI ₃	4	5	.34	.30	.09	.24
BI ₁	5	2	.40	.45	.33	.39
BH ₆	6	6	.05	-.05	.24	.08
Average of Boys ...	...	...	.21	.37	.28	.20
Average of 22 Adults ...	...	...	.32	.39	.12	.28

The variations on each range are greater for the boys than for the adults: the best boy is only equal to 66% of the best adult. At the other end of the ranking there is not much to choose: on average there is no difference. At first sight it is not easy to understand why the boys judge so well. An explanation has already been offered (see p. TI61) that the basis is some delicate natural touch, as yet unmeasured physically. Further confirmation is seen in the "personal" and "trade" grading of the boys which closely agree, although the trade grading was entirely determined by others. An agreement of +.73 indicates that their "personal" judgment also represents a fair "trade" judgment.

As there can be no connection between the two, some common factor is present. This is neither weight nor thickness but has been shown to be some minute difference in yarn construction detectable by Touch alone by persons of good intelligence irrespective of training and experience.

DETECTION OF NATURAL TOUCH ABILITY

It would appear that this subtle variation in judgment between one person and another is one of degree rather than of kind. In this case it should be possible to rank the individuals not perhaps from a commercial, but purely from an educational point of view.

A Trade Standard is necessarily confused by the enormous variety of considerations entering into the judgment of a skilled judge. Not only has

he to form his own conclusions but he must attach even more importance to what he thinks to be the opinion of his customers. If the twenty-two judges be ranked in order of Touch ability, accepting the "Standard Touch" as a basis and comparing this with the average of five "personal" judgments there is an agreement of $+0.40$. It would not be therefore allowable to accept the selection of one as being representative of the other, though the two are moderately agreed. In the case of the Boys and from the same standards there is an agreement of $+0.73$ which does in fact represent a well-founded agreement.

The simpler way of arriving at a comparison between the trained and untrained person is to eliminate as many of the factors as possible which lie outside the main facts of judgment, e.g. fashion may demand a clear in preference to a milled finish. The trained individual would probably judge the clear finish with the greater reliability because of recent practice; the boys might be attracted by the fullness of the milled finish. In such case the results are not necessarily of equal value.

A personal judgment can be well demonstrated by repeating the grading of each range five times and accepting the average as the standard. Whatever dominant idea is present in the mind of the trained or untrained judge will record itself in the final issue and those minor points which fluctuate will, by confusion, have little influence. If the two groups be ranked in order of stability of personal judgment the agreement, by Touch only, is—

	R4	R5	R6	Average
22 Trained Men ...	.87	.73	.73	.78
6 Untrained Boys	.89	.73	.73	.78

This shows a very close relationship in principle and indicates a basis of measuring the degree of Touch ability present in each person.

In contrast to this the rank in order of stability of personal judgment compared with the ranking of the trade opinion shows—

	R4	R5	R6	Average
22 Trained Men ...	.31	.43	.23	.32
6 Untrained Boys	.82	.73	.64	.73

The "personal" opinion appears to be in conflict with the "trade" opinion in the trained men, suggesting confusion of thought. In the minds of the untrained boys the relatively few basic facts register themselves and these with certainty. Also it should be noted that a subtle sense of Touch was the most prominent feature in judgment. It would not be permissible therefore to accept the basis of a "trade opinion" as a measure of the reliability of "untrained" touch.

A simple method is described in a previous paper* and deals only with the placing of the best and worst cloths in a range, because it is shown definitely that these adequately represent the grading of the whole range. Ranking the same persons in the same way and comparing this "Measure of Reliability" of Personal Judgment with the full grading, the results are—

	R4	R5	R6	Average
22 Trained Men ...	.75	.73	.72	.73
6 Untrained Boys	.95	.73	.73	.80

or the "Measure of Reliability" of Personal Judgment compared with Trade Judgment, gives—

	R4	R5	R6	Average
22 Trained Men ...	.31	.41	.37	.36
6 Untrained Boys	.73	.73	.41	.62

* *J. Text. Inst.*, 1926, (17), T619, lines 28-46.

It is suggested, therefore, that the best way to measure untrained ability is to allow it to be self-contained. By inviting an individual to grade a range of cloths five times and then calculating the decision on what may be termed the stability, or strength of decision of the whole, it will give a reliable indication of the probable value of a technical training for that individual.

THE EFFECTS OF SHORT PRACTICE

Repetition of the tests has been shown to give a more balanced judgment of the cloths than a single grading. From the "Standard Touch" some indication of the effect of practice might be drawn. Taking the average agreements between the Touch (Adults) judges on each of their five trials, the results are—

		R4	R5	R6	Average
First Trial ...	...	.58	.59	.59	.58
Second Trial	...	.65	.74	.57	.65
Third Trial	...	.69	.71	.51	.64
Fourth Trial	...	.58	.70	.69	.66
Fifth Trial ...	...	.61	.65	.64	.63
Average	...	.62	.68	.60	.63

These gradings were carried out independently, yet there is a remarkable stability on the different trials which practice seems to have changed very little. The boys on the same basis show—

		R4	R5	R6	Average
First Trial ...	...	.70	.69	.39	.58
Second Trial	...	.40	.59	.52	.50
Third Trial...	...	.45	.68	.35	.50
Fourth Trial	...	.31	.37	.67	.45
Fifth Trial ...	...	.54	.59	.81	.65
Average	...	.48	.57	.55	.54

The boys show an average variation between extremes on the three ranges of $+.39$ and the men only $+.15$ though practice would seem to have caused some improvement in the fifth trial by the boys.

THE EFFECTS OF A LONG PERIOD OF PRACTICE ON THE JUDGMENTS OF THE AUTHOR

In order to trace the effects of a relatively long period of practice the experimenter graded the three ranges 100 times each. No time was recorded but an hour and a half each day for thirty days would certainly have been required to complete the three ranges. As it was not possible to work every day, six weeks to two months were occupied in these experiments.

Some indication has already been given (see p. T158) that weight and thickness did much to influence the average decision. As each of the three ranges of samples were cut from the piece and gimped independently in purely chance order, any variation in the area and the weights (see Tables I, II, and III) of the samples were too minute to indicate any changes in yarn spinning methods. Yet it is significant that in ranges R5 and R4, cloths made from identical yarns, yielded identical results, though the finish was quite different and the strength of the decisions was more marked in the milled than in the clear finishes. As the two ranges produce the same results and R6 is in agreement, $+.75$, this standard grading of cloths may be termed "Touch, 300" and comprised 5,100 placings or units of judgment.

The questions which it seemed desirable to answer are given below and from the data an attempt has been made to reply to them.

What effect has long practice on—

- (1) *The strength of the decisions, disregarding any daily change of opinion.*
- (2) *The strength of decision of five trials on R4 milled followed by five trials of R5 each day.*
- (3) *The daily averages on each range in their relation to the standard "Touch, 300" of the Experimenter.*
- (4) *Improvement or otherwise during the five trials of each range each day, in strength of decision, and in accuracy.*
- (5) *The first set of gradings in regard to accuracy in comparison with the four succeeding ones.*
- (6) *Judging the samples in cuttle form or fully opened, and how these affect the accuracy of the decisions.*

1—The extreme strength or weakness of the decisions vary in the hundred trials of each range as follows—

	Highest	Lowest	Average of 100
R4 Milled	1.00	— .26	.68
R5 Clear	1.00	— 1.00	.57
R6 Milled ... ..	.95	— 1.00	.48

This clearly shows the divergent opinions it is possible for one person to have at different times. A contrast of stable and erratic judgments is given for each trial—

	R4		R5		R6	
	Stable	Erratic	Stable	Erratic	Stable	Erratic
First Trial ... ..	.73	.95	.95	.53	.94	— .48
Second Trial ... ..	.95	.41	.95	.00	1.00	— 1.00
Third Trial ... ..	.95	.82	.95	.89	.46	1.00
Fourth Trial ... ..	.95	— .26	.89	— .26	.46	.00
Fifth Trial ... ..	.95	.41	.82	.00	.46	.75
Average ... ..	.91	.47	.91	.23	.66	.05

This implies that during the period of judgment either a decisive and stable opinion exists or that, for some reason, the mind is wavering.

A complete change from dry weather to a very wet day suggested that a change in judgment might be expected, but the average of ten trials gave an agreement of +.06 above the normal.

2—Comparing the first ten series of gradings in each cloth, there is an agreement of +.13 and in the second ten a disagreement of —.26 giving an average of —.06. This seems to imply that a stable set of judgments on one finish does not necessarily mean stability in grading another finish.

3—From almost a unique standard of touch in which neither of two finishes has been shown to have influenced the judgments of yarn construction, some observations on fluctuations are available. A comparison may be made between the strength of decision and the accuracy as measured from the Standard "Touch, 300".

	R4	R5	R6	Average
Strength of decision ... ..	.68	.57	.48	.57
Accuracy ... ..	.52	.42	.24	.39
Difference ... ..	.16	.15	.24	.18

To this extent, therefore, there is a variation in the selection of samples each day. It must, of course, be borne in mind that these samples represent the maximum difficulty and on a most restricted judgment by Touch alone.

Some contrasts in accuracy are recorded.

	R4		R5		R6	
	Stable	Erratic	Stable	Erratic	Stable	Erratic
First Trial ...	.73	-.26	.99	-.65	.46	.46
Second Trial ...	.99	.00	.73	.00	.75	-.48
Third March ...	.73	.53	.53	-.26	.75	.46
Fourth Trial ...	.89	-.26	1.00	.53	.75	-.15
Fifth Trial ...	.73	-.65	.89	.00	.75	-1.00
Average ...	.84	-.13	.83	-.08	.69	-.14

In the case of R4, +.84 was recorded one day and -.13 the next. The former had a "decision" of +.91, and the latter of +.55. This shows that a sound judgment may be strong one day and on the next, that a moderate "decision" may be associated with a poor judgment.

4—To measure improvement by practice the scores should show a steady advance from the beginning to the end of the tests. The agreements are here stated for the ranking of ten series of five judgments each.

	R4		R5		R6		Average
	First Fifty	Second Fifty	First Fifty	Second Fifty	First Fifty	Second Fifty	
Strength of decision ...	-.38	.07	-.26	-.69	-.26	-.20	-.28
Accuracy... ..	.07	.07	.18	-.04	-.63	.07	-.05
Average ...	-.15	.07	-.04	-.36	-.44	-.06	—

Practice has not improved either of the main factors of judgment. This does not definitely imply no improvement by practice, but it does show that repetition is likely to cause irritation or fatigue thus reducing the powers of judgment.

5—This question may be re-stated as follows. Is the first arrangement of a range likely to be as accurate as any of the following arrangements? Separating the "strength" of the decisions from the "accuracy" the records show—

	"Decision"				"Accuracy"			
	R4	R5	R6	Average	R4	R5	R6	Average
First Trial ...	.73	.59	.52	.61	.54	.52	.45	.50
Second Trial ...	.70	.42	.23	.45	.62	.22	-.08	.25
Third Trial ...	.72	.57	.55	.61	.54	.40	.34	.43
Fourth Trial ...	.62	.60	.56	.59	.39	.56	.35	.43
Fifth Trial ...	.64	.65	.57	.62	.53	.41	.15	.36
Average ...	.68	.57	.48	.57	.52	.42	.24	.39

There is practically no variation of four trials in "decision". On "accuracy" the first arrangement is definitely the best. The second arrangement has both less "decision" and is less "accurate" than any of the others. This confirms observation in other investigations by the experimenter, that second judgments are often bad, sometimes to the extent of reversing the previous and succeeding arrangements.

Regular practice for one to two hours a day on the same samples for two months does not materially alter the judgment, by Touch, of a trained man. His first judgment of a range is probably as sound as any he is likely to make afterwards provided health and environment are the same. With the untrained person there is no evidence in this inquiry on long practice.

6—It was noticed that different judges in the previous inquiry handled the samples in different ways, from being fully opened to remaining in cuttle as they left the bag. These two extremes were tested by the Experimenter himself, the results being—

(a) First, the differences between the samples judged in cuttle or open on the “strength of decision” of 150 arrangements.

				R4	R5	R6	Average
Cuttle	...	...	...	.67	.58	.53	.59
Open	...	...	...	.68	.56	.42	.55
Average ...				<u>.67</u>	<u>.57</u>	<u>.48</u>	<u>.57</u>

The decision and stability of judgment is not, therefore, affected by the difference in method.

(b) Second, the reliability of judgment obtained from the two methods compared with the final Touch grading of cloth by the experimenter himself.

				R4	R5	R6	Average
Cuttle	...	...	...	.43	.39	.26	.36
Open	...	...	...	.60	.46	.23	.43
Average ...				<u>.51</u>	<u>.42</u>	<u>.24</u>	<u>.39</u>

On two ranges there is a definite advantage in accuracy in opening the samples fully out, but from these figures it would appear that a decisive set of judgments can be given by either method.

In the worsted industry the fundamental basis of judgment may be exactly the same in two groups of persons or in two individuals and yet their opinions may vary from a “moderately agreed” to “agreed in the main” basis. This seems to cause confusion to representatives of other industries whose raw materials are not so variable or which can be measured with accuracy by mechanical appliances. An “opinion” is of importance to worsted manufacturers and this in turn is subject to considerable fluctuation by mental and physical changes within the individual and by environmental changes over which he has little or no control.

7—The Time Factor being of importance it is desirable to find a simple, yet reliable, method for assessing “strength” of decision and “accuracy” of judgment by one figure.

That the “Measure of Reliability” does this effectively is shown by the following, which compares this measure with the average of those already given on “strength” of decision, and with the “accuracy” of the arrangement of each range of cloths on a basis of the Standard (in this case) 100 judgments.

			R4		R5		R6		Average
	Fifty		First	Second	First	Second	First	Second	
Strength of decision62	.92	.81	.94	.72	.75	.79
Accuracy...86	.86	.62	.75	.75	.81	.77
			<u>.74</u>	<u>.89</u>	<u>.71</u>	<u>.84</u>	<u>.74</u>	<u>.78</u>	<u>.78</u>

This is a remarkably high agreement, is fairly stable throughout, and should be considered sufficient for all requirements.

MEASUREMENTS OF THE “TOUCH JUDGMENT” ABILITY OF AN INDIVIDUAL JUDGE—MD₂

The series of experiments now to be described were carried out by one of the fifty judges whose services had been secured for the work described in a previous paper*. He was also one of the twenty-two “touch-judges” whose records are given above. He was a manufacturer of botany dress goods and

**J.T.I.*, 1934, 25, 189–1105.

regarded in the trade as a competent judge. He volunteered to perform a further series of cloth gradings and the Experimenter's thanks are here warmly accorded to him for his loyal adherence to a task which proved irksome long before it was completed.

Indications of the Personal Ability of MD₂

The highest score recorded by any one of the fifty judges in their "full" judgments was +.77. MD₂ scored +.74. On the various ranges previously judged his figures compared as below with the average of fifty judges—

	MD ₂	Average of 50 Judges
R1—sight only ... ..	.81	.46
R1—touch only ... ..	.37	.15
R2—milled ... ..	.67	.53
R3—clear ... ..	.76	.49
R4—milled ... ..	.53	.37
R5—clear ... ..	.99	.51
R6—suggestion ... ..	.75	.14
Average ... ..	.70	.38

In the Sight and Touch tests he was remarkably good and resisted the "suggestion" in range R6 at +.75—under a less rigid scheme he might be stated to have resisted absolutely in that he placed the two duplicates next each other in first and second places.

Another proof of his ability was shown in range R3 (fifteen cloths clear finished) in which three samples were duplicated, one being marked "M" and the other "C", to suggest mule and cap. His grading placed each pair of duplicates next to each other, and in each group M had the higher place.

His agreement on the yarn differences in ranges R4 and R5 on full judgment, is +.75; the best and worst cloths being identical in both finishes. The time occupied per unit of judgment was 62 seconds, the average being 38 seconds, ranking him forty-third, thus showing a slow rate.

"Estimated Length" and "Memory" Tests by MD₂

He was next asked to estimate the length of various lines (intended to represent wool fibres) from $2\frac{3}{4}$ inches to 4 inches each. Some lengths were duplicated and a personal suggestion was introduced twice in order to confuse him. The variations were usually $\frac{1}{8}$ inch and not more than $\frac{1}{4}$ inch. "Suggestion" influenced him to the extent of $\frac{1}{4}$ inch in one case and not at all in the other. Including this, there was only a total displacement of $\frac{1}{2}$ inch on ten estimations, an average error of 1/20th of an inch.

A test utilising twenty duplicated photographs of fibres, tops, yarns, and weaves, there being infinitesimal variations in the second group, was next devised and carried out by MD₂. One set was spread out upon a table and the subject was invited to remember the different details in each photograph; no time limit being given. The twenty photographs were then shuffled with the duplicate twenty and all were replaced on the table. MD₂ was asked to select again the original twenty, and he made a 95% correct selection.

"Touch" Data Relating to MD₂

As previously stated he was selected from the first investigation to continue the second investigation by "Touch" alone (twenty-two judges). His results were as follows—

The average of his five trials by "Touch" gave a stability or strength of decision of—

							MD ₂	Average of 22 Persons
Range	R4	...	...	...	...	...	1.00	.62
	R5	...	...	...	...	...	.87	.68
	R6	...	...	...	...	...	.78	.60
(Position—First out of 22)							<hr/>	<hr/>
							.88	.63

His agreement by "Touch" with the selection of the other judges—

							MD ₂	Average
Range	R4	...	...	...	...	...	1.00	.32
	R5	...	...	...	...	...	.26	.39
	R6	...	...	...	...	...	.52	.12
(Position—Twelfth out of 22)							<hr/>	<hr/>
							.56	.28

His agreement on a "Full Judgment" with the "Full Judgment" of fifty judges.

							MD ₂	Average
Range	R4	...	...	...	...	...	.53	.37
	R5	...	...	...	...	...	.99	.51
	R6	...	...	...	...	...	.75	.14
(Position—Third out of 50)							<hr/>	<hr/>
							.76	.34

The stability required to give a "Full Judgment" to be compared with a restricted one on "Touch" two years later, is considerable. For MD₂ these judgments are in agreement to the following degree—

R4	...	...	...	.73
R5	...	...	...	.73

It is significant that (in three of the four judgments) MD₂ made Noble combing, cone drawing, and cap spinning, the first choice; which the fifty judges and the two hundred judgments by the Experimenter confirm. In the "clear finish" range by "Touch" he places Noble combing, cone drawing, and ring spinning as best. In all cases, therefore, the Bradford machine combinations are considered the most excellent after precautions had been taken to make the experiments impartial.

SELECTED CLOTHS FROM RANGES R2 MILLED AND R3 CLEAR MIXED TWO-FOLD AND SINGLE WARP YARNS GRADED BY MD₂

For this experiment five samples, each of two-fold and of single warp cloths, were taken from the full ranges of seventeen cloths in R2 milled and fifteen cloths in R3 clear finishes. The two ranges are not directly comparable as only seven out of the ten pairs of yarn combinations were identical. The grading of these seven cloths in the two finishes by MD₂ shows an agreement of +.26, whilst the same cloths were graded by the "Full Judgment" of fifty experts at .50. This shows that the fundamental differences in the cloth are not generally "finish" but "yarn construction", though in isolated cases (notably in cloth O) the finish makes a complete change. MD₂ grading by Touch, seems to indicate the same but to a less degree.

On gradings of the ten selected cloths, MD₂ agrees with "previous decisions" or those of other judges as follows—

	MD ₂	R2 Milled	R3 Clear
Full Judgment compared with Full Judgment of 50 experts		.54	.81
Full Judgment compared with 10 selected cloths by MD ₂ , 50 trials by Touch alone two years later	...	.69	.94
Fifty Touch trials compared with opinion by Full Judgment of 50 experts	...	.50	.90
		<hr/>	<hr/>
		.58	.88
		<hr/>	<hr/>

Here is shown the efficiency of MD₂; his appreciation of the clear finish indicates very sound judgment, but his dislike of the milled finish probably influenced his gradings.

First Choice Preference of MD₂

In the first inquiry on Full Judgment, it was shown that two-fold warps were preferred to singles on both milled and clear finishes, in the proportion of two to one. MD₂'s opportunity for preferring two-fold warps was greater than on that occasion, yet he only recorded a slight difference with five two-fold and five single cloths—

			By "Touch" MD ₂		Average
			R2 Milled	R3 Clear	
Two-fold warps	...	...	.51	.56	.53
Single warps	...	...	.49	.44	.47

By Touch alone therefore MD₂ has no decided preference.

Observations made by the Subject MD₂ during the Performance of the Special Tests

The gradings were done late in November and at times varying from 2 p.m. to 7 p.m. and on one occasion on a foggy day. Gaslight, as well as daylight, was employed, but there are no indications in the results that time and weather or atmosphere played much part in the gradings.

The physical condition of the subject was also noted and on occasion he recorded a "cold in the head", "influenza", "rough chapped hands", and having to commence the tests "after an arduous day". These indicated to him the probability of his judgment being influenced by physical condition.

When mental condition intruded itself on the subject, MD₂ recorded his impression of lack of training in this work, the handicap of being deprived of "sight", and anxiety to complete the tests. This last condition had a significant effect which will be seen from the figures recorded below.

In regard to the properties, etc. of the fabrics, he noted their surface softness as distinct from, yet involved with, their handle, pliability, and weight. He endeavoured to grade on the surface feel alone and expected thereby erratic results. Later he expressed the view that these properties were combined in "Touch sense" gradings. The "clear finished" cloths were first graded, then the "milled finished", and then each alternately, by which time the subject had expressed uncertainty as to the practical application of the tests and his own anxiety to complete them.

What does this "anxiety to get the job done" show in point of fact? In "strength of decision" the average in "milled" and "clear finish" was—

			R2M	R3C	Average
First "careful" set	...	...	.73	.69	.71
Second "anxiety" set	...	...	.58	.50	.54

and, in average group accuracy, compared with the final average of fifty trials as standard, was—

			R2M	R3C	Average
First "careful" set	...	...	.65	.53	.59
Second "anxiety" set	...	...	.34	.33	.34

Strength of decision in each of the five groups being reduced in harmony with mental conditions and entirely in disregard to the accuracy of cloth grading, accuracy was reduced to an even greater extent by the same conditions.

The subject anticipated that practice would improve his judgment; the facts are that the—

	R2 Milled	R3 Clear	Average
Improvement by practice on decision is	-.63	-.63	-.63
Do. on accuracy	-.75	-.32	-.53
	-.69	-.47	-.58

“Anxiety to be through” negatives any practice effect, the net result being that the earlier judgments from two points of view are better than the later trials. It was found in the tests made by the Experimenter on Touch, that the first judgments in each five were likely to be as sound as any of the others, with the second probably the worst. MD₂ did some of the trials one after the other and the results are recorded. The same tendency is present.

Trials in each Five Groups	R2 Milled Average of 10		R3 Clear Average of 10		Average
	Decision	Accuracy	Decision	Accuracy	
First Trials ... ..	.73	.56	.67	.56	.63
Second Trials ... ..	.67	.53	.52	.30	.50
Third Trials ... ..	.66	.55	.70	.44	.59
Fourth Trials ... ..	.60	.43	.63	.53	.55
Fifth Trials ... ..	.61	.38	.46	.31	.44
	.65	.49	.60	.43	.54

The “cold in the head, chapped hands, lack of sensitivity, and conditions of worry” seem probable causes of both the temporary fluctuations and the more permanent trend of loss of judgment.

The “Measure of Reliability” compared with Spearman’s Footrule Formula shows the agreement given below and is, therefore, over an extended set of trials by restricted judgment under difficult mental and physical conditions, seen to determine quite well the question of “decision”.

	R2 Milled	R3 Clear	Average
Decision ... ..	.90	.92	.91
Accuracy ... ..	.72	.58	.65
	.81	.75	.78

The time per unit was R2 milled, 34 seconds; R3 clear, 44 seconds; compared with Full Judgment time of 62 seconds. This variation may mean less care in handling.

Conclusions in Regard to MD₂ Gradings

The measured judgments of MD₂ show remarkable ability. Some of the results recorded are declared to be astonishing by those who have seen the cloths. He honoured his promise to execute an irritating task and gave the benefit of his feelings, mentally and physically not always of the best, but the results follow definite lines which might be anticipated. First judgments are at least equal to others, and more often are the best, in an experienced man. Tranquility of mind and body would appear to be desirable factors in sound judgment.

A RIGHT-HANDED TOUCH

A manufacturer (M₁) of 23 years’ experience and one of the fifty judges, came second in rank with a score of +.75. On range R3, where three duplicates of cloths were inserted, he placed the samples second and third; sixth and seventh; and twelfth and fourteenth; making only a one place error in the last set. Several months later these six samples were again submitted to him in pairs, and he made the same selection as on the former occasion. He then found a stronger sense of Touch in his right than his left hand—the better

of each pair of duplicates was declared to have a nicer Touch, though the other was "brighter and more sightly".

While acting as one of the (twenty-two) judges he declared —"If two samples are held one in each hand, and they appear to me equal, then I know that the one in the left hand is lower than that in the right. My right hand is a better judge than my left". He again obtained a stability score of +.77; of accuracy +.62; and was third judge by rank. He has since declared that the knowledge of the difference between the sensibility of his hands has been of considerable benefit to him financially and he is most particular to make use of it in his buying.

THE JUDGMENTS OF A BUYER AND AN ASSISTANT BUYER

The value of responsibility (especially financial) in developing ability is recognised in the trade, provided the other elements which educate judgment, such as continual practice, are also operative. A brief comparison between a buyer for a well-known wholesale house and his assistant may indicate the lines on which such development takes place.

				B4	AB2	Average	Average of 50 and 22 Judges
		Range		Buyer	Assistant		
Full Judgment	R2 Milled	.75	.67	.71	.53
"	R3 Clear	.49	.33	.41	.49
"	R4 Milled	.88	.99	.94	.37
"	R5 Clear	.73	.53	.63	.51
Partial	I S Sight	.66	.18	.42	.46
"	I T Touch	.18	-.04	.07	.15
Personal Suggestion—							
Resistance	R6	.46	.46	.46	.39
Touch only—							
Decision	R4 Milled	.52	.39	.46	.62
"	R5 Clear	.56	.71	.64	.68
"	R6 mid.	.61	.21	.41	.60
Accuracy...	R4 Milled	-.08	.03	-.02	.32
"	R5 Clear	.25	-.14	.06	.39
"	RR6 Mid.	.05	.04	.05	.12
			Average	.47	.33	.40	.43

The interesting fact is disclosed that though in these thirteen series of tests, B4 and AB2 generally may be said to rise and fall in their judgments together, the buyer is however on a higher level of efficiency at +.47 than his assistant at +.33. The huge turnover with which these gentlemen have to deal obviously demands careful and impartial judgments under favourable conditions.

PRACTICAL APPLICATIONS

The practical applications suggested by the above (and the previous) experiments may be worthy of indication as the work suggests that a sense of Touch correlates highly with a Full Judgment and may indeed be the final arbiter. To the wool trade as a whole the development of the sense of Touch is important. Fundamental differences in cloth construction can be detected by the means described and are not available by any mechanical or optical method of measurement. These experiments also indicate the possibility of detecting and of registering the degree of natural "Touch ability" in boys and girls and also would be readily employed for other training purposes. It should be the object of training to co-ordinate the employment of the sense organs with sound technical knowledge. The Experimenter has evidence in later tests, that a general measure of tactile sense is possible, applicable at all ages (except infants) and at any stage of experience or training. A simple test, with the proof of its usefulness will shortly be available.

12—THE DISSOLUTION OF CHEMICALLY MODIFIED COTTON CELLULOSE IN ALKALINE SOLUTIONS

PART I—IN SOLUTIONS OF SODIUM HYDROXIDE, PARTICULARLY AT TEMPERATURES BELOW THE NORMAL

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I—INTRODUCTION AND SUMMARY

The term "Chemically Modified Cotton Cellulose" has been used in publications from these laboratories to denote cotton the physical and chemical properties of which have been modified by the action of acids or oxidising agents. In particular, the materials obtained by the action of acids are termed hydrocelluloses, and those produced by the action of oxidising agents, oxycelluloses. The most important properties that are thus affected are the tensile strength, the reducing power (copper number), the acidity (Methylene Blue absorption), the stability towards hot dilute alkali, the fluidity in cuprammonium hydroxide solution, and the solubility in cold concentrated sodium hydroxide solutions. The inter-relations of these properties of modified cottons have been described in numerous papers from this Institute. In particular, Birtwell, Clibbens and Geake³ have investigated the solubility of modified cottons in sodium hydroxide solutions at the ordinary temperature; the object of the work described in the present paper was to extend the investigation to temperatures below the normal.

The use of low temperatures to facilitate the preparation of solutions of cellulosic materials in sodium hydroxide solution has been patented by Lilienfeld¹⁷ and the effect of such temperatures in increasing the solubility of wood pulps and viscose rayons has been shown by the work of D'Ans and Jäger⁹, Fukushima and Takamatsu¹³, and Atsuki and Shimoyama¹.

The solubility relations of modified celluloses, like those of many other colloids, differ from those of crystalloids in that the concentration of the solute in the presence of the solid phase depends on the amount of the solid used with a given volume of the solvent. The usual method of expressing the solubility of crystalloids, as the concentration of a saturated solution, has therefore little significance when applied to a modified cellulose, and in the present paper, following Birtwell, Clibbens and Geake³, the percentage of the material that dissolves under stated conditions is used as a measure of the solubility. When various weights of the same hydrocellulose were extracted with a given volume of sodium hydroxide solution, approximately the same percentage of each was dissolved, so that the solubility in the sense employed in this paper was practically constant; the concentration of material in solution, on the other hand, was proportional to the amount of the hydrocellulose used. This behaviour may be regarded as an indication of the heterogeneous character of modified cotton cellulose.

The results described in the present paper show that the solubility of hydro- and oxy-celluloses at any temperature is a maximum at a certain alkali concentration, and that as the temperature is lowered from the normal, the maximum solubility is greatly increased and occurs at a lower alkali concentration. Thus, for a certain hydrocellulose, the maximum observed

solubilities at 15°, 0° and -5° C. were 8.2, 57.5 and 82.6% and these maxima occurred at alkali concentrations of 3.0, 2.75 and 2.5*N* respectively. Maximum solubility of the hydro- and oxy-celluloses prepared from unmercerised cotton occurred at substantially the alkali concentrations quoted above, but it was found that modified cottons prepared from cotton previously swollen with concentrated sodium hydroxide solution had a maximum solubility at -5° C. at a rather higher alkali concentration. Thus, a series of oxycelluloses obtained by the action of oxygen on cotton impregnated with 10*N* sodium hydroxide solution, and a series of hydrocelluloses prepared from mercerised cotton, had maximum solubilities at -5° C. in 2.75 and 3.0*N* sodium hydroxide solutions, respectively.

When modified cottons are boiled under pressure with dilute alkali, the residual material is more soluble in sodium hydroxide solution at -5° C. than the original modified cotton, in spite of the loss of weight that occurs during the boil. The increase in solubility is slight with hydrocelluloses prepared from unmercerised cotton, but it is considerable with hydrocelluloses prepared from mercerised cotton and with oxycelluloses of the hypochlorite series examined.

When a modified cotton is treated with 5*N* sodium hydroxide—a treatment that effects insignificant dissolution—and, after dilution of the alkali to lower concentrations, the solubility at low temperatures is determined, it is found that the maximum solubility is lower, and occurs at a higher alkali concentration, than with the modified cotton not previously treated with the 5*N* alkali. Thus, a certain boiled oxycellulose had a maximum solubility of 85.2% in 2.5*N* sodium hydroxide solution at -5° C. but when it was treated in the way described above, the maximum solubility at -5° C. was only 38.0% and occurred at a concentration of about 2.75*N*. Similarly, it was found that after pre-treatment with 5*N* alkali and dilution to 2.5*N* at low temperatures, the maximum solubility attained was much less than that found by direct treatment with a 2.5*N* solution at the same temperature. In contradistinction to these results, it was found by Birtwell, Clibbens and Geake³ that pre-treatment with 6 to 10*N* sodium hydroxide followed by dilution of the alkali to the non-swelling concentration of 2*N*, all at 15° C, resulted in the dissolution of a greater fraction of a modified cotton than could be dissolved by treatment with any single solution. The effect of the rate of dilution of the alkali in the 10*N*-2*N* treatment on the solubility has been examined, and it is found that slowing down the dilution results in a diminution of the solubility.

The solubility of any modified cotton, measured under the optimum conditions at -5° C. is greater the greater its fluidity, samples with very high fluidities being completely soluble. Hydrocelluloses made from unmercerised cotton, whether boiled after modification or not, have approximately the same fluidity-solubility relation, but hydrocelluloses prepared from mercerised cotton are much less soluble than materials of equal fluidity similarly prepared from unmercerised cotton. Oxycelluloses of the hypochlorite series are more soluble than hydrocelluloses of the same fluidity, but after an alkali boil, these oxycelluloses show a fluidity-solubility relation that is nearly the same as that found for the hydrocelluloses prepared from unmercerised cotton. The oxycelluloses made by the oxidation of soda cellulose, on the other hand, show the effects of previous swelling in having relatively low solubility for a given fluidity.

By means of successive extractions with sodium hydroxide solutions under suitably chosen conditions, a hydrocellulose has been separated into four fractions differing in fluidity. The fluidity of the original material was 6.2 (2% solution in cuprammonium) and fractions of fluidities 16.6, 10.8, 6.2 and 3.6 were obtained from it.

When the alkali concentration of solutions of modified cotton prepared with sodium hydroxide solutions of greatest solvent power is increased or decreased beyond certain limits by the addition of water or of more concentrated alkali, partial or complete precipitation of the modified cellulose takes place. Quantitative experiments show that at alkali concentrations within a certain region on both sides of the concentration giving maximum solvent power, much more modified cellulose can be retained in solution than can be dissolved directly, even at -5°C .

In the last section of this paper, attention is called to the similarity between the solubility relations of modified cottons in sodium hydroxide solutions at low temperatures and the swelling relations of unmodified cotton under similar conditions. On the basis of this similarity and of present day knowledge of the fine structure of cellulose, an attempt is made to explain the observations recorded in this paper. It is shown that many of the experimental results can be explained on the following assumptions—(1) that cellulose acts as a very weak acid, forming salts with sodium hydroxide; (2) that modified cottons consist of mixtures of chain-molecules of different lengths, the average length decreasing with increasing modification; (3) that the tensile strength, the fluidity and the solubility of modified cottons are all functions of the chain length frequency distribution; (4) that before dissolution of a chain-molecule can occur, the cohesive forces binding it to its neighbours must be overcome by the swelling forces; (5) that the shorter chain-molecules are more easily detached in this way than the longer. Possible mechanisms to account for the alteration of the properties of hydro- and oxy-celluloses by an alkaline boil are also discussed.

II—EXPERIMENTAL

(1) Materials

The modified cottons employed were prepared from an unspun Indian cotton (No. 217) scoured by boiling in the form of sliver with 2% sodium hydroxide solution for 10 hours at an excess pressure of 40 lb. per square inch, and from cotton linters (No. 310) similarly scoured and lightly bleached. Hydrocelluloses were prepared from these materials by the action at room temperature of a hydrochloric acid solution containing 200 gm. of hydrogen chloride per litre, various degrees of modification being obtained by varying the duration of the acid treatment; the series H3-8 was obtained from cotton No. 217, and the series SHL 1-7 from cotton No. 310. A series of hydrocelluloses (MH 1-4) was similarly prepared from cotton No. 217 that had been swollen in 7*N* sodium hydroxide and washed with water; this material is conveniently referred to as "mercerised". The oxycelluloses employed consisted of a series (OL 6-16) prepared from cotton No. 310 by treatment at room temperature with sodium hypochlorite solution of pH 8.4 and either 0.05*N* (OL 13-16) or 0.2*N* (OL 6-12) in available chlorine, and a series (CSO 1-5) obtained by the action of gaseous oxygen at 40°C . on cotton No. 217 impregnated with 10*N* sodium hydroxide solution¹⁰. The oxycelluloses prepared by means of hypochlorite solution and all the hydrocelluloses were also examined after an alkaline boil, the treatment consisting

of boiling with 2% sodium hydroxide solution for 4 hours at an excess pressure of 30 lb. per square inch. The alkali-boiled materials are distinguished by the letter B after the serial number. The modified cottons have been characterised by fluidity (absolute units, 0.5% solution in cuprammonium hydroxide at 20° C.⁵) and in some cases by copper number (Schwalbe-Braidy), these values being given in Table IX.

(2) The Determination of the Solubility of Modified Cotton Cellulose

The temperatures chosen for the investigation of the effect of temperature on the solubility of modified cottons in sodium hydroxide solutions were 15°, 0°, and -5° C. In some preliminary experiments solubility determinations were made at -10° C. but as this temperature is below the freezing point of the more dilute alkali solutions employed, its use was abandoned. By selecting -5° C. as the lowest temperature to be used, it was possible to cover the whole range of sodium hydroxide concentrations of interest in this work without freezing of the solutions.

The high viscosity of concentrated solutions of modified cellulose renders the separation of the solution from the highly swollen undissolved residue difficult, and in order to keep the concentration of modified cellulose low, the ratio of modified cotton to alkali solution adopted in the systematic investigation was 1 gm. in 100 c.c. The moisture content of the modified cotton was determined, and a quantity equivalent to 1.000 gm. of the dry material weighed out. This was extracted in a 150 c.c. stoppered bottle with 100 c.c. of the sodium hydroxide solution. In determinations at -5° C. the bottle was shaken, the stopper removed and a thermometer introduced; the bottle was then cooled in a freezing mixture of pounded ice and common salt, with constant stirring of the contents of the bottle by means of the thermometer. The cooling was interrupted when the temperature had fallen to 0° and -2.5°, the thermometer removed, the stopper inserted, and the bottle vigorously shaken. When the temperature had fallen to -5°, the bottle was again shaken and again cooled to -5°. This alternate shaking and cooling to -5° was repeated three times, and the bottle then set aside for 2 hours to allow the contents to revert to room temperature. Temperature control was easier in the solubility measurements at 0°, and here the procedure was to immerse the bottle containing the modified cotton and alkali in a well-stirred mixture of ice and water, the bottle being shaken at intervals. After 1 hour at 0° the bottle was allowed to stand in the laboratory for another hour. In the measurements at 15° C. the alkali solution was cooled to 15° C. before adding the modified cotton, and the bottle containing the mixture was immersed for 2 hours in a large vessel of water maintained at that temperature, with occasional shaking.

At the end of the stated intervals, the mixtures of solution and undissolved residue were poured into 40 c.c. stoppered tubes and centrifuged at 2,000 r.p.m. By this means a clear supernatant liquor was almost invariably obtained, although with the highly modified materials in the alkali solutions of highest solvent power, the resulting solution was slightly opalescent. An appropriate volume (usually 10 c.c.) of the supernatant liquor was then pipetted out, and the cellulosic material contained in it determined by oxidation with chromic acid. This determination was performed according to the detailed procedure given by Birtwell, Clibbens and Geake³, except that the back-titration of the dichromate was done iodimetrically with sodium thiosulphate instead of directly with ferrous ammonium sulphate solution.

The solubility is expressed as the percentage of the material that is dissolved; in calculating it, any change in the volume of the liquid phase that may occur by reason of the dissolution of modified cellulose or of absorption of solution by the undissolved residue is neglected. If a modified cellulose is completely soluble, and if it is assumed that the dissolved material has the normal specific volume of cellulose the error introduced by the first factor is about 0.6%. Materials that appeared to be completely soluble gave solubilities of 96-98%, results that are probably due partly to this neglect of the volume change and partly to the departure of highly modified celluloses from the composition $C_6H_{10}O_5$ assumed in the analysis.

The conditions employed in the extraction of the modified cottons with alkali are entirely arbitrary; but by adhering to a standard procedure results are obtained that are comparable among themselves and that for given conditions are reproducible within 1 or 2 per cent. Experiments at 15° and 0° C. showed that increasing the time of extraction to 24 hours produced only a slight increase in the solubility, and it will be shown in Section II (5) that even after extraction for 10 days at 15° C. the solubility is but little higher than that found after extraction for 2 hours. It was found that at 0° and -5° C. higher solubilities were obtained by cooling the alkali solution to the required temperature before adding the modified cotton than by following the procedure described above; thus with the oxycellulose OL7/B in 2.5 *N* sodium hydroxide solution the solubilities of 60.2% and 85.2% at 0° and -5° C. respectively obtained by the standard method were increased to 81.4% and 92.2% by cooling the alkali solution before adding the oxycellulose. In determinations at 15° C. the effect of the temperature at which the alkali solution and modified cotton are mixed is pronounced, and serious errors may be caused by adding the modified cotton to the solution at "room temperature" and then cooling to 15° C. For example, the solubility of the oxycellulose OL7/B in 3.0 *N* sodium hydroxide solution at 15° C. was 10.5% when the oxycellulose was added to the solution at 15° C. but 6.8% when the alkali solution was at 20° C. when the addition was made. Owing to the difficulty of separating the solution from the undissolved residue at 0° and -5° C. the procedure adopted for the determination of the solubility at these temperatures involves the reversion of the solution to room temperature before the separation is made. Experiments showed that with alkali solutions of concentrations up to 2.75 *N*, the concentration of solutions of modified cellulose prepared by extraction at -5° C. remained substantially unchanged when the solutions were kept at 15° C. for 10 days in the presence of the undissolved residue, whilst with alkali solutions of higher concentration, the modified cellulose concentration fell only very slowly. It therefore seems probable that measurement of the concentration of cellulosic material after 2 hours gives a good approximation to the concentration at the end of the extraction at the low temperature. Detailed results of the effect of allowing solutions prepared at -5° C. to stand at 15° C. are given in Section II (5). Another factor that might effect the determination of solubility, *viz.* the ratio of alkali solution to modified cotton, has been investigated, and the results are given in the next section.

No attempt was made to exclude air from the modified cellulose during the extraction, except when the latter was prolonged beyond 2 hours, for it has been shown in a previous paper¹⁰ that the conditions of temperature, alkali concentration and duration of exposure to air employed are such as to produce but little effect on the properties of a modified cellulose.

Solutions prepared from materials of low copper number (*e.g.* alkali-boiled modified cottons) may be preserved for long periods without noticeable change, but if the modified cotton dissolved has a high copper number, the solution gradually becomes yellow on standing. This suggests that the type of decomposition that takes place during the alkali boiling of modified cottons proceeds slowly in cold concentrated alkali solutions.

(3) The Effect of Variation of the Ratio of Modified Cotton to Sodium Hydroxide Solution

It is a characteristic of solutions of homogeneous substances that at a given temperature the concentration of the solution in equilibrium with the solid phase is independent of the amount of the solute used. Of many substances that form colloidal solutions, however, this is no longer true; the concentration of the solution increases with the amount of the solid treated with a given volume of the solvent. Neuenstein¹⁹ has shown that when sulphite pulp is extracted with solutions of sodium and potassium hydroxide at the ordinary temperature, the concentration of cellulosic material in solution depends on the ratio of pulp to alkali solution used.

The effect of varying the amount of modified cotton cellulose used per 100 c.c. of sodium hydroxide solution has been determined with the hydrocellulose H₄/B. Various weights of this material were extracted, in the way already described, with 100 c.c. of 2.5*N* sodium hydroxide solution at 0° C.; the results obtained are recorded in Table I. They show that at ratios of modified cotton to alkali solution up to 2.5 gm. per 100 c.c. the concentration of the dissolved material is practically proportional to the amount of hydrocellulose used, *i.e.* the fraction dissolved is constant. Above this ratio, the concentration increases slightly less rapidly than corresponds to the linear relation, or the fraction dissolved decreases slightly. There is some uncertainty about the results for the fraction dissolved at the highest ratios, however, since as the ratio is increased the volume change due to dissolution of modified cellulose and to absorption of solution by the undissolved residue, which are neglected in the calculation of the fraction dissolved, become

Table I

Hydrocellulose H ₄ /B in 2.5 <i>N</i> Sodium Hydroxide Solution at 0° C.										
Weight of hydrocellulose used per 100 c.c. (grams)	...	...	0.35	0.70	1.00	1.50	2.00	2.50	3.00	3.50
Concentration of cellulosic material in solution (gm. per 100 c.c.)	0.191	0.371	0.533	0.799	1.078	1.336	1.524	1.815		
Per cent. of available hydrocellulose dissolved	...	...	54.6	53.0	53.3	53.3	53.9	53.4	50.8	51.9

more important. Further, as the ratio increases, the concentration of sodium hydroxide in the solution is progressively diminished, owing to the well-known preferential absorption of sodium hydroxide by cellulose. Nevertheless, the results clearly show that only a certain portion of the hydrocellulose is able to dissolve, and that at the ratios of hydrocellulose to alkali solution here employed the solution is far from saturated with respect to this soluble portion.

(4) The Effect of Alkali Concentration and Temperature on the Solubility of Modified Cottons

The effect of alkali concentration and temperature of extraction on the solubility of modified cotton celluloses may be illustrated by reference to the results obtained with the hydrocellulose H₄/B, and with the oxycelluloses OL₇/B and CSO 4. The solubility data for various concentrations of sodium

hydroxide at temperatures of 15°, 0° and -5° C. are recorded in Table II, and those relating to the hydrocellulose are shown graphically in Fig. 1. The main features of the curves showing the relation between the percentage of the modified cellulose dissolved and the alkali concentration are that at each temperature there is a maximum solubility at a certain concentration of sodium hydroxide, and that as the temperature is reduced this maximum solubility increases greatly and occurs at a lower alkali concentration. Thus for the hydrocellulose H₄/B, the maximum solubilities observed at 15°, 0° and -5° C. are 8.2, 57.5 and 82.6%, and occur at alkali concentrations of

Table II

Concentration of Sodium Hydroxide Solution (normality at 18° C.)	% Dissolved								
	Hydrocellulose H ₄ /B (Fluidity = 32.4)			Oxycellulose OL7/B (Fluidity = 34.1)			Oxycellulose CSO4 (Fluidity = 45.4)		
	15° C.	0° C.	-5° C.	15° C.	0° C.	-5° C.	15° C.	0° C.	-5° C.
1.75	0.7	1.2	3.0	1.0	1.5	3.3	—	7.3	30.8
2.00	1.1	3.0	26.0	1.4	3.8	35.6	3.5	25.1	64.6
2.25	1.9	23.6	71.3	2.5	36.6	72.4	7.4	49.5	86.0
2.50	3.6	53.3	82.6	4.4	60.2	85.2	15.4	73.7	94.5
2.75	6.3	57.5	76.3	7.8	62.7	77.4	22.4	82.4	94.6
3.00	8.2	40.1	62.1	10.5	42.3	65.2	22.3	73.2	88.1
3.25	7.2	—	—	8.6	—	—	—	—	—
3.50	5.7	12.1	21.1	6.3	13.4	20.7	12.8	45.6	69.1
4.00	3.2	4.7	8.5	3.4	6.7	10.7	7.6	17.8	27.6
5.00	1.4	1.8	2.3	1.7	2.1	3.2	4.1	6.8	9.0

3.0, 2.75 and 2.5*N* respectively. The results obtained with the two oxycelluloses are qualitatively similar to those obtained with the hydrocellulose.

(5) Prolonged Extraction of a Modified Cotton at 15° C. and the Effect of Keeping at 15° C. after Extraction at -5° C.

The solubility of an oxycellulose OL8/B at 15° C. was determined as already described after extraction for 2 hours, and the bottles containing the solutions and undissolved residues were then evacuated, filled with nitrogen and kept in a thermostat at 15° C. for 10 days. The solubilities were determined after 4 and 10 days, and the results obtained are given in Table III. They show that prolonging the time of extraction from 2 hours to 10 days increases the solubility only slightly.

Preliminary experiments on the effect of allowing solutions prepared by the extraction at -5° C. of an oxycellulose with 2*N* and 4*N* sodium hydroxide solution to stand at room temperature showed that while the modified

Table III

Time of Extraction	% Dissolved									
	Concentration of Sodium Hydroxide (normality)									
	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	4.00	5.00
2 hours	2.6	4.3	8.6	21.5	37.1	38.0	25.8	17.0	10.0	5.4
4 days	3.2	5.5	10.4	22.9	38.9	39.8	28.0	19.5	11.7	6.1
10 days	3.7	6.3	10.4	23.2	39.2	40.1	28.0	19.8	12.1	6.2

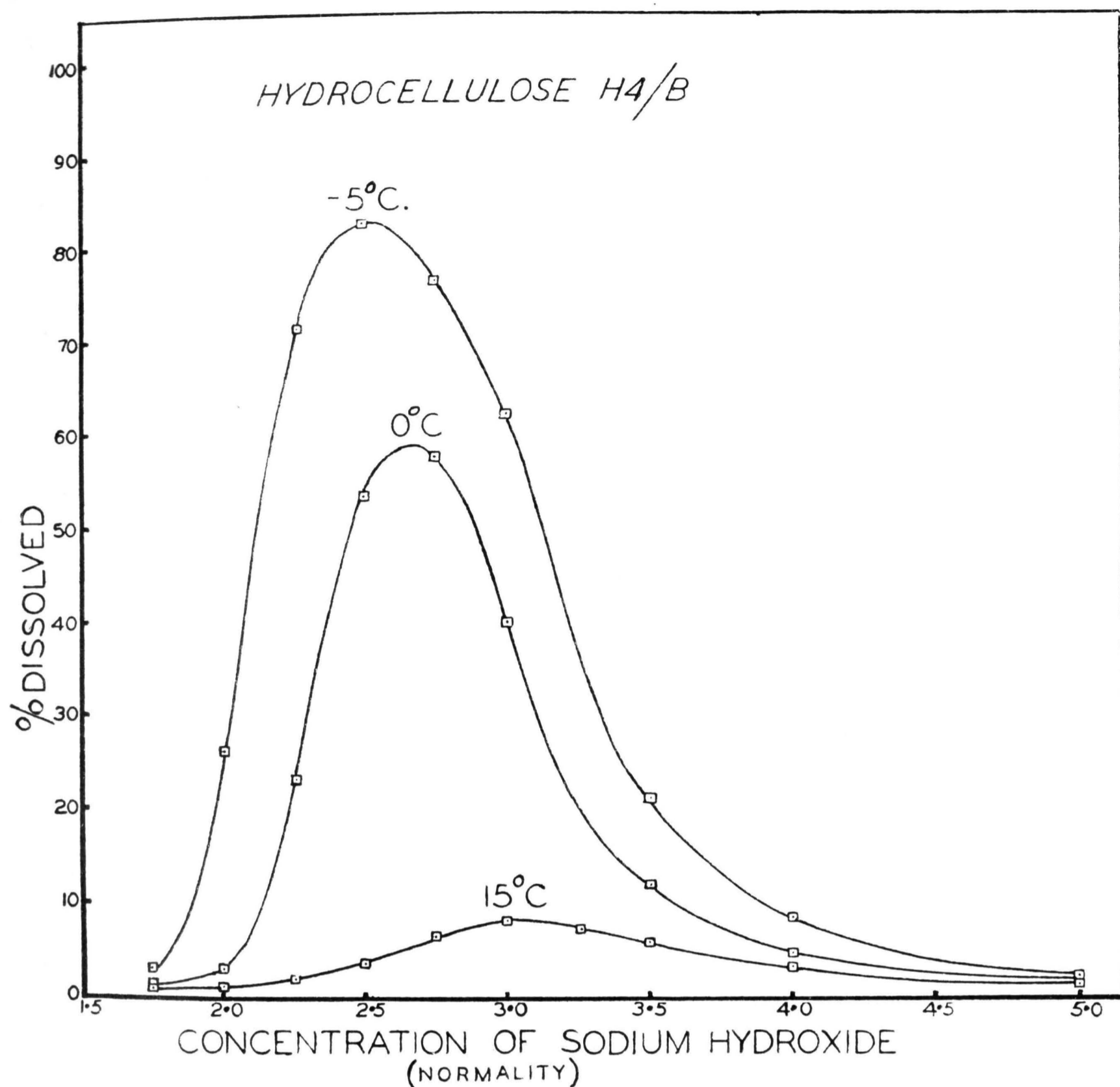


FIG. 1

cellulose concentration of the solution in 2*N* alkali solution was unchanged after 6 days, the concentration of the solution in 4*N* alkali slowly fell and finally became virtually constant after 8 days. The effect of standing at 15°C. after extraction at -5°C. was then examined with an extended series of alkali concentrations. The solubility of the oxycellulose OL8/B was determined after extraction at -5°C. in the standard way described, and then the mixtures of solution and undissolved residue were kept at 15°C. as described in the preceding paragraph. The concentrations were determined after 5 and 10 days, with the results given in Table IV. The Table shows that with alkali concentrations up to 2.75*N*, the solubility is practically unchanged after 10 days, but at higher alkali concentrations there is a fall in the solubility

Table IV

Time of Standing	% Dissolved										
	Concentration of Sodium Hydroxide (normality)										
	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	5.00
2 hours	18.3	59.9	96.2	96.5	95.7	80.6	69.4	58.4	45.2	31.3	10.0
5 days	18.9	59.7	96.5	96.8	96.0	77.7	62.3	47.8	26.2	12.5	4.7
10 days	19.1	59.6	96.5	96.8	96.2	76.0	59.1	43.9	16.8	6.2	3.3

that increases as the alkali concentration increases. At alkali concentrations above 3.75*N* the final solubilities are lower than those found by extraction at 15° C. for 10 days without pre-treatment at -5° C.

(6) The Relation between Alkali Concentration and Solubility at -5° C. for Modified Celluloses Prepared from Cotton Swollen before Modification

The results given in Table II show that a hydrocellulose and an oxycellulose prepared from cotton not previously swollen have a maximum solubility at -5° C. in 2.5*N* sodium hydroxide solution. The variation of solubility at -5° C. with concentration of sodium hydroxide was also determined for a series of oxycelluloses produced by the oxidation of soda cellulose by gaseous oxygen, and the results are given in Table V. The maximum solubility of these materials, which from their method of preparation have been swollen prior to modification occurs at an alkali concentration of about 2.75*N*, *i.e.* at a slightly higher concentration than with the modified celluloses prepared from cotton not previously swollen. As the series is ascended, the solubility at any alkali concentration increases with increasing fluidity, *i.e.* with increasing degree of oxidation. The most highly modified sample CSO5 is almost completely soluble in sodium hydroxide solutions of concentrations from 2.25 to 2.75*N*.

The variation with the alkali concentration of the solubility at -5° C. of two hydrocelluloses, MH3/B and MH4/B, prepared from mercerised cotton and alkali boiled after modification, is also included in Table V. Maximum solubility of these materials occurs in 3*N* sodium hydroxide solution. The solubility in a solution of this concentration is considerably greater than in 2.5*N* alkali, and a similar result was obtained with the same two hydrocelluloses before alkali boiling, as well as with two less modified hydrocelluloses, MH1 and MH2, similarly prepared.

Table V

Material		Fluidity	% Dissolved at -5° C.									
			Concentration of Sodium Hydroxide (normality at 18° C.)									
			1.75	2.00	2.25	2.50	2.75	3.00	3.50	4.00	5.00	6.00
Oxycellulose	CSO1	22.4	2.0	4.8	7.2	10.1	11.4	6.4	3.2	1.9	0.9	—
	CSO2	32.5	7.2	16.5	29.4	47.2	53.4	43.7	11.0	6.1	2.9	—
	CSO3	42.0	17.7	46.5	73.9	86.1	87.7	83.4	36.7	14.9	4.6	1.6
	CSO4	45.4	30.8	64.6	86.0	94.5	94.6	88.1	69.1	27.6	9.0	—
	CSO5	48.9	42.6	76.5	95.6	96.4	96.6	93.9	78.9	37.1	13.7	—
Hydrocellulose	MH3/B	37.9	2.4	6.4	17.4	34.7	60.3	61.8	15.4	5.9	2.5	—
	MH4/B	45.6	—	—	31.4	58.1	84.4	94.1	43.7	—	—	—
Hydrocellulose	H4	32.1	2.4	13.1	63.9	80.3	73.7	54.3	15.9	7.8	2.9	—
	H4/B	32.4	3.0	26.0	71.3	82.6	76.3	62.1	21.1	8.5	2.3	—

The solubility curves for the oxycellulose CSO3 and the hydrocellulose MH3/B are given in Fig. 2, and compared with the curve for the hydrocellulose H4 prepared from unmercerised cotton.

(7) The Effect of an Alkali Boil on the Solubility of a Hydrocellulose at -5° C.

It has been shown by Clibbens, Geake and Ridge⁶ that when a hydrocellulose is boiled with dilute (1%) sodium hydroxide solution, the fluidity of the material is little changed, but the reducing power, as measured by the

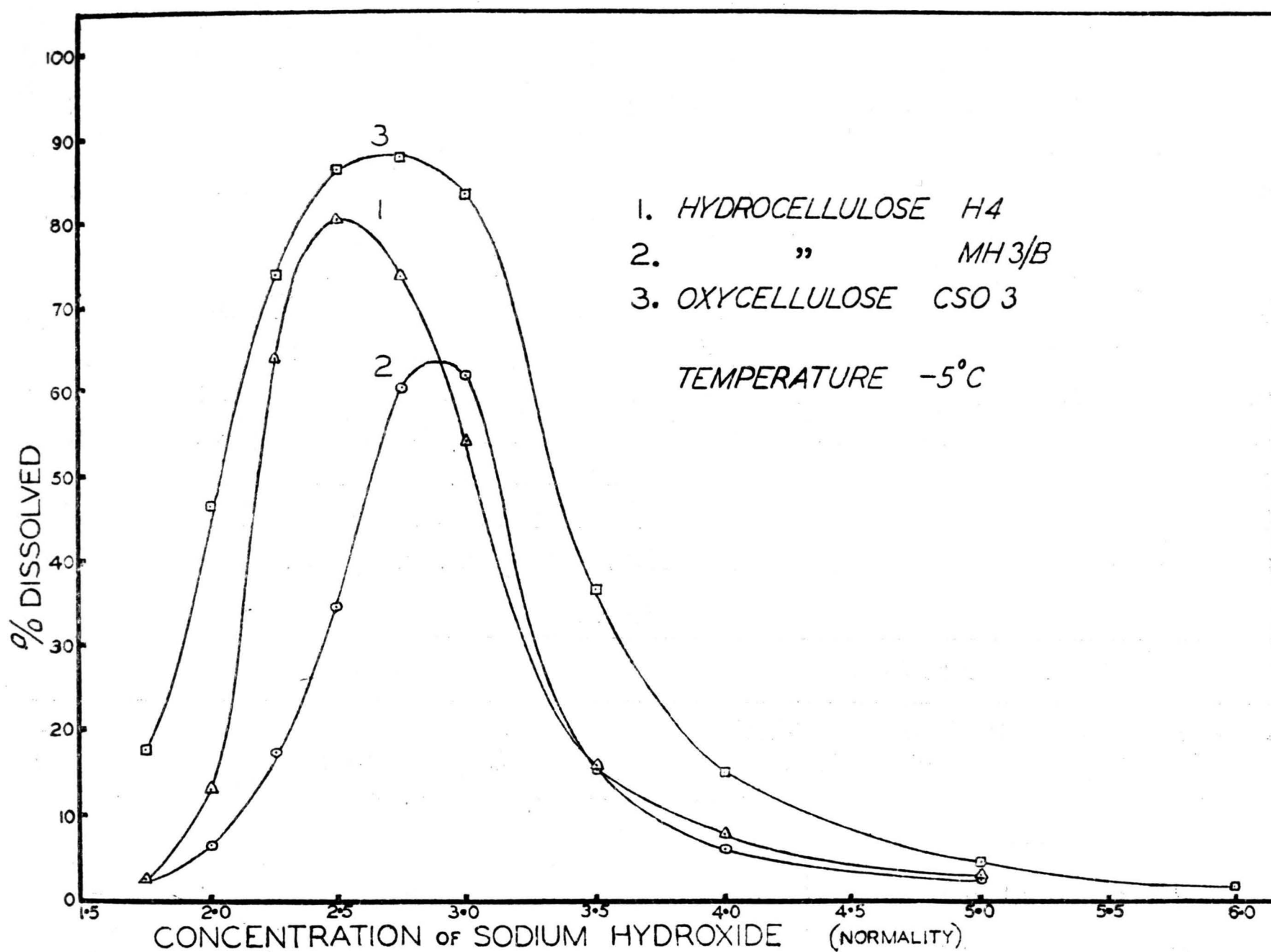


FIG. 2

copper number is diminished almost to zero. At the same time the hydrocellulose suffers a loss of weight that is proportional to the original copper number. The alkaline liquors obtained by boiling modified cotton with dilute sodium hydroxide solution are, however, very different in their properties from the solutions obtained by treating modified cotton with more concentrated alkali solutions at low temperatures. The former are dark yellow solutions from which very little material is precipitated by acidification, and which evidently contain decomposition products of the modified cellulose; the latter are colourless or very pale yellow solutions from which the dissolved material can be precipitated by acidification. Although the ultimate processes involved thus appear to be very different, it is of interest to examine the effect of the loss of material suffered during alkali boiling on the solubility of a hydrocellulose in more concentrated alkali solutions at -5°C . The data obtained with the hydrocellulose H4 before and after boiling with 2% sodium hydroxide solution under pressure are included in Table V. This hydrocellulose had originally a copper number of 2.22, which was reduced to 0.26 by the alkali boil, whilst the fluidity was changed only from 32.1 prior to the boil to 32.4 after it; at the same time there was a loss in weight of about 20%. The results given in the Table show that in spite of this loss in weight, the boiled material is slightly more soluble than the original in sodium hydroxide of all the concentrations used except 5N.

(8) **The Effect of Pre-treatment with 5N Sodium Hydroxide Solution on the Solubility of Modified Cotton Cellulose in More Dilute Solutions**

Birtwell, Clibbens and Geake³ have shown that by treating modified cotton with concentrated (6 to 10N) sodium hydroxide solution at 15°C . and diluting the solution to 2N while in contact with the modified cotton, a much larger fraction is dissolved than by treatment with any single solution.

This observation suggested the investigation of similar treatment at temperatures below the normal. Experiments were made in which 1 gm. of modified cotton was treated with 50 c.c. of 5*N* sodium hydroxide, and the alkali then diluted by the rapid addition of 50 c.c. of water, giving a calculated final volume at 15° C. of 99.2 c.c. and a final concentration of 2.52*N*. The temperatures of pre-treatment with the 5*N* alkali, dilution, and final treatment with the 2.5*N* solution were varied so as to give a range of conditions. The data obtained with four modified cottons are given in Table VI. They show that pre-treatment with 5*N* sodium hydroxide solution at 15°, 0° or -5° C., followed by dilution either at the same time temperature or after reversion to 15° C. causes a decrease in the solubility at 0° or -5° C. compared with that in 2.5*N* solution without pre-treatment. With both oxycelluloses OL6/B and OL7/B, pre-treatment and dilution at 0° C. gives greater dissolution at -5° C. than pre-treatment and dilution at 15° C. or -5° C.

Table VI

Temperature (°C.)			% Dissolved			
Pre-treatment with 5 <i>N</i> NaOH	Dilution to 2.5 <i>N</i>	Final treatment with 2.5 <i>N</i> NaOH	OL16/B	Oxycelluloses OL7/B	OL6/B	Hydrocellulose SHL7/B
No pre-treatment		15	—	4.4	—	—
		0	28.8	60.2	—	—
		-5	50.5	85.2	97.6	94.7
15	15	-5	—	30.7	77.1	54.2
0	15	-5	—	31.0	—	—
-5	15	-5	—	27.1	—	—
0	0	0	—	50.3	—	—
0	0	-5	—	50.4	91.7	—
-5	-2*	-5	13.5	37.5	72.7	—

(* Solution at -5°, diluting water at 1° C.)

A further series of experiments was then made in which after pre-treatment with 5*N* sodium hydroxide at 15° C. and dilution of the alkali to various known concentrations, also at 15° C., the solubility was determined in the diluted alkali after cooling to -5° C. In order to separate the effect of the pre-treatment with 5*N* alkali and the dilution from that of the final low temperature treatment, it was necessary to determine the effect on the solubility of dilution from 5*N* to lower concentrations before proceeding to the determination of the solubility in the diluted solutions at -5° C. One gm. of the modified cotton was treated at 15° C. with x c.c. of 5*N* sodium hydroxide solution for 1 hour, the solution then rapidly diluted by the addition of $(100 - x)$ c.c. of water at 15° C. and the mixture kept at 15° C. for another hour. This dilution brought the alkali concentration to approximately $(5x/100)$ *N* and the volume of the solution to slightly less than 100 c.c. The concentration of cellulose in solution was then determined in the usual way. In a second series of experiments, after pre-treatment with 5*N* solution and dilution at 15° C. the mixtures were cooled to -5° C. before determining the solubility. The contraction produced by the mixing of the 5*N* solution and the water was calculated from data relating the composition and density of sodium hydroxide solutions, and allowance made for it in calculating the percentage of the modified cotton dissolved. The data obtained with oxycellulose OL7/B are given in Table VII and are to be compared with the data for the solubility of this material in single solutions already given in Table II.

Table VII
Oxycellulose OL7/B pre-treated with 5N NaOH and the Alkali diluted at 15° C.
Solubility determined at 15° and -5° C.

Temperature (°C.)	% Dissolved								
	Concentration of Sodium Hydroxide Solution (normality)								
	1.51	1.76	2.02	2.27	2.52	2.77	3.02	3.27	3.52
15	13.5	17.9	22.8	23.8	19.9	15.4	10.4	7.6	5.6
-5	13.7	18.0	22.9	28.0	30.7	38.0	29.7	21.8	16.3

This comparison is shown graphically in Fig. 3. The results show that, in agreement with the findings of Birtwell, Clibbens and Geake³, treatment with 5N sodium hydroxide solution at 15° C. followed by dilution to lower concentrations produces the dissolution of a larger fraction of the oxycellulose than can be dissolved by extraction with any single solution at the same temperature; maximum solubility occurs when the final concentration is between 2.0 and 2.25N. When, after a similar treatment, the mixtures of modified cotton and sodium hydroxide solution are cooled to -5° C. the solubility is further increased, but except at low concentrations where the dilution has already produced greater dissolution than occurs on extraction at -5° C. without pre-treatment, this solubility is much less than that obtained without pre-treatment. In this series of experiments maximum solubility occurs in 2.75N solution, whereas when there is no pre-treatment with 5N solution it occurs in 2.5N solution. Thus a treatment that causes swelling but not dissolution applied after modification has a similar effect

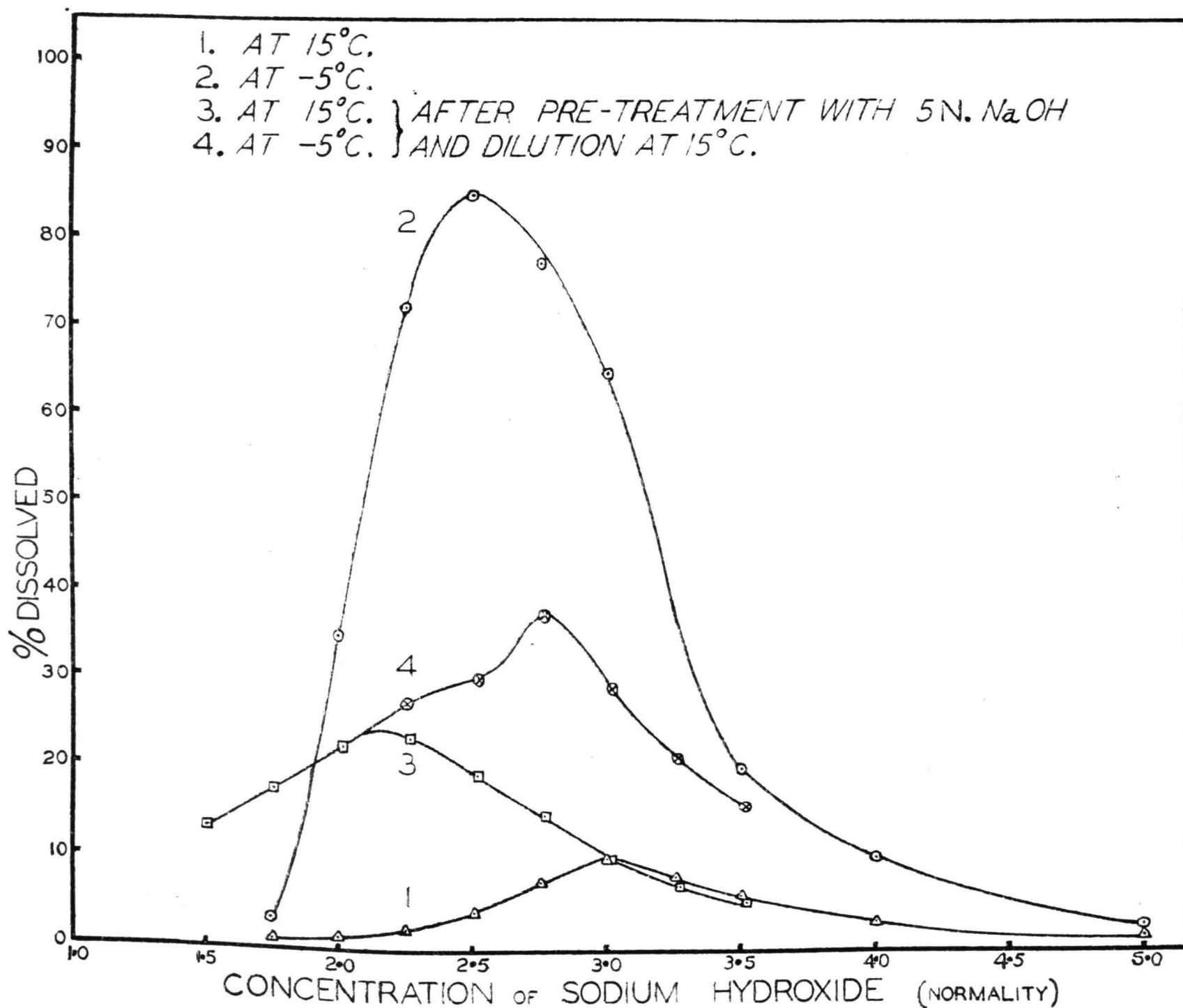


FIG. 3

on the concentration for maximum solubility to a swelling treatment applied before modification.

(9) The Effect of the Rate of Dilution on the Solubility as Determined by Treatment with 10*N* Sodium Hydroxide Solution followed by Dilution of the Alkali to 2*N*

Birtwell, Clibbens and Geake³ have shown that the conditions for obtaining maximum solubility of a modified cotton in sodium hydroxide solution at the ordinary temperature consist in first swelling it in 10*N* solution and then diluting the alkali to about 2*N*. Neale¹⁸ has suggested that this behaviour is due to a transient swelling, which, as he showed experimentally with regenerated cellulose sheet, occurs when a concentrated sodium hydroxide solution in equilibrium with cellulose is suddenly diluted. The explanation of this swelling put forward by Neale, which will be discussed later, leads to the conclusion that if the dilution were performed slowly instead of rapidly, the transient swelling and consequently the increase in solubility when a modified cellulose is used, would not take place. The object of the experiments now to be described was to test this conclusion.

One gm. of the modified cotton was put in a 150 c.c. bottle and steeped in 20 c.c. of 10*N* sodium hydroxide solution for 15 minutes at 15° C. In one experiment, the alkali was then rapidly diluted to approximately 2*N* by pouring in 80 c.c. of water and shaking the bottle. The mixture was then kept at 15° C., with occasional shaking, for 1 hour. In a second experiment the dilution was performed by running in the 80 c.c. of water at the rate of 5 c.c. every two minutes, with shaking after each addition. The temperature was kept at 15° C. throughout the dilution by standing the bottles containing the modified cotton and the diluting water in water maintained at that temperature. The amount of modified cellulose dissolved by the two methods was then determined in the manner already described.

Experiments were performed with two oxycelluloses and a hydrocellulose, and the results are given in Table VIII, along with the maximum solubility of the materials in a single solution at 15° C. The Table shows that in both instances the solubility produced by the slow dilution is considerably less than that produced by the rapid dilution, although it is greater than that in 3*N* sodium hydroxide solution, at which concentration the maximum effect for a single solution is obtained. The conditions in the slow dilution are by no means ideal, since with the highly swollen cotton embracing a large proportion of the volume of the mixture it is impossible to avoid running water directly on the cotton and so producing locally more rapid dilution than is intended.

Table VIII

Conditions of Extraction	% Dissolved		
	Oxycelluloses OL8/B	OL7/B	Hydrocellulose H4/B
10 <i>N</i> —2 <i>N</i> NaOH, rapid dilution	49.4	21.8	18.5
10 <i>N</i> —2 <i>N</i> NaOH, slow dilution	41.0	14.2	10.9
3 <i>N</i> NaOH 	38.0	10.5	8.2

(10) The Relation Between the Fluidity and the Solubility of Modified Cottons

The relation between fluidity and solubility was determined for several series of modified cotton celluloses, the solubility being measured at -5° C. in the sodium hydroxide solution of maximum solvent power. As has already been seen, the alkali concentration which gives maximum solubility at this

temperature varies from 2.5 to 3.0*N* according to the type of modified cotton used. The fluidities and solubilities of all the materials examined are collected in Table IX, and the relation between fluidity and solubility is shown graphically in Figs. 4 and 5.

The results show that whilst within each series of modified cottons the solubility increases with increasing fluidity, the fluidity-solubility relation differs for each class of modified cotton examined. The oxycelluloses prepared by the action of hypochlorite have the highest solubility for a given fluidity. When these oxycelluloses are alkali boiled there is a considerable rise in fluidity and also an increase in solubility, but the solubility of the boiled materials for a given fluidity is less than that of the unboiled oxycelluloses. The solubility of the hydrocelluloses prepared from cotton No. 310 is, for a given fluidity, higher than that of the hydrocelluloses prepared from cotton

Table IX

Material	Sample No.	Concentration of NaOH used	Before Alkali boiling			After Alkali Boiling		
			Fluidity	Copper Number	% Dis-solved	Fluidity	Copper Number	% Dis-solved
Scoured cotton, unspun	217	2.5 <i>N</i>	5.9	0.08	3.5	—	—	—
	310	2.5 <i>N</i>	8.0	0.16	4.3	—	—	—
Hydrocelluloses from cotton No. 217	H5	2.5 <i>N</i>	15.9	0.69	15.8	16.8	0.12	21.0
	H6	2.5 <i>N</i>	22.7	1.28	33.0	23.7	0.20	41.8
	H4	2.5 <i>N</i>	32.1	2.22	80.3	32.4	0.26	82.6
	H7	2.5 <i>N</i>	36.5	—	88.9	36.3	—	91.3
	H3	2.5 <i>N</i>	42.3	—	95.9	—	—	—
	H8	2.5 <i>N</i>	—	—	—	38.2	—	94.9
Hydrocelluloses from cotton No. 310	SHL1	2.5 <i>N</i>	14.7	0.58	17.9	17.5	0.04	19.2
	SHL2	2.5 <i>N</i>	18.0	0.85	30.1	20.3	0.08	32.5
	SHL3	2.5 <i>N</i>	23.2	1.29	52.6	24.9	0.13	56.1
	SHL4	2.5 <i>N</i>	25.7	1.44	65.6	27.7	0.18	70.1
	SHL5	2.5 <i>N</i>	28.1	1.91	72.6	29.4	0.21	73.6
	SHL6	2.5 <i>N</i>	33.0	2.64	87.5	34.0	0.31	86.0
	SHL7	2.5 <i>N</i>	36.7	3.30	93.3	38.2	0.45	94.7
Scoured cotton No. 217 mercerised	217M	3.0 <i>N</i>	7.2	—	1.4	16.5	—	4.3
Hydrocelluloses from mercerised cotton No. 217M	MH1	3.0 <i>N</i>	21.9	—	5.8	27.0	—	17.2
	MH2	3.0 <i>N</i>	29.1	—	11.7	32.8	—	32.6
	MH3	3.0 <i>N</i>	35.6	—	28.3	37.9	—	61.8
	MH4	3.0 <i>N</i>	44.9	—	74.5	45.6	—	94.1
Oxycelluloses from cotton No. 217 (NaOH and O ₂)	CSO1	2.75 <i>N</i>	22.4	0.55	11.4	—	—	—
	CSO2	2.75 <i>N</i>	32.5	1.04	53.4	—	—	—
	CSO3	2.75 <i>N</i>	42.0	1.58	87.7	—	—	—
	CSO4	2.75 <i>N</i>	45.4	1.97	94.6	—	—	—
	CSO5	2.75 <i>N</i>	48.9	2.18	96.6	—	—	—
Oxycelluloses from cotton No. 310 (NaClO)	OL13	2.5 <i>N</i>	9.7	0.39	9.9	13.2	0.03	15.0
	OL14	2.5 <i>N</i>	11.0	0.56	16.7	16.1	0.03	23.5
	OL15	2.5 <i>N</i>	13.2	0.87	24.5	21.2	0.10	36.7
	OL16	2.5 <i>N</i>	15.8	1.17	35.2	23.9	0.12	50.5
	OL11	2.5 <i>N</i>	19.3	1.76	57.1	31.2	0.21	76.4
	OL7	2.5 <i>N</i>	21.6	2.30	77.1	34.1	0.26	85.2
	OL12	2.5 <i>N</i>	27.7	3.46	90.0	39.7	0.36	95.7
	OL8	2.5 <i>N</i>	30.8	4.16	95.2	41.5	0.48	96.5
	OL9	2.5 <i>N</i>	32.8	4.88	96.0	42.3	0.41	96.8
	OL10	2.5 <i>N</i>	35.3	5.63	96.4	43.4	0.47	97.0
	OL6	2.5 <i>N</i>	37.0	6.21	98.7	45.4	0.55	97.6

No. 217. With the hydrocelluloses, the rise of the fluidity on alkali boiling is much less than with the oxycelluloses, and the increase in solubility produced by alkali boiling is also small. For a given fluidity, the solubility of the boiled relative to that of the unboiled hydrocellulose differs somewhat in the two series examined; whilst the solubility of a boiled hydrocellulose prepared from cotton No. 310 is slightly less than that of an unboiled hydrocellulose of the same fluidity, the solubility of a boiled hydrocellulose prepared from cotton No. 217 is slightly higher than that of unboiled hydrocellulose of the same fluidity. Nevertheless, as Fig. 5 shows, the fluidity-solubility relation for the hydrocelluloses of both series, whether alkali boiled or not, could be represented approximately by a single curve, and this curve would also give approximately the fluidity-solubility relation for the oxycelluloses prepared by the action of hypochlorite and alkali boiled after modification. The most noteworthy feature of the results illustrated in Fig. 5 is the difference between the curves for hydrocelluloses prepared from unmercerised and mercerised cotton respectively; hydrocelluloses prepared from mercerised cotton are much less soluble than hydrocelluloses of the same fluidity made from unmercerised cotton. Birtwell, Clibbens and Geake³ observed somewhat similar behaviour in their measurements of the solubility of hydrocelluloses by the $10N-2N$ treatment at $15^{\circ}C.$, namely that for a given copper number the solubility of hydrocelluloses made from mercerised cotton is considerably lower than that of hydrocelluloses from unmercerised cotton. The series of oxycelluloses obtained by the action of oxygen on soda cellulose have a much lower solubility for a given fluidity than the oxycelluloses of the hypochlorite series, so that here also the effect of previous swelling treatment is apparent. This effect may be compared with the observations recorded in Section II (8) which show that a treatment that causes swelling without appreciable dissolution, applied after modification, depresses the solubility in more dilute solutions at $-5^{\circ}C.$

(11) **The Separation of Modified Cotton Cellulose into Fractions of Different Fluidity**

The dependence of the solubility of a modified cellulose on its fluidity suggested that when a modified cotton was separated into a soluble and an insoluble portion by means of extraction with a sodium hydroxide solution, the fractions would differ in fluidity. Further, the very marked effect of the concentration of the alkali and the temperature of extraction on the solubility made it seem probable that, by a suitable choice of these conditions, successive extractions of a modified cotton would yield any desired number of such fractions. The fractionation of a modified cellulose was therefore undertaken and for this purpose the alkali-boiled hydrocellulose H₄/B, the solubility of which under various conditions was already known, was chosen. In order to separate this material into four fractions, three treatments which would dissolve increasing amounts of the hydrocellulose were necessary; the conditions of alkali concentration and temperature selected for these extractions were (1) $2.25N$ at $0^{\circ}C.$ (2) $2.5N$, at $0^{\circ}C.$ and (3) $2.5N$ at $-5^{\circ}C.$

Thirty gm. of the hydrocellulose of known moisture content was treated with 900 cc. of $2.25N$ sodium hydroxide solution at $0^{\circ}C.$ for 1 hour, and after the mixture had reverted to room temperature, the insoluble portion was separated by filtration on a Buchner funnel (without filter paper) under suction. After washing with $2.25N$ sodium hydroxide solution on the filter, and pressing out as much of the solution as possible, the insoluble portion

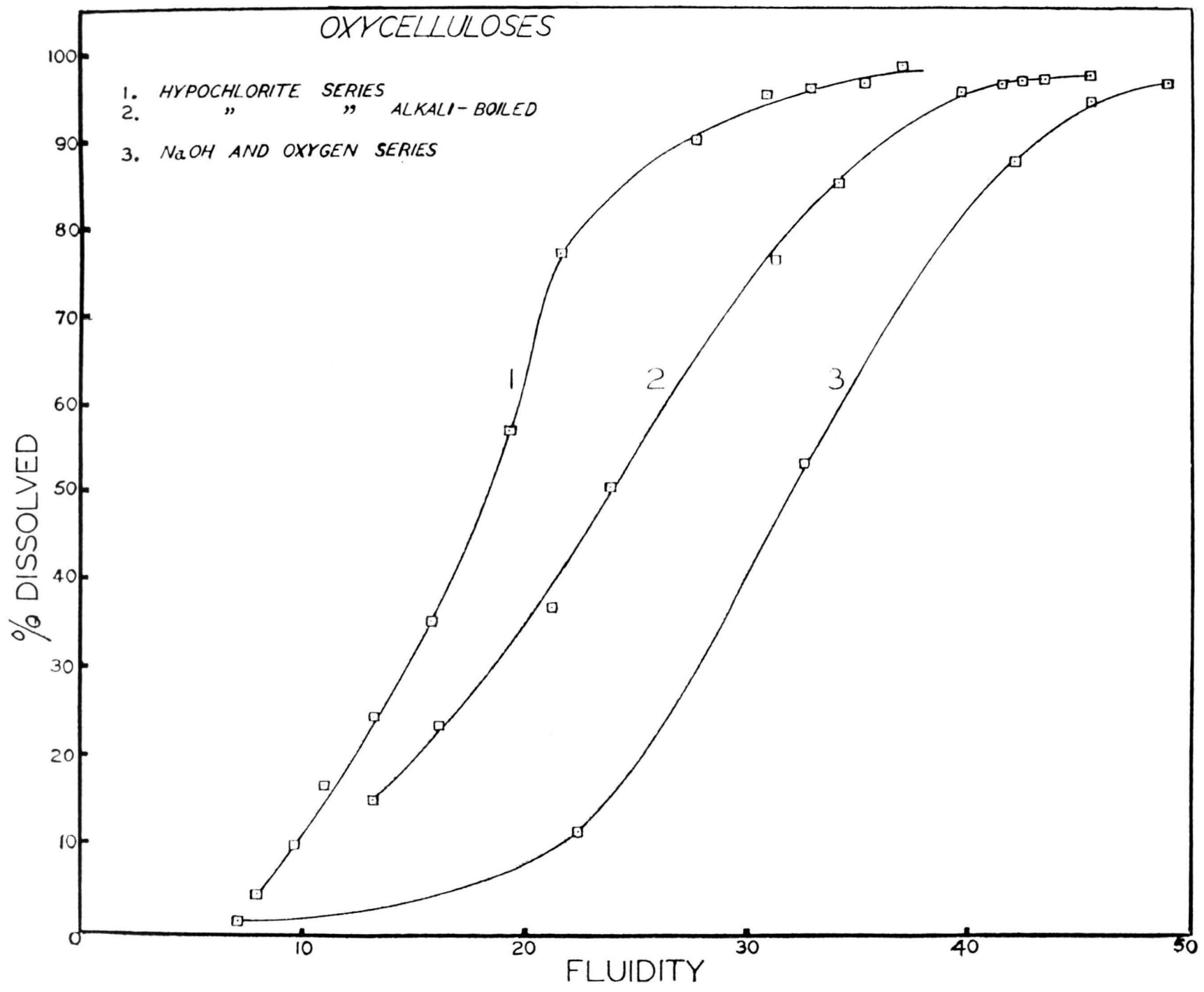


FIG. 4

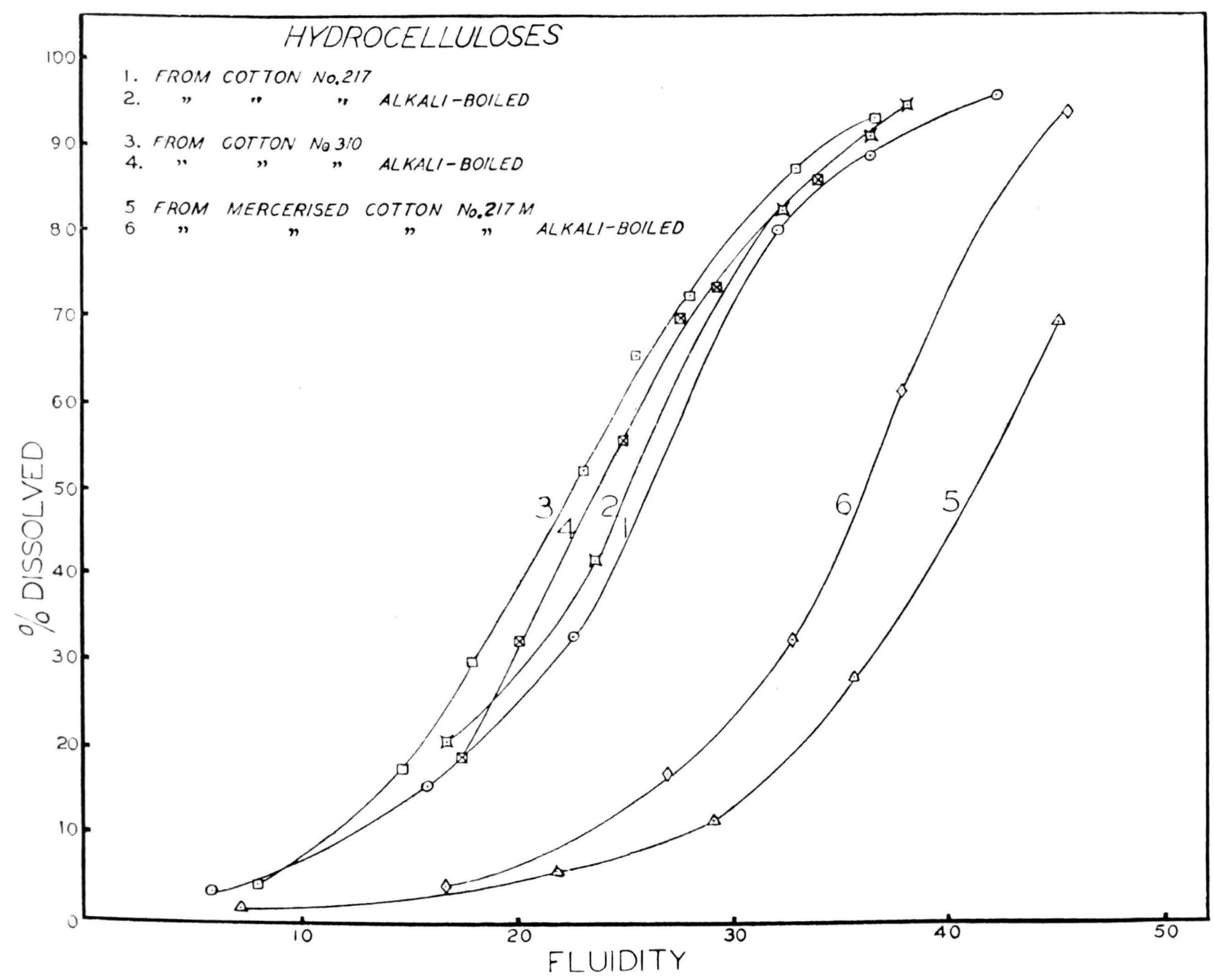


FIG. 5

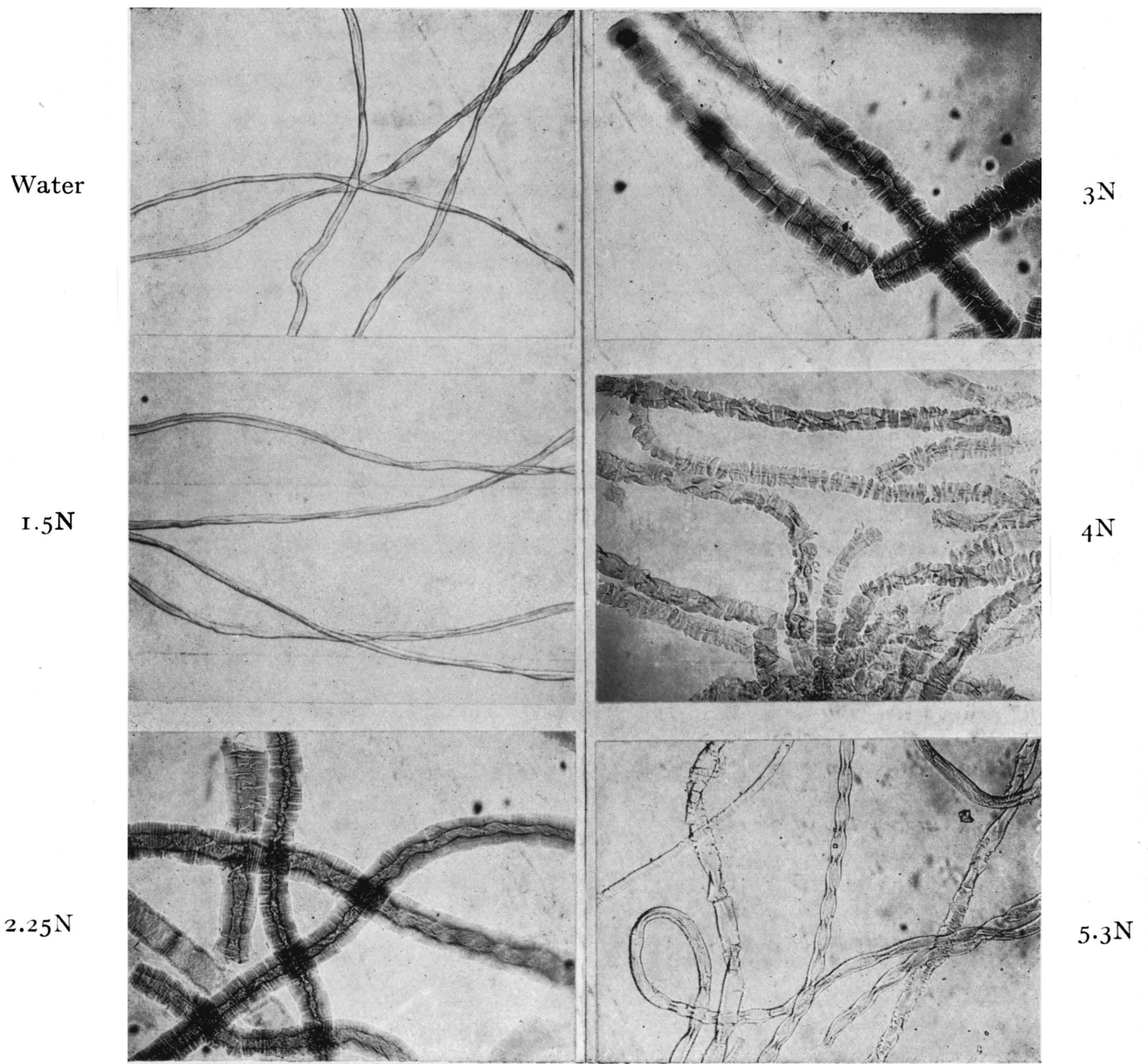


FIG. 7

Hydrocellulose after treatment at -5° C. with sodium hydroxide solution.

was washed with water, followed by $N/20$ hydrochloric acid; it was finally washed to neutrality and allowed to dry at room temperature. The filtrate, which included the solution obtained by washing off the alkali from the insoluble portion, was neutralised with acid and the precipitated modified cellulose filtered in a Jena glass filter. After being washed free from acid and salt, the regenerated hydrocellulose was dried in a vacuum desiccator over phosphorus pentoxide, and powdered. This constituted the first fraction. A weighed quantity of the insoluble portion was then extracted with $2.5N$ sodium hydroxide solution at 0°C ., and after filtering on a fritted glass filter owing to the more gelatinous nature of the undissolved portion, the two fractions were treated as in the first fractionation. The insoluble portion from this second extraction was then treated with $2.5N$ sodium hydroxide solution at -5°C . Here it was found that the mixture was too gelatinous to filter, so it was centrifuged in stoppered tubes and the supernatant liquor taken as containing the soluble portion. The two fractions were regenerated with acid in the usual way. After each extraction, the weight and moisture content of the insoluble portion, and the weight of that part which was used as the starting material for the next extraction, were determined. From these data, it was possible to calculate the percentage of the original material in each of the four fractions.

Table X

Material	Per cent. of Original Hydrocellulose	Fluidity (2% Solution)
Original Hydrocellulose	100	6.2
1st Fraction	19	16.6
2nd ,,	19	10.8
3rd ,,	29	6.2
4th ,,	33	3.6
Insoluble portion after 2 fractionations, <i>i.e.</i> 3rd and 4th fractions	62	4.4
Mixture of fractions in the proportions in which they occur in original material	100	6.7

The fluidities of the four fractions were then determined by the method described by Clibbens and Geake⁵, except that in order to render the measurement more sensitive, solutions in cuprammonium containing 2% instead of the usual 0.5% of cellulose were employed. Table X gives the results obtained, and shows that the four fractions differ very definitely in fluidity, the most soluble portion having a fluidity considerably higher and the least soluble portion a fluidity lower, than that of the original hydrocellulose. The fluidity of the insoluble portion after two extractions, *i.e.* the portion consisting of the third and fourth fractions, was determined, and, as shown in the Table, it had a value intermediate between those of its two constituent fractions. As a final check, fluidity determinations were made on a mixture of the four fractions in the proportions in which they occurred in the original hydrocellulose, the calculated weights of each required being introduced into the viscometer before dissolution. The fluidity found was 6.7, as against 6.2 for the original hydrocellulose.

(12) The Precipitation of Modified Cellulose from Solution

Qualitative experiments showed that if the alkali concentration of a solution of modified cellulose in $2.5N$ sodium hydroxide solution was reduced or increased beyond certain limits by addition of water or more concentrated sodium hydroxide solution, precipitation took place. This behaviour was examined quantitatively for an alkali-boiled oxycellulose OL8/B,

modified so as to be practically completely soluble in 2.5*N* sodium hydroxide solution at -5°C . The variation of the solubility at -5°C . with the concentration of the alkali solution was first determined (see Section II (5)), and it was found that at the optimum concentration of 2.5 *N*, the material was dissolved to the extent of 96.5%. A 2% solution of the oxycellulose in 2.5*N* sodium hydroxide solution was then prepared at -5°C ., and after it had reverted to room temperature, it was centrifuged. By diluting 50 c.c. portions of this solution with an equal volume of water or of sodium hydroxide solutions of various concentrations, a series of mixtures containing 0.965 gm. of modified cellulose per 100 cc. and of alkali concentrations ranging from 1.25 to 5.0 *N* was obtained. In order to get mixtures of lower alkali concentration, but of the same oxycellulose content, more concentrated solutions of the oxycellulose were made, and suitably diluted with water. The bottles containing the diluted mixtures were evacuated, filled with nitrogen, and kept in a thermostat at 15°C . Preliminary experiments showed that where precipitation occurred, it was virtually complete in 10 days, so at the end of this period the concentrations of oxycellulose in the various solutions were determined. The results obtained are shown graphically in Fig. 6, and are compared with the solubilities obtained by (1) extraction of 1 gm. of the oxycellulose with 100 c.c. of sodium hydroxide solution at 15°C . for 10 days, (2) extraction at -5°C . and keeping at 15°C . for 10 days (see Section II (5)). Over the range of alkali concentration from 1.25 to 3.38*N* there was no precipitation, but outside this range there was a rapid fall in the oxycellulose concentration with decreasing and increasing alkali concentration. The

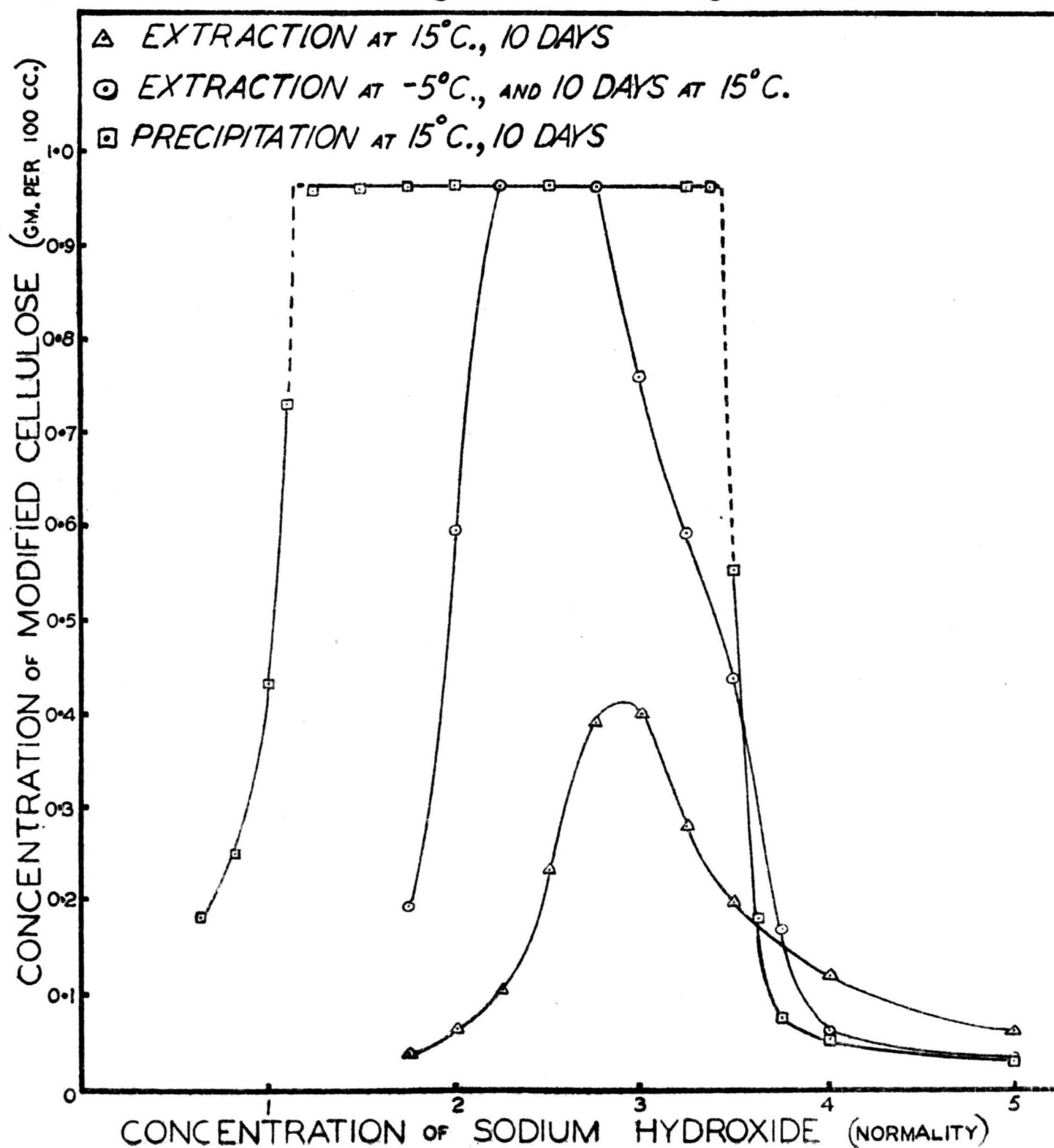


FIG. 6

figure shows that on both sides of the sodium hydroxide concentration that produces a maximum extract at -5°C . there is a region where the alkali solution can retain in solution much more modified cellulose than it can dissolve directly. At alkali concentrations above $3.6N$, the modified cellulose concentrations attained by precipitation are definitely lower than those found by extraction at 15°C . From the absence of precipitation below the alkali concentration of $3.38N$ it might have been expected that solutions prepared by extraction at -5°C . and kept at 15°C . would not show any fall in modified cellulose concentration below a similar alkali concentration, but it has been seen that with alkali concentrations of $3.0N$ and $3.25N$ there is a slight fall. This fall becomes much more pronounced at alkali concentrations within the precipitation zone, and at alkali concentrations of 4 and $5N$, the modified cellulose concentrations found by extraction at -5°C . and keeping at 15°C . and by the precipitation method are almost the same.

III—DISCUSSION AND THEORETICAL INTERPRETATION OF RESULTS

Within the last few years, advances along several lines of investigation have made it possible to assign to cellulose a structure that accounts in a satisfactory way for many of its peculiar properties. It is now thought that cellulose is built up of long chains of anhydro-glucose units, linked by primary valencies and held together laterally by residual valency forces. The anhydro-glucose units have the Haworth pyranose ring structure¹⁴, and are bound together by 1:4 glucosidic oxygen linkages.

Such a structure for cellulose provides an explanation of much of its chemical behaviour. When cellulose is attacked by acids, hydrolysis of the glucosidic linkages is assumed to take place, and shorter chain-molecules of various lengths are produced; at the same time, for each linkage broken an aldehydic reducing group is produced at the end of a chain. As hydrolysis proceeds, the maximum chain-length decreases and the chain-length frequency distribution alters progressively until ultimately only glucose is left. Thus a hydrocellulose is pictured as consisting of chain-molecules differing only in the number of glucose units contained in them, and each having at one end a reducing group which gives rise to the copper number. Such a material prepared from cotton has a lower tensile strength and a higher fluidity in cuprammonium than the original cotton. The fall in tensile strength is an obvious effect of the shortening of the chain-molecules, and the increase of fluidity has been generally attributed to the same cause, the extensive work of Staudinger²⁵ providing ample support for this view. Ridge and Turner²² have shown that the fluidity of mixtures of unmodified cotton cellulose and a modified cellulose (scoured cotton and viscose rayon) is not a linear function of the composition of the mixture, but that there is approximately a linear relation between the percentage of rayon and the logarithm of the fluidity. It is therefore evident that fluidity is related not only to the average chain length, but also to the frequency distribution of the individual chain lengths about the average. However, in the absence of precise knowledge on this point, it will be assumed for the purpose of discussion that fluidity is determined by the average chain length.

The explanation of the properties of cotton that has suffered oxidising attack is less simple than with hydrocelluloses, since here the method of attack on the chain-molecules is largely unknown. The properties of oxy-celluloses vary with the method of preparation, but there is always a fall in tensile strength and a rise in fluidity, indicating the breaking of chain-mole-

cules. It seems probable that the glucosidic linkages are not directly attacked, but that the adjacent primary alcohol group is first oxidised to an aldehyde and then sometimes to a carboxyl group, causing either weakening or actual scission of the glucosidic linkage. The supposition that the chemical stability of the chain-molecules is sometimes diminished by oxidation without actual scission is supported by a study of the action on cotton of dichromate in acid solution⁷. This action leads to a rapid enhancement of reducing power accompanied by a very slow reduction of tensile strength, but a further considerable fall in tensile strength is produced by boiling the oxycellulose with dilute sodium hydroxide solution or even with water—treatments that are without appreciable effect on the strength of unmodified cotton and have but little effect on that of hydrocelluloses.

The hypotheses suggested to account for most of the observations recorded in this paper are (1) that cellulose acts as a very weak acid (*cf.* Neale¹⁸), and forms with a strong base a salt that is soluble in the alkali solution to an extent that depends on the length of the chain-molecules and on the concentration of the alkali, (2) that before dissolution of a modified cotton can take place the cohesive forces of the cellulose gel must be overcome by the swelling forces, and (3) that short chain-molecules are more easily detached from the gel and so brought into solution than long ones. According to this view, salt formation is the fundamental cause of the solubility of modified cellulose in alkaline solutions, whilst the extent of dissolution of a given material depends on the factors that determine swelling and on the frequency distribution of chain length, more particularly on the short chain end of this distribution. When a gel swells without dissolving, the limitation of the swelling may be regarded as due to the balancing of the swelling forces by the cohesion of the gel, and when dissolution succeeds swelling, this may be regarded as due to the cohesive forces being overcome by the swelling pressure. The detachment of a chain-molecule from its neighbours by the overcoming of the cohesive forces in this way is more likely to occur when the chain-molecule is short than when it is long, since the shorter the chain-molecule the greater is the probability of its becoming free at all points simultaneously. Thus, when dissolution is only partial, the dissolved material consists of shorter chain-molecules than the undissolved residue, and the shorter the chain-molecule the less is the critical degree of swelling required to disperse it into solution. Unmodified cotton does not dissolve in sodium hydroxide solution because of the great length of the chain-molecules, but if the cotton has been modified by chemical attack, all chain-molecules up to a certain length, depending on the swelling conditions, are dispersed into solution. The percentage of the modified cotton dissolved will therefore depend on the degree of modification, and therefore on the fluidity, as well as on the alkali concentration and temperature, which determine swelling.

The effect of varying the amount of modified cellulose extracted with a given volume of sodium hydroxide solution finds a simple explanation on the theory outlined above. The results recorded in Table I show that when progressively increasing amounts of a hydrocellulose are extracted with 100 c.c. of 2.5*N* sodium hydroxide at 0° C. the concentration of cellulosic material in solution is approximately proportional to the amount of hydrocellulose used, or the percentage of the available material dissolved is very nearly constant. When the smallest amount of the hydrocellulose is used, a certain proportion comprising all chain-molecules up to a certain length

is dissolved; the solution is not saturated with respect to this soluble portion, however, so that when the amount of hydrocellulose extracted is increased, the same proportion of the available material is dissolved. At the higher ratios of hydrocellulose to solution employed, the percentage dissolved begins to decrease slightly, this probably indicating that the solution has become saturated with respect to the longest of the chain-molecules that have been dissolving.

The theory suggested is strongly supported by the separation of a hydrocellulose into fractions differing in fluidity by means of successive extractions with sodium hydroxide solutions under conditions that produce increasing dissolution of the material. From the very nature of their preparation, these fractions must differ considerably in solubility from the original material, although the third fraction was identical with it in fluidity. According to the theory, however, this fraction is obtained from the original hydrocellulose by the removal from the latter of the shorter chain-molecules, which comprised the earlier fractions, and of the longer chain-molecules, which remained in the insoluble residue. Thus its average chain-length, and hence its fluidity might remain the same as that of the original material, whilst its solubility—determined only by the short chain end of the distribution—would be quite different. It thus appears that any complete statement of the extent of modification of a cotton includes a chain length frequency distribution that cannot be completely described by any single value.

The separation of a hydrocellulose into fractions differing in fluidity is paralleled by similar fractionations of nitro-cellulose and cellulose acetate that have been performed by numerous investigators. The literature up to 1929 has been summarised by Duclaux¹¹, and further work has since been published^{8, 12, 15, 16, 20, 23, 24}. The general conclusions to be drawn from the results obtained with these esters is that the fractions all have approximately the same degree of esterification, but differ in viscosity and some other physical properties. These results are explicable if the esters consist of chain-molecules of various lengths, on each of which, on the average, the same proportion of the hydroxyl groups have been esterified. The conclusions to be drawn from the work on the esters is thus in full accord with those drawn from the fractionation of chemically modified cotton cellulose.

If, as is suggested, the dissolution of modified cotton in sodium hydroxide solution is caused by the same forces that produce swelling, some similarity would be expected between the solubility relations of modified cottons and the swelling relations of cellulose in such solutions. The structure and shape of the cotton hair render exact measurements of swelling difficult, but if the shrinkage of cotton yarn is taken as a measure of swelling, the expected similarity can be demonstrated. The results of Birtwell, Clibbens, Geake and Ridge⁴ on the shrinkage of cotton yarn in sodium hydroxide solutions of various concentrations and at temperatures down to -10° C. show that as the temperature is reduced, the maximum shrinkage is greater, and occurs at a lower alkali concentration. This swelling behaviour has its counterpart in the solubility results illustrated in Fig. 1. Similar swelling relations for cuprammonium rayon were found by Beadle and Stevens², who measured the water absorption of the rayon from sodium hydroxide solutions of various concentrations at temperatures from 40° to 0° C.

Microscopic examination of modified cottons immersed for a brief time in sodium hydroxide solutions at a low temperature confirm the correlation between solubility and swelling. Fig. 7 contains photomicrographs of a

boiled hydrocellulose (fluidity, 34.0) that has been immersed in sodium hydroxide solutions of various concentrations at -5° C. and then returned to room temperature. The photographs show that the swelling is at a maximum in the concentration range 2.25 to 3.0*N*, which includes the solution of maximum solvent power at this temperature; incidentally, they also show the remarkable way in which the hairs break up during the solution process.

It has been found that solubility is very small at alkali concentrations above 4*N*, whereas swelling at these concentrations is by no means small, as Fig. 7 shows. The results found by the precipitation method (Fig. 6) suggest that this small solubility is due not so much to lack of swelling power as to the inability of the alkali solution to retain much modified cellulose in solution. The precipitation of modified cellulose from solution when the alkali concentration is increased above 4*N* is thus probably to be ascribed to the familiar effect of "salting out". A 1.75*N* sodium hydroxide solution, on the other hand, can retain a large amount of modified cellulose in solution, but can dissolve but little directly, even at -5° C. on account of its low swelling power. The precipitation that takes place at low alkali concentrations is to be attributed to increasing hydrolysis of the "sodium cellulosate". As the alkali concentration is progressively reduced and the degree of hydrolysis thus increased, a stage is reached when the longest chain-molecules present become insoluble and precipitate, and then the remainder precipitate in order of decreasing length.

The enhanced reactivity produced in cotton by mercerisation has been attributed to the sub-division of micelles or to the liberation of hydroxyl groups whose residual affinity was previously mutually satisfied. On either view, the proportion of the chain-molecules accessible to reagents is greater in mercerised than in unmercerised cotton, so that on hydrolysis by acids, for example, the chain length frequency distribution of the resulting hydrocelluloses should differ in the sense that a hydrocellulose made from mercerised cotton should be more nearly uniform as regards chain length than a hydrocellulose made from unmercerised cotton. For a given fluidity a hydrocellulose prepared from unmercerised cotton should contain a relatively large proportion of short chain-molecules, and hence should be more soluble in sodium hydroxide solution than a hydrocellulose made from mercerised cotton. As has been shown in Section II (10), this conclusion is in agreement with experiment. Unpublished work by Dr. A. Geake of this Association has shown that mercerised cotton yarn modified by acid attack suffers a considerably less decrease in tensile strength for a given increase of fluidity than unmercerised yarn, and similar results with mercerised yarn modified by hypochlorite oxidation have been found by Ridge and Bowden²¹; here a similar explanation could be given. The explanation in terms of differences of chain length frequency distribution must be regarded as tentative, however, since it has been shown that treatment with 5*N* sodium hydroxide solution after modification greatly reduces the solubility of modified cotton under the optimum conditions. Here the chain length frequency distribution cannot be altered by the preliminary treatment, so that if the effects on the solubility of swelling treatment before and after modification are related, another explanation must be sought.

It has already been pointed out that the action of hot dilute alkali on hydrocelluloses appears to be essentially different from that of cold concentrated alkali. The effect of an alkaline boil under the severe conditions employed in the present work is to cause a slight increase in the fluidity

and in the solubility in sodium hydroxide solutions at low temperatures, so that the action can hardly be confined merely to decomposition and dissolution of the shorter chain-molecules. It is possible that the action of hot dilute alkali consists in the shortening of each chain-molecule by the removal from the end of a portion containing the reducing group, the very short chain-molecules containing only a few glucose units being decomposed into soluble products. It is difficult, however, to account for the large percentage loss of weight that occurs on alkali boiling, unless the portion removed from the end of each chain-molecule is a considerable fraction of the chain. The loss of weight depends on the severity of the boil, and this suggests that progressive shortening of the chain-molecules takes place, the attack being from the end originally bearing the reducing group. The shortening of each chain-molecule would tend to increase the fluidity, but the removal of the shortest as soluble products would tend to lower it, so that it is possible that the two effects might counterbalance one another in such a way that neither the average chain length, determining the fluidity, nor the proportion of short chain-molecules, determining the low temperature solubility, is greatly affected in spite of a considerable loss in weight.

The effect of alkali boiling on oxycelluloses is to reduce the copper number to a low value and to cause a loss of weight proportional to the original copper number, as with hydrocelluloses, but with certain of the oxycellulose series the fluidity is considerably increased and the tensile strength considerably reduced. The hypochlorite oxycelluloses investigated in the present work are of this type, and it has been seen that their solubility at -5° C. is also greatly increased by an alkaline boil. These effects can reasonably be explained by the assumption already discussed that the oxidation does not necessarily always result directly in the breaking of the chain-molecules, but reduces their chemical stability towards alkalis, so that during alkali boiling, in addition to the processes postulated to occur with hydrocelluloses, further chemical decomposition resulting in scission of the chains takes place. The probability of extremely complicated chemical changes occurring when modified cottons are treated with alkalis is strengthened by a study of the extensive literature on the action of alkalis and alkaline oxidising agents on the sugars.

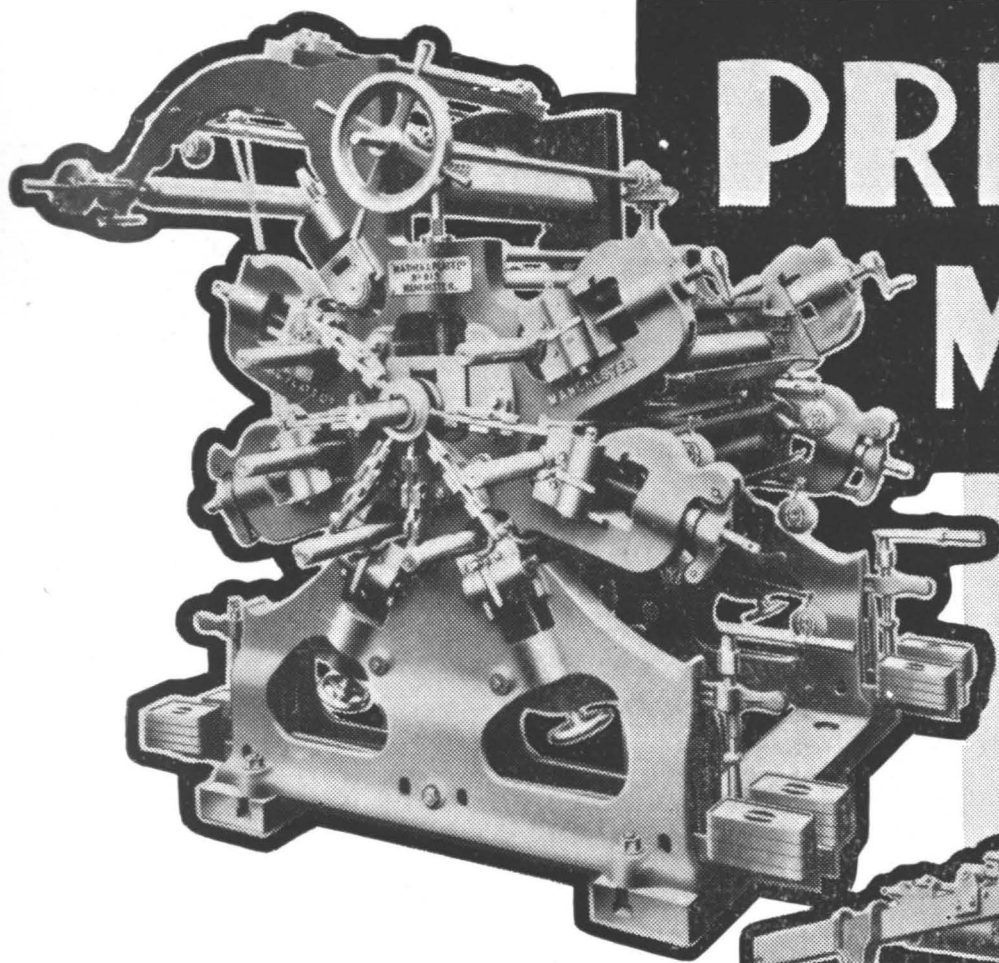
The chemical stability of oxycelluloses towards alkalis may be so reduced that dissolution in the alkaline cuprammonium hydroxide at the ordinary temperature or treatment with concentrated sodium hydroxide solutions at normal or low temperatures might result in the scission of chain-molecules to a greater or less extent. Such an effect would evidently disturb any fundamental comparison of tensile strength, fluidity and solubility. It might account for the fact that the fluidity-tensile strength and the fluidity-solubility relations of oxy- and hydro-celluloses are substantially the same after the modified materials are alkali boiled, since it is improbable that dissolution in cuprammonium, or treatment with sodium hydroxide at low temperatures would produce further scission of chain-molecules after the relatively drastic hot alkaline treatment.

The transient swelling that takes place when concentrated alkali in equilibrium with cellulose is rapidly diluted was explained by Neale¹⁸ in terms of his osmotic theory of swelling by the assumption that water diffuses into the cellulose phase more rapidly than alkali diffuses out, and he made the suggestion that this transient swelling might account for the increased

proportion of a modified cotton dissolved by the 10*N*-2*N* treatment over that dissolved by any single solution. Hence, if by slow dilution of the concentrated alkali the departure from osmotic equilibrium is kept small, the increase of swelling, and therefore the increase of solubility, should be diminished. It has been seen that slowing down the rate of dilution has indeed this effect. Whilst this explanation seems to contain a certain measure of truth, it does not suffice to explain the results obtained with a similar pre-treatment and dilution at lower temperatures. It has been shown that a preliminary treatment of a modified cotton with 5*N* sodium hydroxide solution, which produces swelling but little dissolution, has the effect of depressing the solubility under the optimum conditions for dissolution at low temperatures. It has also been seen that mixing the modified cotton and the alkali solution at a higher temperature than that at which the solubility is to be measured reduces the solubility below that found when the solution is cooled to the required temperature before addition of the modified cotton. These phenomena are probably akin to each other, and suggest either that for a given degree of swelling greater dissolution is produced if the attainment of this swelling is sudden than if it is gradual, or that the swelling under given conditions of temperature and alkali concentration depends on the previous swelling history of the material in a way that is not understood.

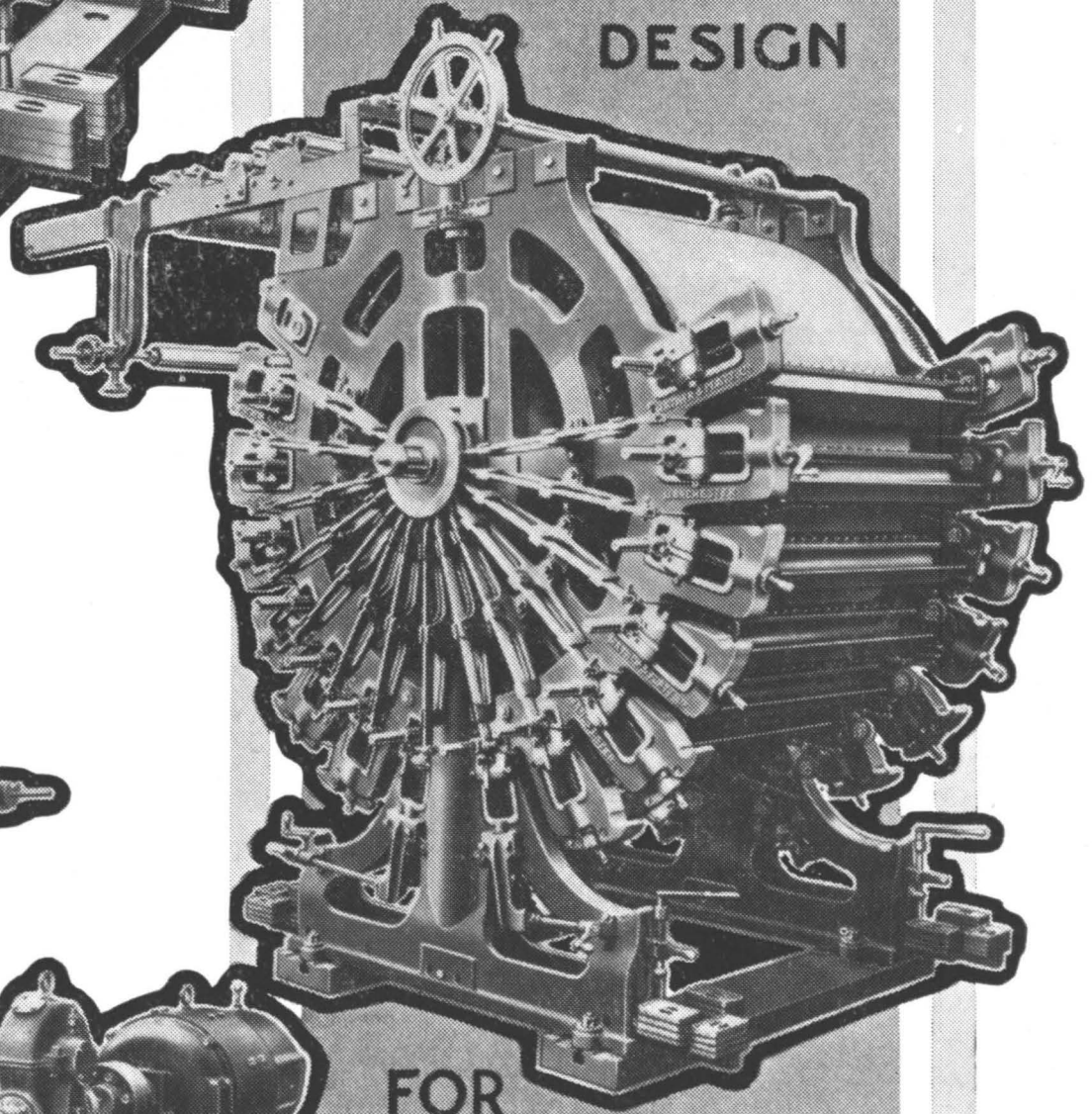
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- ⁵ Clibbens and Geake. *Shirley Inst. Mem.*, 1927, **6**, 117; or *J. Text. Inst.*, 1928, **19**, T77.
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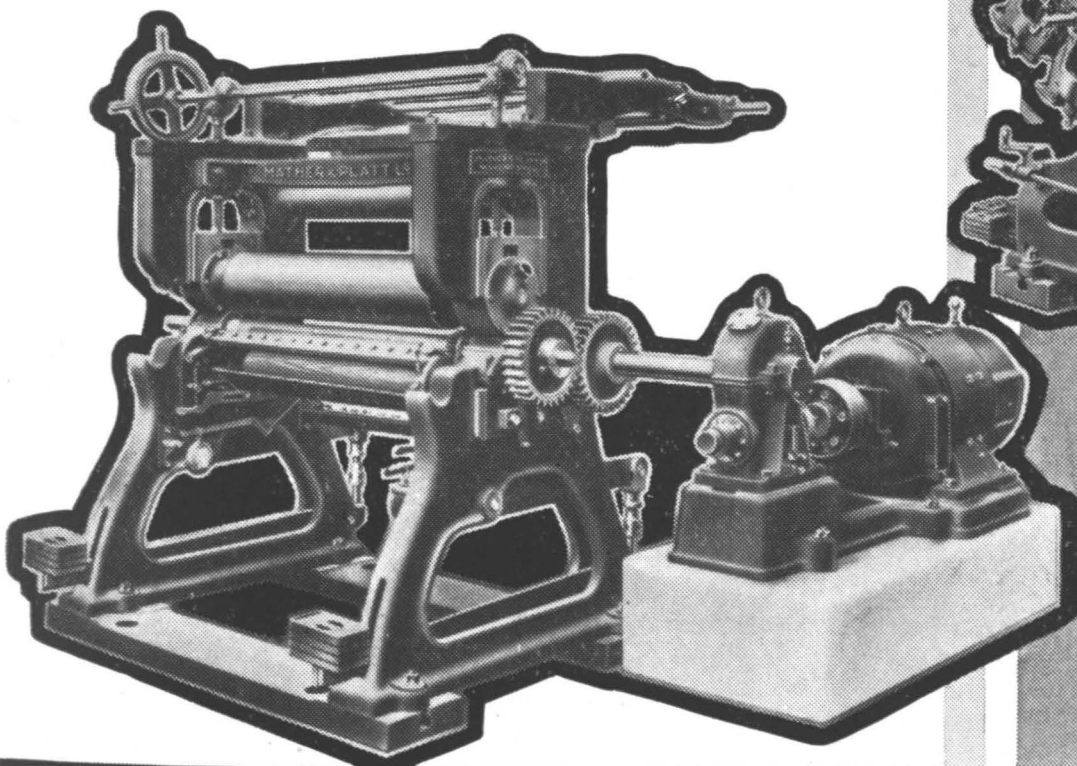


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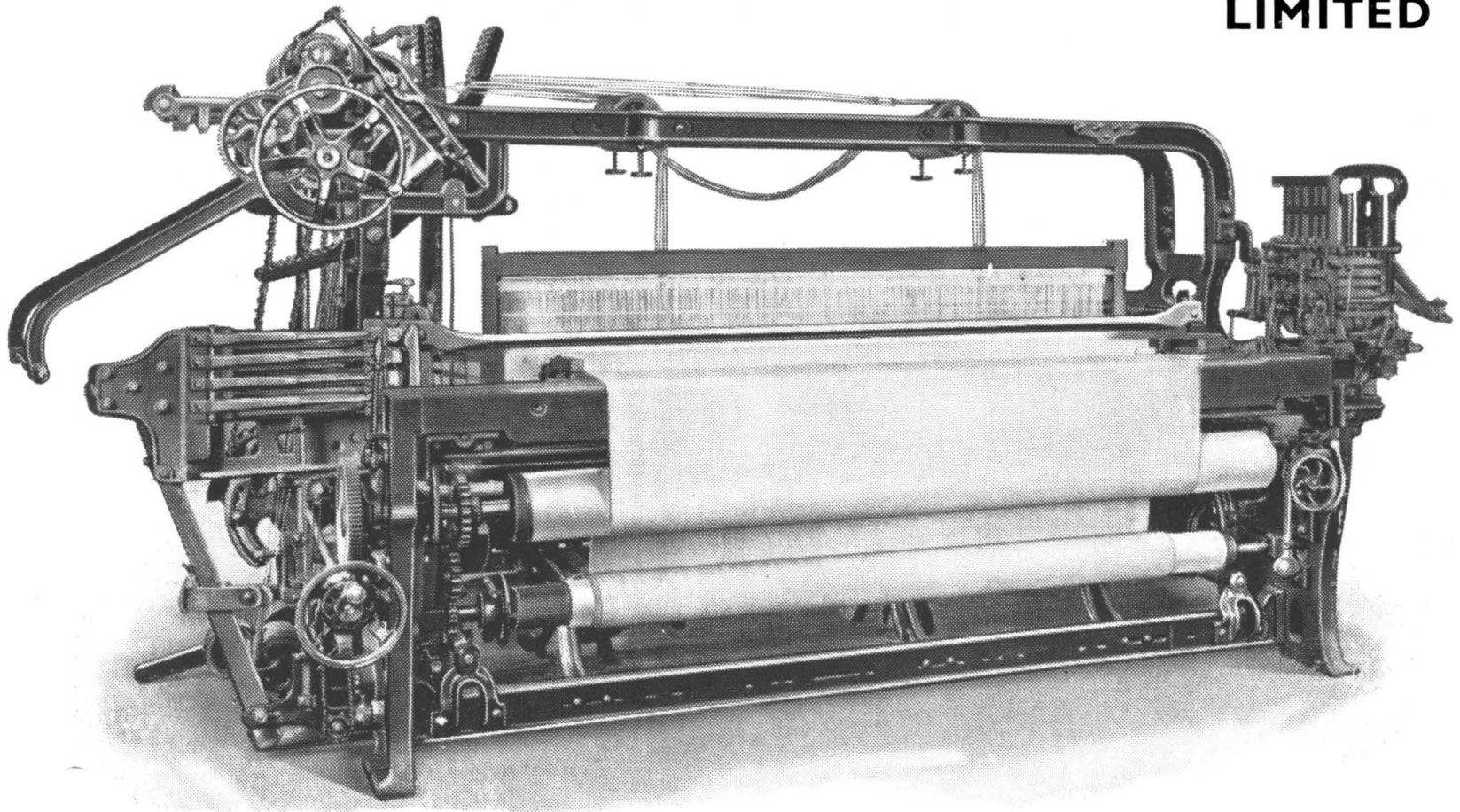


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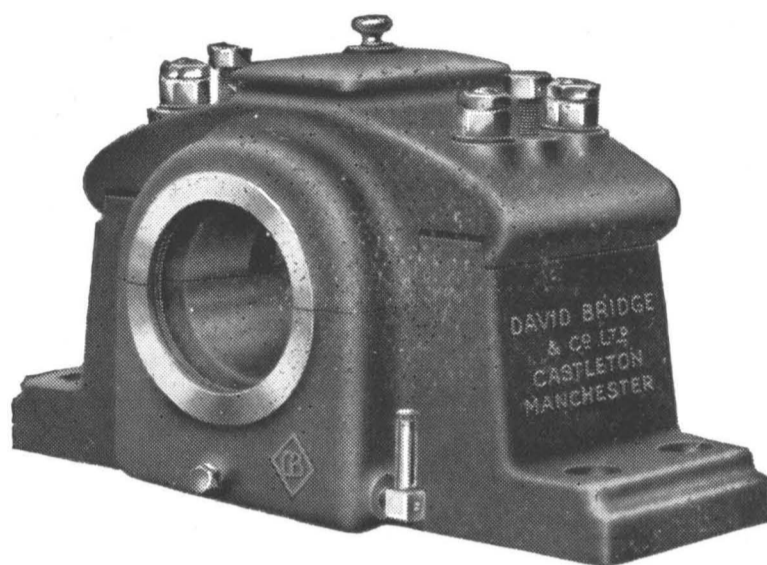
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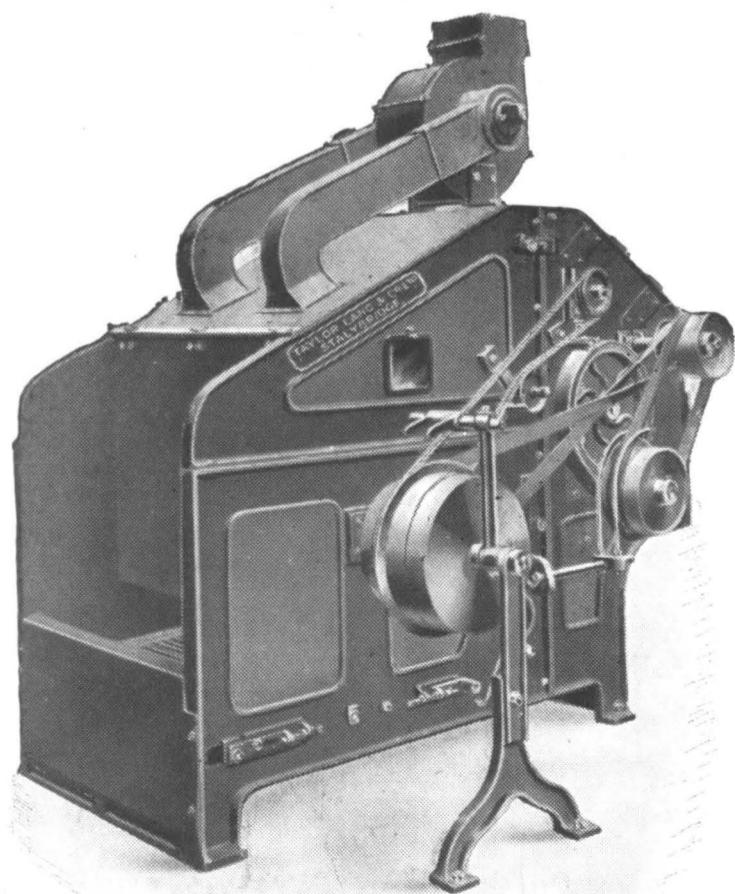
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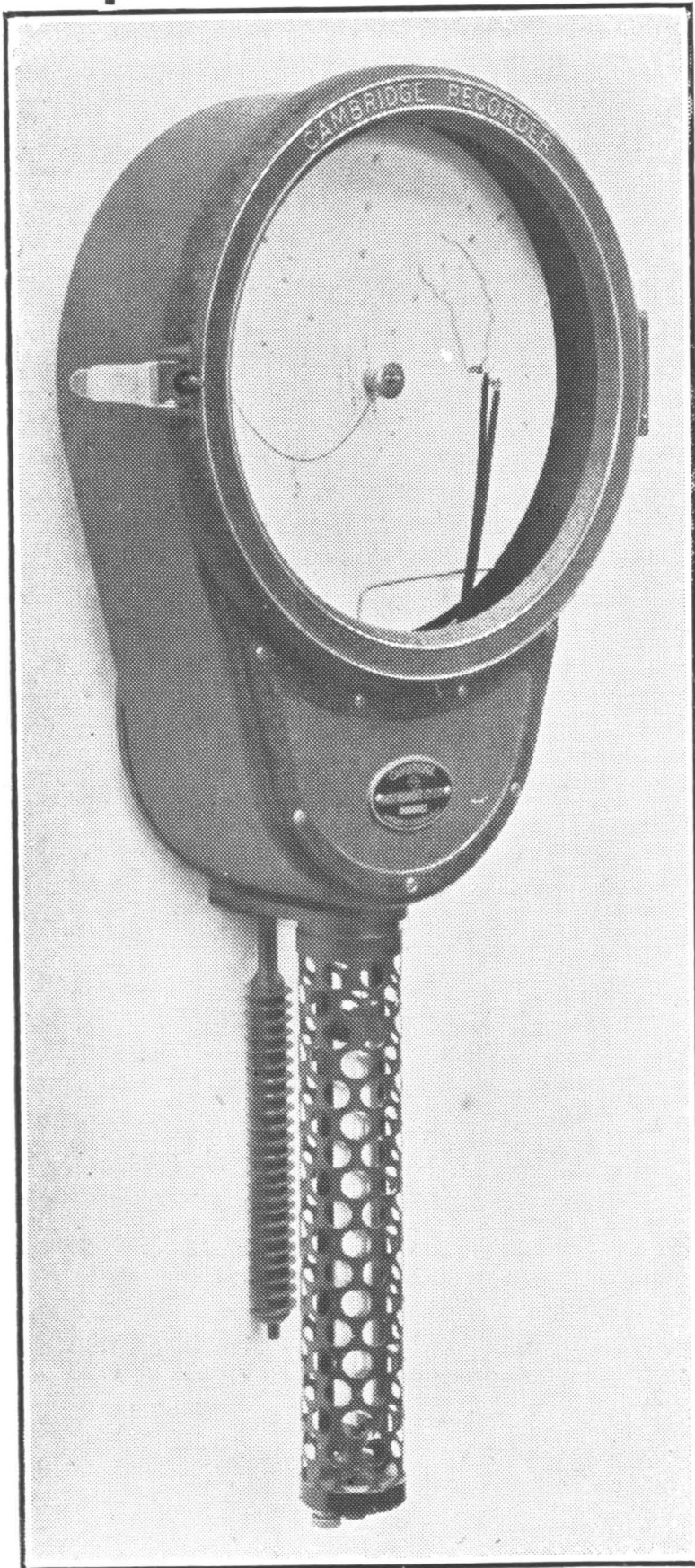
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ABSTRACTS

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The Abstracts in this Section of the "Journal" are supplied by the following Associations, and the source indicated by the initials hereunder shown.

British Cotton Industry Research Association	...	...	...	...	C.
British Silk Research Association	...	...	...	...	S.
Bureau of Hygiene and Tropical Diseases	...	...	...	...	H.
Imperial Bureau of Animal Genetics	...	...	...	...	A.G.
Imperial Bureau of Plant Genetics	...	...	...	...	P.G.
Linen Industry Research Association	...	...	...	...	L.
Textile Institute	...	...	...	...	T.
Water Pollution Research Board	...	...	...	...	D.
Wool Industries Research Association	...	...	...	...	W.

1—FIBRES AND THEIR PRODUCTION

(B)—ANIMAL

Composition of Silk in Relation to Food of Silkworm. G. Colombo. *Boll. uff. R. Staz. sperim. Seta*, 1933, 3, 65 (through *Chem. Zentr.*, 1934, i, 312).

Attempts to detect a difference between normal and starving silkworms in respect of the formation of tyrosine and tryptophane have yielded negative results. S.

Silkworm Chrysalis Oil Emulsions. I—Properties of Dispersions obtained by Boiling Dried Chrysalides with Water. H. Kaneko and K. Yamamoto. *Bull. Sericult. Silk Ind.*, 1933, 6, August, 3-4 (through *Chem. Zentr.*, 1933, ii, 3214).

The dispersed oil globules, which exhibited the Brownian motion, increased in size on addition of alkali and diminished on addition of hydrochloric acid. The protein present has an emulsifying action. The electrokinetic behaviour, surface tension, and viscosity were also studied. S.

Action of Alkaline Copper Solution on Silk Fibroin. V—Application of Conductometric Titration to System Fibroin-copper-amine. VI—Mechanism of Dissolution of Fibroin in Copper-amine Solutions. Y. Takamatsu. *J. Soc. Chem. Ind., Japan*, 1933, 36, 662B-668B and 668B-672B.

V—Equilibria and reactions in the systems fibroin-copper-amine have been studied by potentiometric titration, the amine usually being ethylenediamine.

VI—The rate of dissolution of fibroin in cuprammonium hydroxide solution or solutions of cupric hydroxide in ethylenediamine solutions is given by $x = kt^n$, where x is the amount dissolved in time t , and k and n are constants. It is suggested that the dispersion involves the following consecutive stages—penetration and diffusion of the copper-amine solution into the fibroin, formation of compounds with the fibroin, and dispersion of these solvates. S.

Parasitological and Other Problems in Sheep in Western Australia. I. C. Ross. *Australia—J. Council for Sc. and Ind. Res.*, 1934, 7, 1-8. W.

South African Wools. K. L. Stephens. *Text. Mfr.*, 1934, 60, 99.

Types and characteristics of wools from various districts are discussed. W.

Judging Sheep. G. H. Bedell. *U.S. Dept. of Agric., Farmers' Bull. No. 1199*, 1933.

General information on the judging of sheep, with details of a score card for the judging of mutton sheep. W.

Fleece Density in the Merino Sheep. V. Bosman. *Farming in South Africa*, 1934, 9, 100.

A discussion of fleece density, taking into account the number of fibres per sq. in., the fibre thickness, and the relation of total fibre cross-sectional area to skin area. W.

Contributions to the Study of the Wool of the White Zurkana Sheep. I. Bulgaru. *Inaug.-Diss. Vet. Med. Bukarest*, 1933 (through *Züchtungskunde*, 1934, 9, 110).

Data are given on the length and thickness of the fibre groups in the fleece. The diameter of the down hair is directly proportional to its length. W.

Mycotic Dermatitis in Sheep. M. Henry. *Agric. Gazette of New South Wales*, 1934, 45, 104.

Mycotic dermatitis in sheep appears to be more widespread, although this may be due to the fact that attention has been drawn to the condition. Ordinary dipping will not control the condition. Affected animals should be shorn separately, the crusts removed, and the affected area swabbed with formalin, this treatment at present being purely experimental. The necessity is stressed of thorough cleanliness in all shearing operations. W.

The Distribution and Origin of Sulphur in Wool. I—Methionine in Wool. J. Barritt. *Biochem. J.*, 1934, 28, 1-5.

The methionine content of various wools has been determined. It is shown that the amount present does not substantially affect previous work on the relation between total and cystine-sulphur in wool, which indicated that substantially all the sulphur in wool could be accounted for as cystine. The suggestion is made that methionine occurs widely in feeding stuffs and grasses and may play an important role in the ultimate synthesis of wool and hair-proteins. W.

Influence of Protein Constituents on Wool Fibres. W. O. Teeters. *Text. Rec.*, 1933, 4, 3-28.

A survey of literature on the chemical composition of wool is given. Clean dry wool has been degraded by using absolute ethyl alcohol saturated with hydrogen chloride. This reagent disintegrated the wool after a five to seven day treatment to such an extent that none of the original fibre was left when the process was completed. The products isolated in this hydrolysis can be enumerated as follows—(1) volatile compounds containing sulphur; (2) an alcohol insoluble solid containing no sulphur, but giving characteristic protein reactions. Determination of the composition of this compound is being investigated; (3) an alcohol soluble fraction composed of (a) an ether soluble portion (probably the ethyl esters of amino acids); (b) an ether insoluble portion from which a compound containing a high percentage of sulphur was isolated. Wool has been extracted with (1) distilled water, (2) dilute sodium hydroxide solution, (3) dilute sodium carbonate solution, (4) dilute hydrochloric acid solution, and the concentrated extracts have been examined for the presence of carbohydrates previously described as "Elasticum". No positive reactions for carbohydrates were obtained, and hence the conclusion is drawn that the reactions and changes involved in the felting of New Zealand wool are due to the protein constituents. W.

(C)—VEGETABLE

Cotton: Cultivation in São Paulo. J. G. Dantas. *Industria Text.*, 1933, 2, No. 18, pp. 33-34.

Cotton cultivation in the State of São Paulo has been encouraged by the crisis resulting from over-production of coffee. As a result of variety trials and selections the quality of the cotton has been improved in recent years and the average staple length has been increased to about 28 mm. Internal demand and prices are good and it is probable that an export trade in cotton will develop as crops increase. C.

Cotton Plant: Influence of Soil Moisture on Yield. S. A. Kudrin and S. V. Nemilovsky. *Chem. Social. Agric.*, 1932, 1, No. 2, 72-80 (through *Brit. Chem. Abs. B*, 1934, 215).

Soil-moisture conditions are only of importance when the nutrient content is low. The moisture content should be about 22 wt.-% just before fluorescence, and 23-30% during flowering. Pot culture methods are satisfactory for determining the manurial requirement of cotton. C.

Cotton Plant : Effect on Soil Properties. C. A. Zhorikov. *Pedology*, 1933, 28, 318-329 (through *Brit. Chem. Abs. B*, 1934, 250).

Perennial culture of cotton under artificial irrigation produced an increase in the clay content of the soil. Water-soluble salts (containing SO_4'' and Cl') are leached out, and adsorbed potassium and sodium are replaced by calcium and magnesium. Humus, nitrogen, and available phosphate contents decrease. C.

Sisal Bale Covering : Advantages. C. Vinson. *Cotton Oil Press*, 1934, 17, No. 10, pp. 20-21.

The relative merits of jute, cotton, and sisal bagging are discussed and it is claimed that sisal is much less prone to break off and mingle with the cotton than is jute, as well as being stronger, whilst its cost is much less than that of cotton bagging. C.

Cotton Plant Collar Necrosis Disease : Occurrence in Central Asia. P. G. Estifeyeff. *Sci. Res. Inst., Cotton Growing, Tashkent*, 1930, pp. 39 [in Russian] (through *Rev. Appl. Mycol.*, 1934, 13, 93).

A detailed report of a damping-off of cotton seedlings that is prevalent in certain seasons over the whole of Russian Central Asia. The disease was formerly called a root rot, but the chief symptom is the development of dry cankers on the collar of the stem, especially at the two-leaf stage, the roots generally remaining healthy. A number of parasites are associated with the disease, chiefly *Moniliopsis aderholdi*, *Fusarium vasinfectum*, *F. buharicum* and *Verticillium* sp. Mites and insects further the fungus attack. C.

South Carolina Cotton, 1930-31 and 1931-32: Price—Quality Relationships.

J. S. Burgess and M. Guin. *S. Carolina Sta. Bull.*, No. 290, 1933, pp. 31 (through *Exp. Sta. Rec.*, 1934, 70, 120).

A continuation of a previous inquiry into defects in local marketing conditions. Farmers sometimes received higher prices for some grades and staples than other farmers obtained for higher grades and longer staples sold in the same market on the same day. Lack of knowledge of the correct classification and commercial value of cotton is held to be one of the reasons why farmers do not properly share in the better prices for better cottons. C.

Cotton Plant : Grafting. H. E. Rea. *Plant Physiol.*, 1933, 8, 171 (through *Exp. Sta. Rec.*, 1934, 70, 40).

Field experiments on Lone Star cotton at the Texas Experiment Station indicate that the cotton plant can be successfully grafted under a wide range of temperatures. C.

The Biological Phenomena resulting from Late Sowing of Hemp. R. Fleischmann. *Faserforschung*, 1933, 10, 147-155.

Hemp seed was sown in 1931 at four fortnightly intervals and samples of seed from each of the four lots were sown the following year to examine any hereditary influence. It was found that abnormal early flowering occurred as a result of a certain delay in the sowing, and with it was associated a decrease in the plant length. Seed from such late sown hemp showed no effect on the offspring, but whether it would after several generations of late sowing remained to be proved. The author emphasises the importance of hemp breeding work being based upon correct genetic and ecological grounds. L.

The Growing and Marketing of Jute. A. Wigglesworth. *Text. Mfr.*, 1934, 60, 66-68 and 81.

The question of the supply of jute presents many peculiarities and problems, both on the side of production and consumption. The writer states that 60% of the jute crop is retained in India for manufacture, the balance being exported. Mention is made of the high technical skill applied in Dundee to the production of better class articles than those produced abroad, and the adoption of high-speed automatic doffing frames has helped considerably in the reduction of costs. Reference is made to important research work in improved types of seed carried out by R. S. Finlow, and the average yield of the new strains of seed is 25% above that of local varieties, but it is difficult to get the considered opinion of spinners on the quality of jute of any new or improved strain without the application of research. Experimental work has also been carried out in manuring. The cultivation, harvesting and retting of the crop is also discussed, while the grading of the various qualities is also considered. L.

New Pure Strains of Flax. W. J. Megaw. *J. Min. Agric. (N.I.)*, 1933, 4, 67-71.

During the past three seasons four new pure strains of flax—Stormont Gossamer, Stormont Cirrus, Liral Monarch and Liral Crown—have been compared with J.W.S. and with commercial varieties in field trials which have been carried out in four different counties by the Ministry of Agriculture, Northern Ireland. The number of trials was five in 1930, six in 1931, and six in 1933. The size of each plot in all the trials was one-tenth of a statute acre, and the flax was grown and handled in the manner commonly practised in the North of Ireland. The results showed no significant difference, either as regards yield of fibre or monetary value per acre, between these four pure strains, but each proved superior to J.W.S. in each season's trials. Another notable feature was the very poor yields of fibre and money value of the commercial varieties in comparison with those of the pure strains; the average monetary value of commercial varieties being about 45% less than that of the pure strains. It is, therefore, quite evident from these results that the future success of the flax growing industry in this country will be largely dependent on adequate supplies of pure strains of flax seed being available to growers at a moderate cost. L.

Flax Variety Trials in Hungary. Gyula Csókás. *Faserforschung*, 1933, 10, 155-177.

Trials carried out at three stations in Hungary, differing widely in climate and soil, demonstrated the superiority in yield of straw and fibre of the three Hungarian varieties over White Dutch and Riga. Another experiment in which some German pure lines were included, was conducted for three years at one of the stations, and the results showed that some of the German strains were quite suitable for conditions in Hungary. The results of trials in other countries of the Hungarian pure lines showed that they have a very wide ecological range. Data are given showing the effect of special environmental conditions, more particularly the dew, upon the development of the flax plant during the different stages of its growth. It is suggested that sowing should be earlier in the drier regions, in order to secure the benefit of the winter moisture. A lower percentage of fibre was found in the flax from the warmest of the three stations, and a dry season was found to have an adverse effect on seed formation. The station with an alkaline soil, rich in phosphorus, produced heavier seed and more seeds per capsule. The importance of using seed of good germination and vitality in order to produce an even stand is emphasised. L.

(D)—ARTIFICIAL

Pulp for Acetylation: Preparation. F. Ohl. *Papierfabrikant, V.Z.I.*, 1934, 32, 114-116.

The author discusses the various processes for pretreating wood or pulp to obtain satisfactory acetate products. He argues that mere chemical removal of non-cellulose matter is not enough; the absorptive capacity of the fibre for the acetylating agents must be uniform over the surface. C.

Rayon: Development and Uses. G. S. Heaven. *Text. Weekly*, 1934, 13, 51-52.

A general discussion of the development of the rayon industry, the various types of rayon, and trends in the direction of finer filaments, higher strengths, increased softness, reduced lustre, lower twist, crêpe effects, and the use of staple fibres and spun yarns in mixtures, for effect threads and for effects resembling wool. C.

Rayon Liquid Treatment Apparatus. Société Cuprum. *RUSSA*, 1934, 9, 101-103.

The rayon travels in a helical path round a rotating roller and the liquid is also caused to travel round the roller in a helical path which may or may not coincide with that of the liquid. A counter current system is advantageous. When a vertical roller is used the liquid may be directed tangentially against the surface near the top; when a horizontal roller is employed the liquid may be forced along by means of compressed air. The rollers may be provided with grooves for guiding the liquid. Various forms are shown. C.

Rubber Threads: Manufacture. W. Schlitt. *Kolloid Z.*, 1934, 66, 252-254.

A review of patents for the production of smooth thin rubber threads from latex. Some of the apparatus used is illustrated. C.

Cellulose: Acetylation. I. Sakurada and R. Inoue. *J. Soc. Chem. Ind. Japan*, 1934, 37, 53B-55B.

Experiments on the acetylation of cotton wool show that the reaction may be accelerated 50-100 times by suitable pre-treatment (swelling) with water or acetic acid, preferably the latter. Tables and graphs are given. C.

Viscose: Flow in Tubes. A. Pakschwer and M. Bunin. *Kunstseide*, 1934, 16, 38-42.

Equations of flow of liquids are discussed and it is pointed out that the flow of solutions of cellulose and its derivatives in tubes of circular cross section is not accurately represented by the equation of Bingham. Data for the pressure loss in the flow of viscoses of different viscosities in tubes are given. An empirical formula for the relation between the viscosity determined by the falling sphere method and the effective viscosity coefficient calculated from Poiseuille's equation is given; as the Stokes and Poiseuille equations are not valid for non-Newtonian liquids this empirical equation has no theoretical significance. Data showing the influence of temperature on the viscosity of viscose and the relation between the velocity of flow of viscose in tubes and the effective viscosity coefficient are also given. A method of calculating the diameter of tube for a given flow of viscose under specified conditions is illustrated by an example. C.

Viscose and Latex Mixtures: Properties. F. Ohl. *Textilber.*, 1934, 15, 126-127.

Data are given showing the influence of additions of Revertex and Revultex in varying proportions on the properties of viscose. Such additions make possible the spinning of unripened viscose or viscose which has only been ripened for a short period. The threads produced show increases of up to 30% in dry strength and of about 20-33% in wet strength compared with those containing no latex. The admixed rubber gives the rayon a matt appearance, increases its resistance to moisture and to boiling, and does not affect its dyeing properties when present in small amounts. C.

Viscose Rayon: Adsorption of Iron. K. Tanemura, H. Kohno, and K. Nishimura.

J. Soc. Chem. Ind. Japan, 1934, 37, 89B-90B.

The electrolytic adsorption of iron by viscose rayon, silk, cotton or wood is at a maximum at pH 2.5-3.0 for ferric chloride solution and pH 4.0-5.5 for ferrous sulphate solution. The degree of adsorption varies with the different fibres, which is ascribed to change in the micellar structure of the iron oxide sol. The highest amount of iron on the fibre which was not detected with the tannic acid test was 0.01% of the fibre as Fe_2O_3 . This establishes what is termed an "allowable concentration" of iron in the rayon acid precipitation bath. For 0.1 N sulphuric acid the limit is given as 0.005 gm. per l. and for N-acid 0.01 gm. per l. C.

PATENTS

Production of Powdered Silk. P. Küller (Germany). F.P.745,400 of 4/11/1932 (through *Chem. Zentr.*, 1933, ii, 3786).

Strusæ are reduced to lengths of 0.5-3 cm. before grinding, which may be carried out in stages, the coarser parts being sieved off at intervals. The ground material may be reground in a ball-mill with addition of such substances as sand, salt, sugar, and corundum. S.

Protein-Viscose Rayon: Preparation. M. Guinet. F.P.758,336 (through *Revue Text.*, 1934, 32, 115).

Animal skin is prepared for tanning in the usual way, subjected to a pickling treatment with salt and sulphuric acid, and dissolved in a solution of slaked lime. The solution is brought to a concentration of 20° Bé and calcium salts are removed by the addition of caustic soda or ammonium oxalate. The solution is mixed with viscose in proportions of 10 to 60% and the mixture spun by the process used for the production of ordinary viscose rayon. By means of such incorporations of animal products it is possible to obtain artificial fibres resembling silk, wool, or hair. C.

Separating Bast Fibres from Shives. C. C. Heritage, E. R. Schafer, and Lynn A. Carpenter. U.S.P.1,922,366 of Aug. 15th (through *Chem. Abs.*, 1933, 27, 5199).

For separating seed, flax, straw, etc. into its components, the material is subjected to vibration to remove chaff, seed pods, and other foreign constituents, cut into varying lengths, extracted with organic solvents to remove gums, resins, waxes, and fats, the solvents are drawn off, and the resulting material is subjected to the action of a heated dilute alkaline solution, such as 1% NaOH solution, and the remaining material is extracted, washed, dried, disintegrated, and screened. L.

Depilating Pelts. Metallges. A.-G., O. Schober, and A. Schnitzspahn. E.P. 401,038 of 15/6/1932.

Products containing aluminium silico-sulphides, or mixed sulphides of aluminium and silicon, which furnish sulphuretted hydrogen on contact with water, are used for removing hair from pelts. W.

White Rayon : Production. Algemeene Kunstzijde Unie N.V. (Arnhem, Holland). E.P.403,349 of 12/3/1932.

Pure white rayon is obtained by incorporating in the spinning solution a small quantity of finely divided inert pigment which has a colour complementary to the natural colour of the filaments, whether the filaments are coloured due to the nature and quality of the materials used in their preparation, or due to the presence of finely divided incorporated substances. Suitable pigments are blue cobaltous stannate, blue oxide of tungsten, and cobalt phosphate, and these may be employed alone or carried on colourless inorganic or organic substances such as alkaline earth sulphate, titanium oxide or thorium oxide. The colour supports may be used also with organic colouring matters, e.g. Indanthrene Brilliant Blue R. The pigments may be rubbed up with soaps such as sodium ricinoleate before incorporation in the spinning solution. C.

Cellulose Acetate : Partial Hydrolysis. A. H. Stevens, London (E. Berl, Darmstadt, Germany). E.P.403,554 of 12/4/1933.

Cellulose triacetate is hydrolysed, for example, to acetone solubility, by the addition thereto of perchloric acid in the presence of acetic acid. In place of perchloric acid there may be used perchlorates or complex bodies or mixtures containing perchloric acid, e.g. perchloric acid and phosphoric acid dissolved in glacial acetic acid. C.

Cellulose Mixed Ester and Ether-ester Rayons : Production. H. Dreyfus (London). E.P.403,645 of 17/6/1932.

Artificial filaments, threads, yarns, ribbons, films, plastic masses, etc. comprise mixed esters or ether-esters of cellulose which contain not more than 10%, e.g. 5-6%, of aromatic acid radicle, and a substantial proportion of ether and/or aliphatic acid radicle. The products are characterised by a high heat test. The aromatic radicle may be the radicle of benzoic, toluic, nitrobenzoic, chlorbenzoic, cinnamic or phthalic acid, and may be introduced by treating the cellulose with the corresponding acid chloride in the presence of pyridine, dimethylaniline, or other base, or the process of E.P.403,646 may be employed, in which acidylation is effected by means of benzoic anhydride. The other radicle which is present in substantial proportions, i.e. of the order of 2 to 2.25 substituent groups or more, may be acetyl, or other lower aliphatic acid radicle, or an ether radicle. In the production of the artificial products any suitable solvent or solvent mixture may be used. Filaments, threads, etc. can be made by dry or wet spinning processes, and may be subjected to various after-treatments. C.

Cellulose : Esterification. H. Dreyfus (London). E.P.403,646 of 17/6/1932.

Unsubstituted polymeric hydroxy compounds, particularly cellulose, are acidylated with anhydrides of benzoic acid or its homologues, or with halogen (e.g. chlorine) or nitro substitution derivatives thereof. Other polymeric hydroxy compounds are starches, dextrin and polyvinyl alcohol. Polymeric hydroxy compounds partially esterified with the aromatic radicle may be subjected to further esterification to introduce aliphatic acid radicles and/or to etherification to introduce ether radicles. Mixed esters or ether-esters of cellulose containing aromatic acid radicles and also acetic or other lower aliphatic acid radicles and/or ether radicles are particularly useful. The cellulosic material, e.g. cotton linters or wood pulp, may be acidylated so that the ester is obtained in solution, or fabrics or other textile materials may be esterified without losing their fibrous structure, such esterification being either uniform or local. When mixed esters or ether-esters are produced, the introduction of the lower ester or ether group takes place simultaneously with or after the benzoylation or other acidylation. The products may be employed in the production of filaments, films, plastics, etc. C.

Rayon Staple Fibre : Stapling by Drawing. British Celanese Ltd. (London) and F. C. Hale. E.P.403,738 of 4/7/1932.

Yarn of a fibrous character is obtained by subjecting a plurality of continuous filaments having thin portions at intervals along their length to a breaking load so as to break the filaments at the thin portions, the fibres being associated as a continuous end. Preferably a series of yarns are fed simultaneously to the breaking means, the thin portions of the different yarns being arranged in staggered relationship so as to maintain the continuity of the yarns, which may be further drawn and then twisted, or may be wound and subsequently drawn and spun. The denier ratio of thin to thick portions is preferably 1.1-1.5 to 1. C.

Rayon Staple Fibre: Stapling by Drawing. British Celanese Ltd. (London), W. I. Taylor and L. B. Gibbins. E.P.403,739 of 4/7/1932.

Yarn of a fibrous character is obtained by subjecting to a breaking operation a plurality of continuous filaments which have undergone modification in strength at intervals along their length, the resulting sliver of staple fibres being spun. The modification in strength may be effected by weakening the filaments at intervals, e.g. by bruising them or by applying a solvent or softening agent or, in the case of cellulose esters, by applying saponifying agents at intervals; alternatively, the filaments may be strengthened except at points at intervals by applying a size intermittently to them. The filaments are then broken by passing through two pairs of rollers, of which the second pair rotate faster than the first, and may be spun, or wound and subsequently spun, or doubled. Filaments comprising a yarn are preferably weakened in staggered formation so as to preserve the continuity of the yarn after breaking, but when several yarns are being broken together, all the filaments of any one yarn may be weakened at the same point. False twist may be applied to the broken filaments and they may be supported by travelling bands or the like. C.

Rayon Delustring and Colouring Pigments: Application. H. Dreyfus (London). E.P.403,944 of 23/6/1932.

Wet inorganic pigments are dried by contact with hot vapours of organic substances. The dried pigments are incorporated in the solutions from which are obtained artificial threads, films, etc. or are applied to such materials subsequent to their production. When pigments which have been dried in this manner are employed, there is less tendency for the materials to cut the guides or other portions of the apparatus with which they come into contact. The pigments may be white or coloured. When the pigments are applied to artificial threads after their formation it is preferable to treat the textile material with a swelling agent. C.

Benzylcellulose: Purification. I.G. Farbenindustrie A.-G. (Frankfort, Germany). E.P.403,982 of 29/6/1932.

The extraction of by-products from the crude benzylcellulose mass obtained when benzylating cellulose is facilitated by transforming the crude product into a consistent foaming mass. The latter is produced by stirring or kneading the mass, and its production may be assisted by the addition of emulsifying agents such as soap. For extraction, the foaming mass is introduced into ligroin, methanol, ethanol, etc. with stirring and in portions at a time, the foam being destroyed with the production of a finely divided powder which, after washing with water and drying, is in a form suitable for working up into lacquers, films, etc. C.

Cellulose Acetate: Preparation. Kodak Ltd. (London). E.P.403,988 of 8/4/1932.

Substantially completely acetylated cellulose acetate is made by preheating the cellulose at a fairly high temperature with a mixture of acetic acid and acetic anhydride in presence or absence of an added catalyst and subsequently adding further acetic anhydride and acetylating the cellulose in presence of a catalyst in the same bath by allowing the temperature to rise and maintaining the temperature until a clear homogeneous dope is obtained, not more than three parts of acetic acid and three parts of acetic anhydride per one part of cellulose being used in all. The initial temperature may be 100° F., and may be allowed to rise to 120-150° F. and kept at this temperature. The product is soluble in acetone or ethylene chloride-alcohol. C.

Rayon Spinning Apparatus. Viscose Co. (Marcus Hook, Pennsylvania, U.S.A.). E.P.404,062 of 6/8/1932.

In apparatus for making filaments from solutions of cellulose or cellulose esters there is provided, in combination with a spinning nozzle and pump and in the line of flow between the pump and the nozzle, a device consisting of a hollow cover, a flexible diaphragm beneath the cover forming a chamber between the cover and the diaphragm, and a non-fluid cushioning medium in the chamber supporting the diaphragm. The device may be positioned in such manner that the diaphragm cuts off communication in the delivery conduit between the pump and the nozzle when the pump is not being operated. The cushioning medium may be a spring, preferably of the coiled conical type, or it may be a mass of rubber, preferably spongy rubber. The chamber formed between the cover and the diaphragm may

be in communication with the atmosphere through a vent hole, or it may be entirely closed. In the latter case, the air enclosed within the chamber exerts a cushioning effect additional to that of the spring or mass of rubber. C.

Matt Rayons : Production. H. Dreyfus (London). E.P.404,346 of 14/7/1932.

The process described in E.P.344,510 according to which the lustre of artificial filaments, yarns, etc. is reduced by incorporating therein insoluble organic fibrous material, including regenerated cellulose and cellulose derivatives, in a finely divided state, is modified either by the employment of an organic fibrous material reduced to a fine state of subdivision by precipitation in a liquid medium, or by the use of finely divided cellulose benzoates, in particular dibenzoyl cellulose, as the delustring agent. The cellulosic material to be afterwards precipitated may be dissolved in sulphuric acid, zinc chloride, thiocyanates, cuprammonium solution, etc.; or it may be converted into viscose and subsequently precipitated from such solution. Precipitation may be effected by heat, by chemical action, or by dilution with water or other non-solvents. The necessary subdivision of the cellulose or cellulose derivative during the process of precipitation may be effected by agitation or stirring as by mechanical means or by means of liquid jets or by introducing a gaseous precipitating agent through spray nozzles; precipitation may be carried out in the presence of dispersing agents such as organic sulphonic acids, gelatin, glue, etc. C.

2—CONVERSION OF FIBRES INTO FINISHED YARNS

(A)—PREPARATORY PROCESSES

"Cotonia" Cleaning Machine. P. Trützscher and Gey. *Leipz. Monats. Text. Ind.*, 1934, 49, *Fachheft* 1, 4 and 6.

The new machine for the cleaning of dirty cotton, cotton waste, flat strips, etc. does not cause shortening or twisting of the fibres but loosens and opens the material. During the cleaning process dust is removed by suction fans and impurities collect under the machine. One or two cylinders are provided according to the nature of the material to be cleaned. The use of a hopper feeder is recommended. A cone drive giving five different speeds is provided. C.

Drawframe Sliver Dividing Mechanism. A. R. Kolb. *Rev. Fil. et Tissage*, 1934, 19, 46-50.

A new drawframe divides the sliver longitudinally into two as it leaves the last drawing rollers. Both portions are collected in a single can, from which they can be withdrawn without becoming twisted together. Division of the sliver is effected by extension of the guides below the rollers into upright blades. The can rotates eccentrically about a fixed point, so that the slivers are coiled into the can but are not twisted at all. Diagrams are given. C.

Lap Regulating System. F. Engels. *Textilber.*, 1934, 15, 53-55.

A diagram is given of the device referred to in a previous abstract and its action is briefly explained. (See J.T.I., 1934, 25, A118.) C.

Draw Frame Sliver: Influence of Speed of Drawing and Number of Passages.

E. Lipowsky. *Spinn. u. Web.*, 1934, 52, No. 12, pp. 1-3.

Tests were carried out on the same material subjected to two passages of drawing with a delivery roller speed of 250 turns per minute and to three passages with a delivery roller speed of 350 turns per minute. Examination of the resulting slivers showed that the mean length of the constituent fibres was higher for the higher delivery speed and increased with the number of passages. The regularity of the sliver produced by three passages at the higher speed is better than that produced by two passages at the lower speed. When the strength, regularity, extension and twist of the yarns spun from the slivers are considered it is found that the lower speed gives better results when only two passages of drawing are used, but that the best results are given by three passages at the higher speed. An advantage of the lower speed is that it gives smoother slivers and yarns. C.

Chemical Engineering in the Silk Throwing Industry. Emulsions. D. S. Chamberlin. *Amer. Silk J.*, 1934, 53, No. 2, pp. 31, 32, 56, and 58.

A review of the methods of preparing throwing emulsions. S.

Chemical Engineering in the Silk Throwing Industry. Silk and Rayon Soaking Formulæ. D. S. Chamberlin. *Amer. Silk J.*, 1934, 53, No. 3, pp. 35-37 and 58. Silk and rayon soaking is discussed and recipes are given. S.

Wool Combing: Finishing of Worsted Tops. J. H. H. *Text. Mfr.*, 1934, 60, 97. An article dealing with the processing and finishing of worsted tops, reference being made to routine attention to the various machines. The question of humidity is discussed. W.

Jute Batching. Wilfred E. Billingham. *Text. Mfr.*, 1934, 60, 70. The advantage of emulsions in jute batching for the production of stronger and better yarns is discussed here. The action of the mixture on the fibre is explained, and suitable emulsions are suggested for different qualities of fibre, together with the best means of applying. L.

Flax Fibre Structure and Quality. IX—Grades and Qualities of Tow. S. A. G. Caldwell. *Text. Mfr.*, 1934, 60, 47-49.

The grades and qualities of tow produced during the decortication of flax straw, and the conversion of the raw fibre into the finished line is discussed in this article. Tables are given showing the loss incurred in flax dressing, and the loss incurred in tow dressing of different flax and tow. The carding of tow is briefly described and rules given for card setting. L.

Flax Decorticating Process. *Irish and Scottish Linen and Jute Trades Journal*, 1934, 21, 36.

Mentions a new system of retting flax straw without immersing it in water. It is claimed that the cost of retting under the new process is almost negligible, that it can be undertaken at any time of the year, that the plant is inexpensive and reliable. Fibres thus processed, it is stated, is suitable for warp yarns. The straw has given a yield of 20% scutched fibre and 84% of hackled flax off a 16-tool machine. L.

(B)—SPINNING AND DOUBLING

Cotton Spinning Mill: Rationalisation. K. W. Mühlen. *Spinn. u. Web.*, 1934, 52, No. 7, pp. 1-3; No. 8, pp. 1-5; No. 10, pp. 4-5.

Various improvements in technique are described, including the use of an electro-magnetic roller to remove particles of iron from raw cotton, modifications in settings and speeds, the use of speed regulators and the use of tape instead of band drives for spindles. The importance of temperature and humidity control is pointed out and a sling psychrometer is briefly described. C.

Fly Frame Yarn Tension: Measurements. F. Oertel. *Textilber.*, 1934, 15, 49-53.

The tension in the thread on a fly frame for spinning jute or flax is discussed and it is shown that the tension (T) between the delivery rollers and the eye above the flyer is less than the tension (P) between the eye and the point of contact with the bobbin. Methods of calculating these two tensions and devices for direct measurement are briefly described, and the calculated and experimental values are compared. Curves are given showing the variation of P , T , P/T and other factors with increase in the diameter of the bobbin when the spindle speed is kept constant. Both P and T decrease with increasing bobbin diameter. Dead weight and band braking systems are considered and the possibility of maintaining constant tension is discussed. C.

Ring Traveller. M. Godefroy. *Revue Text.*, 1934, 32, 107-109.

A new traveller for ring frames is of such a shape that the angle making contact with the upper internal edge of the ring is bisected by the straight line joining the points of greatest width of the traveller. This line, during the running of the machine, practically coincides with the longitudinal axis of symmetry of the upper part of the ring and the centre of gravity of the traveller lies on this line or very nearly on it. C.

Flyer Spindles: Prevention of Deformation. Société Générale de Constructions Electriques et Mécaniques Als-Thom. *Rév. Fil. et Tissage*, 1934, 19, 50-53.

In a device due to V. Panoff, deformation of the flyer branches at high speeds of rotation is avoided by fixing them directly to the widened end of the shaft of an electric motor permitting the individual drive of each spindle, the shaft end being wide enough to contain the empty bobbin, which emerges from it gradually as it is filled. C.

Twisting Machines without Rings or Flyers. E. Schmid. *Textilber.*, 1934, 15, 99-102.

Several German patent twisting machines working without rings or flyers are briefly described. These machines depend on the use of rotating discs, hollow bobbins, spindle caps, twisting tubes or similar devices. The advantages and disadvantages of each type are pointed out. C.

Mule Spinning and Carriage Draft. "Tex." *Wool Rec.*, 1934, 45, 565-567.

An article dealing with mule spinning, and discussing in detail carriage draft in relation to woollen, worsted, cotton, and condenser cotton spinning. W.

Self-contained Worsted Spinning Plant. B. C. Johnson. *Metropolitan-Vickers Gazette*, 1934, 14, 351-354.

A description of a self-contained worsted spinning plant for the manufacture of hosiery yarns. As far as possible, individual drives are utilised. W.

Worsted Spinning Costings. S. Kershaw. *Text. Rec.*, 1934, 51, No. 611, pp. 36-37.

Production and costs in open drawing are discussed. A table is given showing the cost of each operation in pence per lb., the figures being based on a piece worker earning 25s. per week. W.

Woollen Yarn Spinning: The Rim Shaft of the Mule. "Scribbler." *Text. Rec.*, 1934, 51, No. 611, p. 39.

An article describing the functions of the mechanisms on the rim shaft of the mule, and the possibilities of altering them to vary the amount of twist, and to regulate the balance between draft and twist. Diagrams are given. W.

Waste in Worsted Spinning. *Wool Rec.*, 1934, 45, 507-509.

In the Botany trade a maximum of 5% waste may be considered representative. Laps, hard waste, and brush waste are discussed, piecing-up in the drawing and spinning processes, running out old lots and starting new ones, and tying up ends in twisting and winding. W.

Origins of the Mechanical Processes in the Spinning of Carded Wool and of the French System of the Spinning of Combed Wool. A. Schmitt. *Rev. Text.*, 1929, 27, 1655-1667; 1930, 28, 5-15, 165-177, 345-367, 529-535, 701-719, 869-877, 1037-1045, 1197-1211, 1365-1377; 1519-1539, 1687-1699, 1847-1865; 1931, 29, 5-13, 147-153, 435-449, 587-597, 723-731, 867-879, 995-1005, 1131-1143, 1259-1271, 1387-1397, 1499-1515; 1932, 30, 5-15, 115-125, 227-239, 331-355, 435-443, 531-539, 627-633, 707-721, 867-879, 951-959, 1035-1039; 1933, 31, 3-9, 83-85, 167-173, 263-269, 355-361, 447-455, 539-543, 627-635, 715-721, 803-811, 891-895, 979-983; 1934, 32, 3-11, 91-93, and 171-173.

A detailed account of the historical, geographical, and mechanical development of the spinning of carded wool and of the preparing and spinning of combed wool in France. The patent literature is reviewed, and numerous diagrams and references are given. W.

Assembling of Yarns for Twisting. "Tex." *Wool Rec.*, 1934, 45, 505.

The assembling of yarns for twisting is discussed, and the English and Continental systems compared. Special reference is made to the Magnum ring twister working in conjunction with the Magnum ring spinning frame, and this is stated to be the best combination for securing long lengths of yarn per package. W.

Doubling Principles and Machines. C. Ashworth. *Text. Rec.*, 1934, 51, No. 612, pp. 23-24.

The principles underlying the various methods employed commercially for twisting several strands of yarn together are examined and the latest type of doubling frame described in detail. L.

Economy in Jute Spinning. J. & T. Boyd Ltd. *Text. Mfr.*, 1934, 60, 84.

This article refers particularly to savings in costs and general efficiency obtained in the use of the self-doffing spinning frame, and advantages to be obtained in converting existing frames. L.

Draft and Twist Constants. A. Brand. *Text. Rec.*, 1934, 51, No. 612, p. 22.

The maintenance of flax, hemp and jute preparing machinery is discussed, and the matter of maintaining the counts of the yarns within the desired limits of accuracy is of first-class importance. Mention is made of the correct methods to adopt in order to keep rollers and gearing at the proper ratio. L.

Flax Fibre Structure and Quality. X—Effect on the Material of the Processes of Sliver Forming, Doubling, Drafting, and Spinning. S. A. G. Caldwell. *Text. Mfr.*, 1934, 60, 98-99.

The effect on the material of the processes of sliver forming, doubling, drafting, and spinning is discussed. Tables are given of the necessary drafts and doublings for the production of tow and line roves, and an illustration is given showing the essential details of a flax drawing frame. L.

Jute Spinning Frames. T. Woodhouse and A. Brand. *Text. Rec.*, 1934, 51, No. 611, pp. 25-26.

A very good description of a standard spinning frame for jute warp hessian, tarpaulin, and sacking fabrics, and for weft for hessian fabrics is given. The action of the machine is considered as an assemblage of three distinct mechanisms, designed to carry out the three elemental operations involved in spinning, viz. drafting, twisting, and winding-on. L.

Modern Lay-out and Methods in Jute Spinning. J. Barbour Pears. *Text. Mfr.*, 1934, 60, 76-77.

This article is a summary of the modern machinery and methods being adopted by some of the more recently reorganised jute mills of the present day. Flax and jute cards are compared and the general principles of modern preparing and spinning machinery is fully discussed. A sketch is given showing the lay-out of jute preparing machinery. L.

Preparing Machinery Pressing Rollers. S. A. G. Caldwell. *Irish and Scottish Linen and Jute Trades Journal*, 1934, 21, 28-29.

The maintenance of rollers for preparing machinery is discussed here. Mention is made of the essential properties in wood for roller manufacture, and a list of different classes of timber most suitable for the work is given. Reference is also made to the washing of rollers and the best type of mixture for the purpose. L.

The Monifeth Preparing and Spinning Plant. Jas. F. Low & Co. *Text. Mfr.*, 1934, 60, 82-84.

Reference is here made to improvements in jute preparing machinery, whereby greater production and efficiency is obtained. High-speed self-doffing spinning frames with increased turn-off are also discussed. Mention is also made of an improved twisting frame with individual doffing arrangement for each spindle. An improved type of shuttle is also described and particulars of weaving tests given. L.

Modernising the Jute Spinning Mill. Fairbairn Lawson Combe Barbour Ltd. *Text. Mfr.*, 1934, 60, 72-79.

The application of labour-saving devices making higher speeds possible, and improved yarn regularity, are the principal features discussed in this article. Double-thread spiral screws and can tramping and turning motions are special features mentioned in preparing, while roving frames with larger bobbins and higher speeds are advocated. In the spinning section the automatic doffing arrangement is fully described and sketches given of the different motions. L.

Evolution of Modern Jute Machinery. Jas. Mackie & Sons Ltd. *Text. Mfr.*, 1934, 60, 85-86.

A brief account is given of the evolution and production of jute preparing and spinning machinery by this firm. Special features mentioned are automatic can-turning, tramping, changing and sliver breaking motions, double-cam screws, electric choke signals, automatic stop motions, etc. Rovings fitted with 10 in. × 6 in. bobbins and other special arrangements, also spinning frames with the Mackie-Schneider automatic doffing motion. L.

The Frazer Patent High-speed Quick-doffing Roving Frame. Douglas Frazer & Sons Ltd. *Text. Mfr.*, 1934, 60, 80-81.

With improved spinning frames giving higher production and the elimination of the doffing squad it became necessary to improve the rovings in order that the correct balance of material should be maintained. A step in this direction has been made by Douglas Frazer & Sons Ltd., Arbroath. The size of the bobbin has been increased to 12 in. × 6 in., which increases the capacity of the bobbin by 75% over the 10 in. × 5 in. size, and other notable features are the quick-doffing arrangement with much higher speeds, coupled with a 50% decrease in the doffing time, and increased production. The automatic mechanism is fully described. L.

(C)—SUBSEQUENT PROCESSES

Yarn: Gassing. F. Mendousse. *Fils et Tissus*, 1934, 22, 5-7 and 48-50.

A general discussion of the aims of gassing, the controlling factors in the gassing process, the unwinding and winding of the yarn, types of burners and automatic stop motions used, the ventilation of gassing rooms, the loss of weight on gassing and speeds and productions for different yarns. C.

Robot Silk Reeling. J. A. Scheibli. *Amer. Silk J.*, 1933, 52, No. 12, pp. 32-33.

The Scheibli reeler utilises a photo-electric cell, which controls the machine and ensures the maintenance of a uniform thickness of thread. One operative is able to attend to a large number of machines. The reeler is particularly suitable for reeling at isolated plantations from which transport of cocoons to the filatures is inconvenient. It is suggested that sericulture might very profitably be undertaken on Mexican coffee plantations; raising mulberry bushes on abandoned plantations reconditions the soil for coffee planting and it is estimated that an annual production of 40,000 bales of raw silk could soon be achieved. S.

The Winding of Jute Yarns. Universal Winding Co. *Text. Mfr.*, 1934, 60, 86.

Refers to developments and improvements in design, precision of construction, increased speeds and productions, and improved quality of product that have taken place in winding machinery. Winding is classified into two sections, (a) for transport purposes, including make-up for sale; (b) for internal processing, such as warp or weft winding. Two machines for the production of yarns for either purpose are described. L.

(D)—YARNS AND CORDS

Fancy Loop Yarns. K. F. Seim. *Leipz. Monats. Text. Ind.*, 1934, 49, *Fachheft I*, 4-5.

A new type of yarn for use in knitting or weaving is composed of a series of interlinking loops of uniform or varying size. The loops may be formed from a single thread or from several threads and in the latter case the constituent threads may be composed of different textile fibres and may vary in lustre and colour. The yarns show good dry and wet strengths and high regularity, and fabrics prepared from them have a soft, full handle and withstand washing well. Details of the patent process and machines for the production of these yarns are not yet available, but specimens of the yarns are provided. C.

Weaving Properties of Yarns in Relation to their other Properties. I—Natural Silk (Grège). W. Weltzien (with H. Evers, K. Werner, and W. Rhein).

Monatsh. Seide und Kunstseide, 1934, 39, 14-18.

The seriplane tests are reviewed. An especially serious shortcoming is the subjective character of the tests; objective tests giving results which can be expressed by numbers are essential. Further, deviations in mean denier between the various panels are not detectable, so there may be at the same time considerable uniformity within each panel but considerable divergences between different panels. For assessing evenness, denier determinations by weighing 9-metre lengths are advocated. Determination of evenness by observation of thread diameter with a micrometer eyepiece does not give the same result as weighing, and is not satisfactory. It is proposed that evenness shall be expressed in terms of the mean deviation in the denier determinations. S.

Flax Fibre Structure and Quality. VIII—Characteristics and Qualities of Dressed Line: Grades of Tow. S. A. G. Caldwell. *Text. Mfr.*, 1934, 60, 12-13.

Special mention is made in this article of the characteristics and qualities of dressed line, and grades of tow. In good qualities of dressed line, the fibre bundles have a rounded appearance, and the fibre bulks out well to the ends. Sometimes there is a fair amount of fine fibre associated with the main fibre bundles. This is specially noticeable in the finer grades of flax, and is probably responsible for the "neppy" tow removed from this class of material. In the coarser grades, this fine fibre is absent, the line having the appearance of straight, smooth, rod-like bundles with branching projections only. Good yields are a feature of flax of this description. "Flat" fibre is associated with various grades and qualities of material. The bundles in this case have a flat, ribbon-like appearance, and fibre of this nature is considered to be obtained from straw which was over-ripe. This flat fibre structure is also associated with material of a wefty nature. Green tinted fibre of a light warp or weft nature, which shows this ribbon-like structure in the hackled line as well as in the scutched flax. Such flax is supple and handles well,

possessing a fair degree of quality. The general opinion is, that it has been obtained from straw which was pulled rather green. There is also to be obtained a flat-ribbed weft flax that is hard and hasky, due to the straw being pulled too late. The flat fibred flax—with the exception of the green-tinted type mentioned—is not of good spinning quality. Mention is also made of the “breaking and ending” section of the hackling machine, also some remarks on the hygroscopic properties of different flaxes. L.

PATENTS

Pneumatic Cotton Mixing Apparatus. J. J. Rieter et Cie. F.P.757,328 (through *Revue Text.*, 1934, 32, 115-117).

A delivery device in the form of a wheel with paddles for use in pneumatic mixing installations is designed to travel along the feed pipe and supply the various mixing chambers in turn. Suitable openings are provided in the pipe and an air current carrying cotton from the latter turns the wheel. The cotton is separated from the air current and thrown outwards by centrifugal force. C.

Gill Boxes. Nouvelle Soc. de Construction Ci-Devant N. Schlumberger et Cie. E.P.377,392 of 23/6/1931.

In a gill drawing frame in which the faller bars are propelled by toothed wheels engaging the shaped ends of the bars, freely-mounted pinions, which are braked by spring-pressed clamping screws, are provided on each side at the front of the machine, the teeth of the freely-mounted pinions meshing with the teeth of the front bars, the first of which is descending. The pinions serve to guide the descending bars in a vertical direction, the bars being disengaged therefrom only after the pins have completely left the sliver. W.

Gill Boxes. Nouvelle Soc. de Construction Ci-Devant N. Schlumberger et Cie. E.P.400,475 of 11/2/1933.

In the gill-box drawing mechanism described in the parent specification E.P. 377,392 (see *J.T.I.*, 1934, A229) and having faller bars propelled by toothed wheels engaging the shaped ends of the bars and controlled by brake pinions, the bars are cranked in the middle of their length so as to approach closely to the drawing rollers when treating short staple fibres and are adapted to be reversed so that the needles are more remote therefrom when treating long staple fibre, e.g. long staple combing wool. A diagram is given. W.

Variable-speed Bobbin Driving Mechanism. Fabriques de Soie Artificielle d'Obourg Soc. Anon. (Obourg-lez-Mons, Belgium). E.P.403,363 of 18/3/1932.

In mechanism for varying the rate of rotation of a bobbin-holder shaft inversely with the radius of the winding, a single belt co-operates with two extensible pulleys, the diameter of one of which is reduced or increased in accordance with the increase or diminution of the diameter of the other which drives the bobbin, and the diameter of which is controlled by one or more revolutions at a constant speed of a rotating member. C.

Condenser Bobbin Stripping Device. W. Tatham Ltd. and H. Thornton (Rochdale). E.P.403,510 of 26/10/1932.

Waste sliver is stripped from condenser bobbins by a rotating stripping roller provided with a number of radial strips of leather, rubber or like resilient material, which acts in co-operation with a fixed or adjustable guide plate adapted to receive the bobbin and provided with a sharp edge or blade which loosens the sliver on the bobbin when the latter is slowly rotated. A back guide plate directs the stripped material downwards and a curved guide plate may be provided additionally. The machine may be enclosed to localise the stripped material which may be collected in a container or pneumatically by means of cages. C.

Reeling Machine. C. Guseo and V. Ravasio (Brescia, Italy). E.P.403,533 of 2/2/1933.

Reeling mechanism comprising cross bars on which the hanks are wound, and each of which is mounted on a radially movable spoke of the reel, a locking device being provided to lock the spokes in their extended positions, is characterised by the provision of a single control connected with the spokes and locking device in order with one operation to release the locking device and retract the cross-bars radially of the reel, or to move the cross-bars radially to the expanded position and actuate the locking means to lock them there. The reel is of metal, having a hub with tubular arms to receive rods carrying the cross-bars. Two or all of the

cross-bars carry combs, the teeth of one being opposite the slots of another, so that each lea of a hank is separated horizontally and vertically from the next lea. C.

Winding Machine Traverse Mechanism. L. H. Leedham, J. Coley, and Wildt & Co. Ltd. (Leicester). E.P.403,656 of 23/6/1932.

In traverse mechanism for yarn winding machines of the kind wherein a progression or riser wheel operatively connected with the yarn guide is mounted on a screwed spindle, the yarn guiding means is so arranged that the resultant pull of the yarn is in a direction spaced from the axis of the riser wheel a radial distance substantially not greater and preferably less than the radius of the wheel. C.

Winding Frame Yarn Dressing Device. British Celanese Ltd. (London). E.P.404,171 of 27/3/1933.

In the application of treating liquids (oil, size or colour) to yarns, threads, etc. the speed of which varies during the application, e.g. during winding, the amount of liquid applied per unit length is kept constant by moving the line of contact with a surface wetted by the liquid into a different plane to vary the length of contact. The thread may be led over a revolving felt cone dipping into a trough containing the liquid to be applied. The thread is supported by guides carried by a bridge piece which is connected to a reciprocating member. As the size of the spool increases the bridge piece and the thread are moved towards the larger end of the cone. C.

Rubber and Textile Cords. C. F. Hansen (Oslo, Norway) and E. Meier (Oslo, Norway). E.P.404,227 of 18/7/1933.

A cord of quadrangular cross section comprises alternate layers of parallel textile threads and rubber or the like, so that two parallel faces of the cord are formed of textile threads, and the other two faces of alternate strips of rubber and thread. The cords may be formed by cutting or tearing a sheet of rubber covered on both sides with parallel textile threads into narrow strips; alternatively, a sheet of rubber covered on one side only with parallel textile threads may be cut or torn into strips, and textile threads applied to the remaining side of the rubber strip. C.

Twisting and Winding Apparatus. N. Gribojedoff (Paris). E.P.404,265 of 7/4/1932.

Apparatus for twisting and winding yarns comprises a rotating casing carrying a centrally disposed bobbin tube upon which the yarn is wound and guides which effect the twisting, the yarn or yarns passing from the guides to the tube through tensioning and guiding devices carried by a reciprocating rod which is arranged also to raise the tube to build the cop by ratchet gear, means being provided to stop the apparatus upon breakage of the yarn or completion of the winding. Additional twist may be imparted by means of a ring rotating in the opposite direction to the casing. C.

Winding Machine Lint-removing Device. A. H. Stevens, London (Universal Winding Co., Boston, U.S.A.). E.P.404,462 of 21/1/1933.

In a yarn winding machine a tubular envelope or cell surrounds each supply bobbin and a current of air is maintained through the members to remove the lint released in unwinding. The members are constructed as open cylinders and communicate at their lower ends with suction trunks. C.

Rubber-covered Bobbin. A. S. Lowry (Romiley). E.P.404,645 of 14/5/1932.

A bobbin tube of fibrous material is completely covered by a jointless single sheath of rubber. The rubber is applied by dipping the tube into rubber solution or, preferably, into latex and then vulcanising. If desired, the yarn-receiving portion may have a soft resilient coating, whilst the end or ends may have a hard, smooth and thinner coating. This may be effected by protecting the ends of the tube with caps, dipping the tube into the latex, removing the caps and dipping the ends only into another latex having a lesser density and higher sulphur content, vulcanisation being effected after each dipping or after the second dipping. Colouring matter may be added to the latex. C.

Broken-end Suction Collecting Device. P. Swyngedauw (Lille, France). E.P.406,063 of 7/9/1932.

In a suction device for collecting broken ends on spinning and similar machines comprising suction nozzles each normally closed by a member adapted to be

released by the breaking of a thread engaging a feeler associated with the member, the member normally closing the suction nozzle comprises a plate or the like adapted to move in its own plane. The feeler is adapted to move about an axis disposed below its centre of gravity and is normally maintained by the thread in a position of unstable equilibrium. C.

Cop Cross-winding Apparatus. W. Ayrton & Co. Ltd. (Manchester), E. M. Baines, E. C. Baines, and F. Osborne. E.P.406,087 of 5/11/1932.

The invention relates to improvements in the spindle supports of apparatus for producing cross-wound cops of the type in which a movable support arm is provided adapted to be turned in a plane parallel to another arm, or in a plane at right angles to the spindle, and turned against spring pressure. The improvements are characterised in that the movable support arm is mounted on a turned spindle on the doffing slide bar, the latter being fashioned to engage notches or recesses in the barrel or boss of the movable support arm which contains an enclosed spring and whereby the movable support arm is locked in one position and held out of action in the other. C.

Drawing Frame Funnel Guide. L. Jacobi (Vienna). E.P.406,508 of 25/4/1933.

A funnel guide for the delivery of slivers from cotton drawing frames is divided at right angles to the direction in which the sliver is fed into two parts separated in the direction of this movement, and consists of a fixed end or delivery funnel and of an entry funnel which is pivotally mounted in front of the delivery funnel in such a manner as to be movable in the feed direction of the sliver, the movable entry funnel serving as an actuating member for the detector and stopping mechanism. C.

Combing Machine. Société Alsacienne de Constructions Mécanique (Mulhouse, France). E.P.406,614 of 16/10/1933.

In a rectilinear combing machine of the Heilmann type, the comb cylinder, the nipper and the drawing-off mechanism are combined with a device for considerably increasing the distance between the drawing-off mechanism and the other operative parts of the machine. This device consists of movable supporting members carrying the drawing-off mechanism and of guiding means, stops and locking means serving to fix and to lock the drawing-off mechanism in normal position. To give easy access to the operative parts of the machine, the arrangements permit the drawing-off mechanism to be retracted in a single movement and over a relatively considerable distance apart from the other operative parts of the machine. The supporting members are preferably pivotally mounted so as to allow displacement of the drawing-off mechanism substantially along the direction the sliver takes during the drawing-off. C.

Double Twist Spindle Stop Motion. Société Textile Twistok (Chamalieres, France). E.P.406,801 of 31/10/1932.

A double twist doubling or twisting spindle having a bobbin or bobbins carrying the threads to be twisted is provided with a stop motion in which a feeler, arranged in proximity to each bobbin, is constantly pressed against the threads or each bobbin until an approximately predetermined length of thread remains on the bobbin, whereupon it operates electrical means for stopping the spindle. The feeler may be constituted by a pivoted lever. In arrangements comprising several bobbins of threads to be twisted, a knocking-off motion is provided to stop the spindle on breakage of one of the component threads. The knocking-off motion comprises movable members suspended from the elementary threads and adapted to operate electrical means for stopping the spindle when a thread breaks. These feeler and knocking-off arrangements may be combined with arrangements for stopping the spindle in case of an oscillation of the carrier carrying the bobbin or in case of excessive tension on the thread to be twisted. C.

Double Twist Spindle. Société Textile Twistok (Chamalieres, France). E.P.406,806 of 3/11/1932.

A spindle for double twist comprises two shafts placed in line and connected together by a deformable member or a set of deformable members of wire or the like which enable one shaft to be driven by the other. One of the deformable members is provided with means for guiding the yarn between these shafts and along this deformable element during work. The deformable members may be constituted in different ways. An example in which the deformable system is produced by means of funicular elements is described. C.

Yarn Delivery Regulating Device. G. Horn (Berlin). E.P.406,931 of 31/8/1933.

In an arrangement for regulating the delivery of thread from supply bobbins, the thread is first led around the longer arm of a brake lever and then over a thread tension lever, whereby on exerting a pull on the thread first of all the brake lever is moved in such a manner as to effect braking of the bobbin until the thread tension lever yields to the pulling force of the thread to such a degree that in consequence of the altered path of the thread the pulling force of the thread upon the brake lever is reduced to such an extent that the bobbin rotates more freely and correspondingly increases the thread delivery. C.

Endless Belt Drafting Device Cleaning Apparatus. F. Casablanco (Sabadell, Spain). E.P.407,252 of 8/8/1933.

An apparatus for cleaning or clearing the upper belt in drawing mechanism for textile machinery having endless belts consists of a plush roller of relatively large diameter resting solely on the upper drawing roller which imparts motion to it by contact. The plush roller presses lightly against the surface of the upper belt, without resting on it, and the difference in speeds of the roller and the belt produces a friction between the two which cleans the surface of the belt. C.

Winding Machine Traverse Mechanism. Maschinenfabrik Schweiter A.-G. (Horgen, Switzerland). E.P.407,261 of 23/8/1933.

In yarn winding, spooling, twisting at delivery, rayon spinning and similar machines in which the yarn guide is reciprocated by means of screw spindles rotating in opposite directions, the spindles being alternately engaged with spring-controlled segmental units by means of a finger co-operating with a template which is displaceable in two directions, the template is automatically moved in a direction perpendicular to the yarn guide rod so that the path of the yarn guide is gradually reduced. Combined with the reciprocation of the template parallel with the rod, this causes the yarn package to be given a short taper at the ends, with the build strengthened so that the package does not collapse. C.

Crighton Opener Grid Adjusting System. W. J. Tennant, London (J. J. Rieter & Co. Ltd., Winterthur, Switzerland). E.P.407,269 of 6/9/1933.

The patent relates to means for changing the inclination of the longitudinal axes of the bars of the grid in either direction relatively to the generating lines of the conical grid surface. The individual bars of the grid are guided at one of their ends in a stationary mounting and at their other ends in a rotationally displaceable annular member disposed concentrically with the axis of the beater head. C.

3—CONVERSION OF YARNS INTO FABRICS

(A)—PREPARATORY PROCESSES

Cop Winding Frame. Ateliers Schweiter. *Revue Text.*, 1934, 32, 109-111.

In a new machine for winding tubular cops the spindle is fixed and the cop is moved along the spindle continuously during the winding process. Two forms are shown. Devices for protecting the spindle from oil are not required. C.

High-speed Warping Machine. W. Schlafhorst & Co. *Leipz. Monats. Text. Ind.*, 1934, 49, *Fachheft* 1, 24-26.

The patent Model 80 high-production warping machine has only a single reed, and one measuring roller replaces the numerous subsidiary rollers of early models. The measuring device provides for automatic stopping of the machine after the warping of a given length. A hand wheel for lowering the beam and patent devices for ensuring steady running of the beam are provided. Different creels for use with this machine are briefly described and diagrams are given of Model 8 in which conical cross-wound bobbins are arranged in pairs, the end of yarn from one bobbin of the pair being fastened to the beginning of the other. On this creel bobbins can be replaced and the ends joined without interrupting the warping process. C.

Warping Process : Rationalisation. *Spinn. u. Web.*, 1934, 52, No. 11, pp. 1-5.

The results are given of time studies of the warping process and investigations of improvements in efficiency resulting from the use of improved creels, higher speeds, bobbins containing greater lengths of yarn, signals and electric control devices. Considerable savings in time, labour and wages can be effected by rationalisation along the lines indicated. C.

Yarn: Winding; Speed and Output. S. Viellenave. *Fils. et Tissus*, 1934, 22, 51-53.

The winding of yarn on to bobbins depends on the relative speed of rotation and the relative speed of translation in a vertical direction of the bobbin with respect to the device guiding the yarn to the bobbin. A formula showing the relation between these two speeds, the length of yarn delivered in unit time and the diameter of the bobbin is deduced, and it is shown that both these speeds should vary inversely with the diameter of the bobbin. The arrangements are simplest for bobbins on which the yarn forms successive cylindrical layers. For tapered formations the relations become more complicated. On flyer and ring spinning frames the speed of rotation varies automatically with the diameter of the bobbin and special mechanisms are only required to produce the necessary variations in the speed of vertical displacement. On speed frames and mules complicated mechanisms are required to produce the necessary variations in both speeds. C.

Cross-wound Rayon Bobbins: Warping. *Kunstseide*, 1934, 16, 63.

The advantages of the use of longer cops in the weaving of rayon, and unsatisfactory features of the present method of warping rayon from cross-wound bobbins are pointed out. A comparatively high tension is applied to the yarn in the winding of cross-wound bobbins and the inner layers are affected in places by the pressure of the outer layers. The effects of this pressure are often visible in the finished fabric. C.

Weft: Winding. W. O. Bitzenhofer. *Silk and Rayon*, 1934, 8, 75-77, 115-117.

Tests are reported to find the most favourable degree of economy in weft winding with respect to quantity wound per spindle per hour, inactive time of operative, and number of spindles wound per hour. The most favourable total performance amounts to 2,110 grams of wound material from 26 spindles per hour, with 19% inactive time. The hourly quantity performance amounted to 1,850 gm., so that the basis for wages was taken as $1.85 + 2.11 \div 2 = 1.980$ kg., showing an increase of 28.5% on the former average. C.

(C)—WEAVING

Pile Fabrics: Weaving. H. Schrunz. *Textilber.*, 1934, 15, 57-59.

A general discussion of the weaving of fabrics on which a pile is produced by a raising operation giving imitation doe-skin and similar effects. Suitable weaves are shown and methods of avoiding various faults are indicated. C.

Saurer Multi-shuttle Ribbon Loom. *Filaments*, 1934, No 1, pp. 8-12.

This loom can be used for silk, rayon, or light cotton ribbons, and can make from 6 to 40 pieces simultaneously in widths from $\frac{1}{2}$ to $6\frac{1}{8}$ inches. It can be fitted with a dobby designed to work up to 32 shafts, a tappet motion permitting weaving up to 16 shafts, and auxiliary apparatus to be combined with either the tappet motion or the dobby. The shafts are lifted by horizontally and vertically working wooden rods, and the batten is arranged with two rows of shuttles. C.

Shuttle Brake. A. Brugger. *RUSSA*, 1934, 9, 133-135.

A device for stopping the shuttle in the shuttle box before it comes into contact with the picker comprises a lever which moves about an axis at one end and is pressed towards the interior of the box by a spring, and a double-nosed cam. One nose of the cam is in contact with the lever and the other moves into a groove in the conical end of the shuttle and thus stops the shuttle. This arrangement prevents any recoil motion of the picker and catching of the latter by the shuttle when the boxes move up or down. The shuttle is released automatically when the picker moves forward to drive it through the shed again. C.

"Terta Embru" Automatic Cop-changing Mechanism. Telefonfabrik A.-G. *Text.*

Lloyd, 1934, 8, No. 4, p. 27.

The advantages of automatic weft supply mechanisms are discussed and illustrations are given of a simple cop-changing mechanism which can be applied to ordinary looms with either fast or loose reed and either over or under pick motions. The replacement of the usual wooden slay by an iron slay is advantageous. The feeler device used with the new mechanism may be either electrical or mechanical and is adjusted so that the cop is only changed when the weft is completely exhausted, thus avoiding waste of weft yarn. C.

Towel Fabric: Weaving. A. Poyet. *Revue Text.*, 1934, 32, 135.

In a new method of weaving towelling the number of ground warps is the same as usual, but each of the usual loop warp threads is replaced by two threads so

that double loops are formed. The warp beam is turned at twice the usual velocity, but the rate of picking remains the same, so that the weft density in the cloth is halved. A special reed is placed between the beam and the harness. Towelling produced by this method has a greater weight per unit length, a greater power of taking up water, and a lower cost of production than that produced by the usual method. C.

Warp Twisting-in Machine. Warp Twisting-in Machine Co. *Text. Rec.*, 1934, 51, No. 611, p. 48.

A photograph is given of a machine used for twisting-in warps composed of gum silk, organzine, synthetic yarns and fine cottons by the broadgoods and velvet manufacturers. The same machine can be used for twisting-in warps in the loom or away from the loom, whichever method is most convenient for mill practice. Warps require an end and end cross or lease. During twisting, operators can detect any mistake made in the harness by the weaver and correct these mistakes immediately. C.

Cotton Ribbons: Weaving. *Filaments*, 1934, No. 1, pp. 13-17.

Directions are given for weaving taffeta, twill, petersham, hat, and satin ribbons, and the structure of each ribbon is analysed. C.

Loom with Leno Reed; Patterning on——. E. Gräbner. *Spinn. u. Web.*, 1934, 52, No. 13, pp. 1-4.

The action of a loom having, in place of the usual leno harness, a reed with a half rib in each space provided with an eye through which a crossing thread passes is outlined. Systems of patterning for such a loom in which a change reed is used to produce sideways displacement of the ground warp threads or the leno reed is given a sideways displacement are explained with the aid of diagrams. C.

Tappet Loom Stocks and Bowls. W. Shuttleworth. *Text. Weekly*, 1934, 13, 100-101.

The best and simplest settings for connecting the healds to the half moons at the top and stocks and bowls below on a tappet loom are given. Attention is drawn to the need for previously stretched or stretchless leather straps, the use of rimmed bowls of moderate size, and the use of a threaded shaft for the bracket, so that this can be raised or lowered to get the correct tension on the heald shafts. C.

Warps: Relation between Twist and End Breakage during Weaving. W. E. Morton and A. Pollard. *J. Text. Inst.*, 1934, 25, T60-T69.

Mechanical Fabrics: Weaving. A. Hamann. *Textilber.*, 1934, 15, 107-109.

The author discusses briefly the weaving of cloth for automobiles and carriages, billiard table cloth, floor coverings, piano cloth, filter cloths, roller coverings, artificial leather, etc. C.

Shuttle for Lastex. H. Dolan (Adamson Bros. Co., New York). *Text. World.*, 1934, 84, 280.

A special shuttle with respect to tension has been devised for the weaving of Lastex yarn. The device consists of a simple mechanical principle adjustable by means of a screwdriver applied outside the shuttle. The thread passes between a soft rubber sponge mounted on a metal plate opposite the eye of the shuttle. Fur is mounted on the working surface of the sponge for contact with the yarn. A diagram is given. W.

Some Recent Improvements in Jute Weaving. Urquhart Lindsay and Robertson Orchar Ltd. *Text. Mfr.*, 1934, 60, 87.

Refers to prospects of improvements in weaving efficiency by the additional loom mechanism now available. An automatic re-shuttling loom is mentioned which changes the empty shuttle for a full one, and the combined weft protector and brake arrangement which automatically stops the loom when the weft breaks or runs out. Warp stop motions are also commented on and described. Looms with special rolling up motions behind the weaver for linoleum backing cloths, heavy wide looms for cotton belting, etc. are also mentioned. Winding machinery is also discussed. L.

(D)—KNITTING

Spun Silk and Rayon: Application in Knitting. W. Davis. *Silk J.*, 1934, 10, No. 117, pp. 16-17.

Articles made from spun silk are remarkable for their springiness and bulk in handle. They have also very desirable properties of cover, surface attraction and heat retention. The use of spun silk is, however, limited by its high price. Staple fibre rayon yarns have a soft handle, attractive cover and subdued lustre and are being used successfully for interlock fabrics. These yarns have a structure similar to cotton yarns. Graphs are given showing the results of tests of staple fibre and continuous filament rayon yarns. The staple fibre yarns have lower breaking loads and extensions and show greater irregularity than the corresponding continuous filament yarns. C.

Pile Fabrics: Knitting. C. Aberle. *Textilber.*, 1934, 15, 110-112.

A general account is given of the production of velvet, plush, imitation fur and similar types of fabric on knitting machines. C.

Rayon Open-work Fabric: Knitting. A. Elster. *Kunstseide*, 1934, 16, 64-72.

Open-work knitted goods are classified according to the type of machine on which they are produced and the use of rayon for this type of work is discussed. The method of producing open-work effects on circular knitting machines is contrasted with the method of production on flat knitting machines and different forms of open-work apparatus for circular machines are described in detail. Patterning possibilities are discussed. C.

The Production of Rubber Warp Fabrics on the Raschel Machine. F. Will. *Deut.*

Wirkerzeitung, 1933, No. 47, p. 9 (through *Textilber.*, 1934, 15, 82).

The production on the Raschel loom of fabrics containing rubber thread is discussed and methods of introducing the thread suggested. W.

Knitting of Interlock Fabrics—V. J. B. Lancashire. *Text. Rec.*, 1934, 51, No. 610, pp. 57 and 59.

Drawing-off mechanisms are described, and the production of tuck and striped fabrics on the ordinary interlock machine (see also *J. Text. Inst.*, 1934, A75). W.

(G)—FABRICS

Coloured Woven Fabrics: Designing. R. H. Wright. *Text. Mfr.*, 1934, 60, 48.

The effects of warp pattern, weave, particulars, finish and materials on colour are discussed and specimens illustrating these effects are given. C.

Frost-effect Patterned Fabrics. A. Beyer. *Textilber.*, 1934, 15, 59.

Weaving details are given for a fancy check fabric ("Phantasilkaro") containing a yarn composed of wool with 20% hair and a striped fabric ("Stichelhaar-Rayé") containing a yarn composed of cotton or rayon spun with long rayon fibres and a yarn composed of wool and rayon. The short bristly fibres in the mixtures give a silvery frosted effect. C.

Cloth Patterns: Classification. —. Paur. *Textilber.*, 1934, 15, 105-107.

A scheme for the systematic classification of methods of producing patterned fabrics is explained. C.

Complex Twills: Structure. W. Bertram. *Textilber.*, 1934, 15, 102-104.

The author explains the calculation of the repeats of complex twills produced by the combination of crossing twill lines in different ways, and gives drafts showing the nature of the interlacings. C.

Crêpe Fabrics: Changes in Width. H. Haarmann. *Kunstseide*, 1934, 16, 58-62.

The production of crêpe fabrics is discussed and the commercial values and properties of five different types are described. Diagrams are given showing the width on leaving the loom, the width of the wet creped fabric and the width to which it is subsequently stretched, for an example of each type. In the examination of a given sample for purposes of reproduction the wet creped width and the width on leaving the loom can be determined approximately by determining the width to which the sample shrinks on washing in cold water and the width to which the wet sample can be stretched without disturbing the thread structure. C.

Doubled Cotton and Linen Weft Fabrics: Production. N. Vohs. *Textilber.*, 1934, 15, 104-105.

A fabric resembling linen in appearance and showing a resistance to wear and washing comparable with that of cotton fabrics is produced from a cotton warp

and a weft yarn obtained by doubling a cotton and a linen thread. The two components of the doubled yarn are not twisted together; in the fabric they probably lie side by side in places and twist round each other in other places in an irregular manner, thus giving a characteristic mixture effect. Fabrics produced in this way are only slightly dearer than all cotton fabrics of similar weight and structure and are cheaper than the usual type of half-linen fabric. C.

Use of Elastic Yarn. Dunlop-Revere Thread Co. Ltd. *Wool Rec.*, 1934, 45, 551.

A general article dealing with the possibilities of fabrics incorporating various percentages of "Lastex" yarn. W.

Uses of Elastic Yarn in Textile Manufacture: Experiments with "Lastex". W. Wilkinson. *Text. Merc. and Argus*, 1934, 90, 270.

Brief abstract of address before the Blackburn Textile Society, dealing with "Lastex" yarn, and fabrics made from it at Blackburn Technical College. W.

Rubber Latex: The New Textile Assistant. *Dyer*, 1934, 71, 183-185 and 343.

The preparation of latex is described for the processing of rubber textiles. The cloth to be treated must be free from mineral acid, from deposits of lime and magnesia salts resulting from hard water, from copper, and from the metallic salts of iron and manganese. A close weave usually gives the best results. The use of latex tends to prevent warp slippage. Its applications are discussed in the production of artificial velvet and artificial leather, in the doubling of fabrics, in the felt industry, in the single-proofing of jute for dust- and water-proof sacks, and in the carpet trade. In one type of carpet, the pile is formed from a card web of suitable material. The bases of the loops formed when the material passes over a fluted roller are treated with a latex mix whilst in the crimped form. They are then made to come into contact with a simple fabric base also treated with latex. Thus the pile is made to adhere to the fabric, and after vulcanisation by moderate heat, brushing and cropping, a lofty and serviceable carpet results. In a carpet of the Axminster type, the tufts are loosely held together by the back of the carpet, and kept in place by a size of starch, glue, or, preferably, latex compound. The compound is applied to the carpet by means of a roller dipping in a bath of the mix and transferring it to the back of the carpet, the excess being removed by a doctor knife. The fabric is then passed through a heated chamber at such a speed that the compound is dried off and vulcanised. W.

Weaving Properties of Yarns in Relation to their other Properties. I—Natural Silk (Grège). See Section 2D.

PATENTS

Warping Creel Bobbin Brake. W. Wasserloos. F.P.754,821 (through *Revue Text.*, 1934, 32, 137-139).

The new brake device is applied to warping creels on which there is provided for each bobbin a brake pulley around which passes a band or cord subjected to tension by means of a weight or spring. According to the invention the fixed ends of the cords are attached to toothed wheels which gear with a rack. By moving the latter the toothed wheels can be turned so that the arcs of contact of the cords with their respective pulleys are increased or decreased as desired. C.

Warping and Winding Frame Electric Stop Motion. J. Laurent. F.P.757,370 (through *Revue Text.*, 1934, 32, 139-141).

An electric stop motion for warping and winding frames is provided with detectors made from thin metal rods bent into loop form. These detectors are normally supported by the threads but when a thread breaks, the corresponding loop falls and closes an electric circuit, thus causing the lighting of a signal lamp and the stoppage of the machine or an appropriate section of the machine. Diagrams showing details of construction are given. C.

Combined Ground and Warp Yarn Knitted Fabric. E. Wildt, H. H. Holmes, and Wildt & Co. Ltd. (Leicester). E.P. 402,772 of 4/6/1932.

A knitted fabric is composed of a combination of ground and warp yarns and has in some or all of the stitches in certain courses warp yarns floated whale-wise and/or ground yarns floated course-wise as by tucking. The warp and/or ground yarns in these positions will be neither knitted nor interlocked with ground yarn loops. C.

Circular Rib Machine Needle Actuating Mechanism. Spiers Ltd. (Leicester), E. Spiers, and J. C. Hurd. E.P.402,914 of 6/10/1932.

The dial stitch cam of a circular rib machine is arranged with its knocking-over point in the same radial plane as that of the cylinder stitch cam and is movable radially from operative position so that the dial needles may be knocked over later than the cylinder needles by an auxiliary stitch cam. This cam is adjustable radially for varying the length of stitch, but may be otherwise fixed; alternatively, the auxiliary switch cam may be movable radially into and out of operative position. The dial stitch cam is operative for 2×2 rib work or for forming jacquard or other patterned fabric, and is inoperative during the formation of 1×1 rib fabric. C.

Knitting Machine Dial Needle Actuating Mechanism. W. W. Triggs, London (Nolde & Hurst Co., Reading, Pennsylvania, U.S.A.). E.P.402,943 of 23/12/1932.

In a machine of the cylinder and dial type for knitting plain or ribbed fabric, a cam is provided for holding the latches of the dial needles in closed position to distend the loops therein while the previously inactive cylinder needles are raised to take the loops. The cam is controlled by levers actuated by a pattern drum. Each loop formed by the dial needles is held by two adjacent dial needles, the dial needles being projected in pairs to replace single cylinder needles. The dial is concentric with the cylinder and arrangements are made for adjusting it angularly with respect to the cylinder. A brush is mounted upon the latch ring for opening dial needles projected into operative position. C.

Loom Picker Buffer. N. C. Shah (Bombay, India). E.P.403,254 of 10/3/1933.

A picker buffer comprises layers of leather, hide, etc. moulded to shape, the outer layer being formed with a hooked end for securing the other end which has an enlarged part, whereby the usual lacing or metal cramps are dispensed with. The usual holes are provided for the spindle. C.

Ribbed Fabric: Construction. P. Dehler (Chemnitz, Germany). E.P.403,372 of 13/6/1932.

A ribbed jacquard fabric for carpets, etc. comprises a binding warp, a more tightly tensioned warp situated below the binding warp, various weft threads, pattern-forming warps which pass over certain weft threads to form the ribs and pattern, and light warp threads at the back of the fabric serving to support the ribs. C.

Rotary Shuttle Box. R. H. Smith (Keighley). E.P.403,453 of 2/7/1932.

The cells of a rotary shuttle box are made by stamping and bending pieces of sheet metal so as to form in each compartment a guiding groove for the picker, a recess to accommodate the swell and overhanging edges for holding the shuttle in the box. The cells are mounted on end hubs fixed to a shaft and are secured by means of screws. C.

Jacquard Cards: Manufacture. D. Carmichael (Philadelphia, U.S.A.). E.P.403,918 of 12/9/1933.

In making jacquard cards, one repeat of the pattern with a slight overlap is produced on a perforated zinc sheet by filling certain of the holes with whiting and dextrin. The painted plate is then used as a pattern for punching as many perforated paper sheets as there are repeats in the width of the fabric to be woven. The paper sheets are placed side by side to make a wide sheet containing the complete pattern and the jacquard cards are made by a machine reading into the wide paper sheet. After use, the zinc sheet is cleaned for re-use. C.

Jacquard Mechanism. Boucher & Co. Ltd. (Kidderminster), B. French, and B. Poyner. E.P.403,968 of 27/6/1932.

The needles of a jacquard mechanism, for use particularly in gripper looms, are returned to normal position after each engagement with the pattern cylinder by a spring or mechanically actuated plate which is slidably mounted on the frame of the machine and is perforated or provided with slots closed at the ends to accommodate the reduced portions of the needles. C.

Superposed Needle Cylinder Knitting Machine. T. Grieve & Co. Ltd. (Leicester) and T. S. Grieve. E.P.404,064 of 10/8/1932.

The holding-down sinkers or web holders of a superposed rotary needle cylinder machine are mounted on the outside of the needle cylinders. Each sinker is

furnished with an operating butt, a rib and throat for holding down the knitted loops, and a horizontal draw edge over which an associated needle draws yarn in loop formation and which assists in casting the old loop off the needle. A sinker cam ring is mounted coaxially with the sinker bed. The invention is applied mainly to machines having double-ended latch needles and transferring jacks or sliders, and in which the cylinders have rotary motion for the production of seamless hosiery. The sliders in the bottom cylinder may be raised subsequently to their passage through the plain cam system so that their upper ends act as latch guards to the needles associated with the upper sliders. C.

Superposed Needle Cylinder Knitting Machine. W. Spiers Ltd. (Leicester), W. Spiers, and E. Spiers. E.P.404,076 of 26/8/1932.

A superposed needle cylinder machine having double-ended needles is provided with means for feeding yarns to the needles at separated feeding points at the same feed, and patterning means operative upon the sliders of one cylinder, so that some of the needles of that bed take and knit one only of the yarns and others of the needles take and knit only other or another of the yarns. By causing the needles of the other bed to take and knit the yarns together a fabric having no visible float threads is produced. The sliders are preferably selected by pivoted cams arranged at levels corresponding to pattern butts on the sliders, and brought into action by pins upon a pattern drum. The patterning means may be rendered inoperative, e.g. during the knitting of the leg and foot portions of socks. C.

Cyclic Oxo-ketone Rayon Dressing Agents. H. Dreyfus (London). E.P.404,331 of 2/6/1932.

Dopes, varnishes, plastic materials, artificial filaments, films, etc. are made from cellulose esters or ethers using cyclic oxo-ketones, other than oxanones, as solvents or plasticisers for the cellulose derivatives. The cyclic oxo-ketones may also be employed in the treatment of already formed filaments, yarns, fabrics, films, etc. They may, for example, be employed to diminish the tendency of fabrics to slip, split or ladder, to improve the pliability or extension by shrinking processes and to improve the tenacity of filaments or other products by stretching processes during or subsequent to softening. The solvents may also be used in the preparation of sizes and for relustring. A further application is in the treatment of cellulose derivative yarns prior to the application of substances adapted to dye, print, discharge, load, mordant or delustre the materials in order to facilitate the absorption of these agents by the materials. C.

Swivel Looms. H. G. Smith and G. W. Shackleton (Keighley). E.P.404,431 of 3/11/1932.

In swivel looms each shuttle is provided with two racks adapted to engage pairs of toothed pinions. Each pair of pinions is mounted on a common hub and one of the pinions is driven by a reciprocating rack. The studs on which the hubs rotate are riveted at one end to a bracket and are carried at their other ends in a vertically-adjustable bracket. The shuttles are provided with a projection and a slot whereby they are guided on the brackets. C.

Yarn Beaming Apparatus. T. J. Durkin (Middleton). E.P.404,435 of 16/11/1932.

In reeds for beaming and similar machines in which the dents are spaced by springs placed between them and are expanded and contracted by a screw in the lower part of the reed, two independent adjusting screws are inserted, one in each end section without extending into the central section. C.

Loom Temples. Tefag Textil Finanz A.-G. (Zurich, Switzerland). E.P. 404,526 of 15/4/1933.

A gripper or clamp device having jaws above and below the warp is reciprocated inwards and outwards and grips the fabric near the fell on its outward stroke, so as to stretch it. The jaws may be mounted on a rod acted upon by a spring and reciprocated by a cam, the jaws being opened when moving inwards and closed when moving outwards. The gripper may be formed by two U-shaped members which serve as guides for each other and are reciprocated by a lever, each member comprising two bifurcated arms acting alternately to stretch the fabric near the fell. The gripper jaws may have teeth inclined outwardly and also in the direction of the take up, or the jaws may be ribbed or be provided with pawl-like gripping members. The jaws may be positively moved away from one another, or they may be merely resiliently held together, the teeth gripping only on the outward movement. The jaws may be pivoted and be normally closed by springs. Near the end of the outward and fabric-stretching movement of the jaws, the lay

beats up and the reed engages the jaws, rocking them about the pivot so that they are opened by a wedge. The opened jaws now move inwards, the lay returns and the springs close the jaws. In another construction, one jaw is plain and the other is recessed to receive fabric-gripping rollers acting only when the jaws move outwardly. C.

Pirnless Shuttle. R. Dewas (Amiens, France). E.P.404,545 of 16/6/1933.

The dummy shuttle described in E.P.403,292 is modified to permit of weft being inserted alternately from each side of the loom, a weft-engaging clamp comprising two straight flexible prongs which may be pressed together by auxiliary springs being mounted in the central groove. Weft is presented to the shuttle and released therefrom by a thread guide and a blade carried by a cam-operated member, one of which is provided at each side of the loom. Alternatively the shuttle may be provided with two spring clamps disposed in independent grooves, the weft presenting eyelets and weft-releasing blades being fixedly mounted on each side of the loom. Fabrics with or without selvages are formed by providing a cutting blade on the shuttle or on the loom frame. The shuttle may be propelled across the loom by means of electro-magnets. C.

Circular Loom. British Celanese Ltd. (London), F. C. Hale, and W. Howarth. E.P.406,028 of 18/8/1932.

A circular loom is provided with a number of shuttles, a shaft for each shuttle, vane wheels on the shafts adapted to penetrate the warps and hold the shuttles in position in the warp sheds, and a plurality of means for driving the shafts, each adapted to drive a plurality of shafts. A series of inter-connected shuttle-holding means may be employed which are driven at, say, four points round the circle. In this manner, without increasing the complexity of the shuttle-holding means or adding to the weight of the gearing involved, the invention enables a circular loom to employ as many as 20 or 24 shuttles and still to run at the same speed or at even higher speeds than looms with fewer shuttles. In addition, the adaptability of the loom for patterning purposes is enormously increased. The shedding means is adapted to act successively upon the warp threads before they reach the tail of a shuttle so as to cause them to spring into position immediately on passing the shuttle to form a new shed for the reception of the succeeding shuttle. C.

Terry Fabric Loom. Co-operative Wholesale Society Ltd. (Manchester), A. Thornley, and F. Williamson. E.P. 406,077 of 30/9/1932.

Two lever arms are provided, one at or near each end of the reed case, and each pivoted at one end of the loom sley, the lever arms each having a curved, slotted part engaging a bowl carried by the stud of a bracket fixed to a supplementary sley sword which carries the lower rear part of the reed case. The arrangement is such that with the lever arms in their normal position, they and the brackets hold the reed locked, but on the lever arms being tilted, they and the brackets unlock the reed. The tilting of the lever arms is controlled by long rods with hook-like shoulders engaging the lever arms under the control of the dobby mechanism. C.

Loom Electric Control Apparatus. Tefag Textil Finanz A.-G. (Zurich, Switzerland). E.P.406,160 of 11/5/1933.

The apparatus comprises two or more control circuits for operating indicating means and/or stopping the loom, each circuit being controlled by two switches in series with each other, one a timing switch and the other an operating switch, and means whereby the operating switches are respectively controlled in accordance with a plurality of different factors such, for example, as the condition of a thread or the operation of a part of the loom, the timing switches in all the circuits being closed at determined intervals by contact-making members spaced apart upon a common carrier member such, for example, as a rotating cylinder or disc. C.

Looms: Warp Stop Motion. K. H. A. Niemi (Hyvinkää, Finland). E.P.406,230 of 30/9/1933.

The warp stop motion is of the type in which each lamina is provided with two holes, one or more warp threads being threaded through or looped into each hole in a manner such that no thread coacts with both holes. The laminae co-operate with a laminae-contacting and feeler device and the tension exerted by the laminae on the warp threads is varied from time to time by means of a periodic

relative movement between the warp threads and the feeler, the arrangement being such that when a warp thread breaks, the relative motion produces tilting of the corresponding lamina and, therewith, stopping of the loom. The required relative movement may be obtained either by moving the feeler periodically toward and away from the plane of the warp or by corresponding warp threads being moved toward and away from the feeler periodically, for instance, when changing shed. Since the loom-stopping action of the laminae is independent of their weight, very light laminae may be employed. Preferably the feeler device supports the laminae in such a way that, when the laminae stretch the warp threads, differences in tension between the warp threads in the different holes of the same lamina may vary within fixed limits, without causing the lamina to move in relation to its supporting point or points whilst, if this difference in tension exceeds a definite limit, the lamina alters its position and thus causes the loom to stop. C.

Circular Loom Shedding Mechanism. British Celanese Ltd. (London) and W. Howarth. E.P.406,310 of 18/8/1932.

Shedding mechanism for a circular loom comprises a plurality of banks of fine shedding needles, each bank comprising closely spaced slots adapted to permit sliding movement of the needles and to support the needles over a substantial portion of their length, and means to engage selected needles and to draw them under tension to perform a shedding movement in one direction. The needles thus receive their operative movement by tension only, and so can be made very fine and capable of close spacing. At the same time, the support accorded to the needles by the slots enables the needles to stand up to the action of the engaging means and provides for an easy motion of the needles. Preferably, the engagement of the needles by the operating means takes place within the supported length of the needles, as by the provision of butts on the needles for engagement by cams in connection with each bank operating within the length of the needle slots. A similar butt may serve to limit the movement of the needles in the reverse direction on their release from the cams, stops being provided in the slots to engage these further butts. The reverse movement of the needles may be effected by the tension imparted to the warp threads in the shedding movement of the needles, or springs may be provided for this purpose. The banks of needles are preferably arranged outside the warp circle for accessibility. C.

Reed and Lay Controlling Mechanism. Duplan Silk Corporation (New York). E.P.406,467 of 6/2/1933.

After an alteration in the position of the normal fell of the cloth due to lost picks, pick-outs and/or stretching or shrinking of the warp, the beating-up device is adjusted by means adjustable through a predetermined number of picks or fractions of a pick, while the loom is at a standstill, in such a way that the foremost or beating-up position thereof is shifted to the altered position of the fell. For this purpose use is made of a manually operable micrometer arrangement, by means of which a relatively large movement along a scale will cause a relatively definite and fine adjustment of the beating-up position of the lay. The variation in the lay position is preferably effected by an eccentric arrangement at the point of attachment of the lay connector to the lay sword. The preferred embodiment consists in the use of an eccentric pin which joins the crank connector to the lay sword so that the latter, which forms a part of the lay and supports the reed, will respond to any alteration of the pin and thereby effect a corresponding change in the position of the reed. C.

Warp Tension Control Device. Y. Nogamy (Nakaku, Nagoya, Japan). E.P. 406,520 of 18/5/1933.

A warp tension or let-off control for a loom is described in which a link lever, connected at one end to a constantly moving part of the loom so as to reciprocate or oscillate through a given amplitude of movement, is displaceable under the influence of the warp tension, relatively to a fixed pivot serving as a fulcrum for the link lever, so as to alter the leverage thereof, and has a pin at its other end engaging in a slot in a second lever pivoted on a fixed pivot and constituting a driving member for effecting the let-off of the warp, the velocity ratio between the end of the link lever driven by the loom and the second lever being increased on increase of warp tension. C.

Shuttle Braking Apparatus. Tefag Textil Finanz A.-G. (Zurich, Switzerland).
E.P.406,527 of 24/5/1933.

Apparatus for braking shuttles comprises a series of contact points arranged within the shuttle box, these braking contact points being successively displaced (as by compression or flexing) by the shuttle as it enters the box. The braking force thus applied to the shuttle increases smoothly and progressively from the moment when the shuttle enters the box until the shuttle is wholly within the box. C.

Air-drying Sizing Machine. Howard & Bullough Ltd. (Accrington) and J. Irving.
E.P.407,165 of 5/1/1933.

In order to prevent overheating of yarns on air-drying sizing machines, arrangements are provided for preventing the withdrawal of humid air when the machine is brought to a standstill. An exhaust fan provided on both sides with air ducts which are capable of being closed by pivoted valve plates is employed and the valve plates are connected to the usual stop-and-starting mechanism, such as the ordinary stop rod of the machine. C.

Picker Driving Mechanism. F. Phily (Lyons, France). E.P.407,238 of 14/7/1933.

An electric motor of known type which makes only partial revolutions is employed for the driving of each picker. The motor is cut in automatically at the beginning of the pick in dependence on the rotation of the crankshaft and is cut out again after the pick has taken place. The invention can be carried out in its simplest form by the picker being directly fastened on the shaft of the motor. In this case, the motor traverses during the pick only a rotary path of a fraction of a revolution and may be replaced by a rotary magnet. The picking strength in the drive can be varied by varying the torque of the motor by known means, for instance, in induction motors, by cutting in resistances in advance of the stator winding or in the armature circuit of the motor. For cutting the picking motors in and out electrically remote-control switches can be used, the controlling circuits of which are operated independently on the rotation of the crankshaft or on the movement of a device effecting the shedding or the beating up. C.

Yarn Warping and Beaming Apparatus. A. E. Spowage (Nottingham). E.P.407,342 of 14/9/1932.

A device for determining and recording the amount of thread wound on to a beam or the like on yarn warping or beaming apparatus comprises a fixed scale or similar graduated member or plurality thereof, one or more fingers moving over the scale or scales, the finger or fingers being driven from a thread tensioning roller over which the threads pass and means whereby when the finger or fingers reach a predetermined position on the scale or scales during the winding operation electrical contacts are closed so as automatically to complete an electrical circuit and stop the apparatus. Pivoted dropper elements are suspended upon individual threads adjacent to the thread tensioning roller and when released or dropped by breakage or undue slackening of the supporting threads these elements fall into contact with a contact rod and are maintained in continual contact with the rod, so as to complete an electrical circuit to bring the apparatus to a standstill. C.

Beaming Apparatus Stop Motion. A. E. Spowage (Nottingham). E.P.407,343 of 14/9/1932.

In yarn beaming apparatus threads simultaneously withdrawn from bobbins or equivalent supplies are passed under tension to a beam or other member for receiving the threads through a sley which reciprocates transversely of the threads, and wherein dropper elements co-operating one with each of the threads are accommodated by and moved with a part which reciprocates in unison with the sley, each dropper element functioning in the event of breakage or undue slackness in the thread co-operating therewith automatically to complete an electrical circuit and operate mechanism to bring the apparatus to rest. Means are also provided for ensuring that each dropper element when brought into the operative position is positively maintained in such position and prevented from being accidentally displaced therefrom by vibration or otherwise. C.

Stop Motion Drop Wire. Comptoir d'Appareils Textiles S.à.r.l. (Mulhouse, France).
E.P.407,514 of 16/2/1933.

A drop wire or blade for looms or winding frames is distorted around the eye zone in two opposite directions in such a manner that the distorted portions lie substantially in parallel planes substantially parallel to and equidistantly spaced from the general plane of the drop wire. With this arrangement deleterious friction on the yarn is reduced to a minimum. C.

4—CHEMICAL AND FINISHING PROCESSES

(A)—PREPARATORY PROCESSES

Wetting Agents and Assistants: Nature, Properties and Uses. R. Brauckmeyer. *Spinn. u. Web.*, 1934, 52, No. 9, pp. 10-16; No. 10, pp. 7-11.

A general discussion of the chemical nature and properties of various wetting agents and assistants, and of their use in the finishing of woollen fabrics. C.

(B)—BOILING, SCOURING, DEGUMMING, AND WASHING

Hosiery Degumming. Textile Research Dept. of Proctor & Gamble. *Amer. Silk J.*, 1934, 53, No. 2, pp. 37 and 38.

Recipes for the double and single bath processes of degumming are given. S.

Hosiery Degumming. Textile Research Dept. of Proctor & Gamble. *Amer. Silk J.*, 1934, 53, No. 1, pp. 37 and 38.

The use of degumming oils containing lightly sulphonated oils and alkaline substances such as potassium carbonate and cresylates is condemned. Their resistance to hard water is little or no greater than that of soap, the alkali damages the silk, and the low proportion of emulsifying agent makes removal of soaking oil and colouring matter difficult. Sodium oleate is the most satisfactory degumming agent. The crisp, wiry state said to be obtained with degumming oils can be more satisfactorily obtained by using an amount of soap insufficient to remove all the gum. S:

Hank Scouring Machines. *Wool Rec.*, 1934, 48, 681-683.

A description of Petrie and McNaught's and Prince-Smith and Stells' scouring machines for wool in hank. Particulars of processing and capacity are given. W.

(E)—DRYING AND CONDITIONING

Bobbin Drying Apparatus. Société A. Smith. *RUSSA*, 1934, 9, 109-111.

Apparatus for the drying of hard bobbins is described in which the drying process proceeds in three distinct stages. In the first stage warm air is circulated in the drying chamber in a closed circuit in order to bring all the layers of thread on the bobbin to a suitable temperature and uniform humidity. In the second stage a certain quantity of additional air is introduced into the circuit and a correspondingly small quantity of air is removed. The latter carries with it some of the water vapour which is beginning to be liberated. In the third stage warm air circulates in an open circuit and evaporation is rapid. This method of drying does not diminish the strength and flexibility of the thread. The dried material retains about 5% moisture. C.

(G)—BLEACHING

Bleachery Sprinklers: Construction. E Kreiling. *Textilber.*, 1934, 15, 95-96.

A mathematical study is made of the path of water droplets from the sprinkler of a bleaching or similar apparatus and the application of the calculations to the determination of the most suitable shape for such a sprinkler is indicated. C.

Beamed Yarn: Bleaching. R. Golbs. *Spinn. u. Web.*, 1934, 52, No. 13, pp. 6-8.

Methods and apparatus for the bleaching of cotton yarns on warp beams are briefly described and the advantages of bleaching in this form, including savings in time, labour and costs are pointed out. C.

The Bleaching and Dyeing of Jute. *Text. Mfr.*, 1934, 60, 122.

The best method of bleaching and dyeing jute is fully discussed and lists are given of the most suitable types of dyestuffs to select for different purposes. L.

(H)—MERCERISING

Cloth Mercerising Machine. C. G. Haubold A.-G. *Leipz. Monats. Text. Ind.*, 1934, 49, *Fachheft* 1, 12-13.

A new mercerising machine without padding apparatus and chains for the treatment of piece goods consists essentially of an impregnation device, a system of squeezing rollers and a washing or neutralising device. The impregnating apparatus comprises a bath holding the mercerising alkali and containing two series of rollers. The rollers in the lower series are totally immersed in the alkali and these rollers alternate with other rollers placed at a higher level so that they are only partially immersed in the alkali. The cloth passes round upper and lower rollers alternately. The lower rollers are driven and the upper rollers are pressed

against them by the cloth which has a tendency to shrink and are thus driven indirectly. The squeezing roller system consists of two fixed rollers against which is pressed an upper roller attached to a lever. The washing or neutralising apparatus is provided with rollers arranged in a similar way to those in the impregnation apparatus and also with spraying devices and arrangements for counter-current washing. The arrangements are such that shrinkage of the cloth is avoided. Measuring devices, weft thread straightening apparatus, and rollers for pressing air out of the cloth immediately prior to impregnation may be used in combination with the mercerising machine described. It is claimed that this machine gives a mercerised product of even high lustre and pleasant, full handle with low costs and alkali consumption. C.

Mercerised Cellulose: Solubility in Cuprammonium. Y. Shinoda. *J. Soc. Chem. Ind. Japan*, 1934, 37, 55B-58B.

Samples of cotton cellulose were mercerised with 18% caustic soda for different times and at different temperatures, and were also aged at various times and temperatures, and the solubility of the variously treated samples in cuprammonium solutions was then determined. Tables show that mercerisation decreases solubility, and that ageing not only increases solubility but makes the product more uniform. C.

(I)—DYEING

Azo Dyes: Application to Wool. A. E. Everest and J. A. Wallwork. *J. Soc. Dyers and Col.*, 1934, 50, 37-41.

Examples are described which show that the freedom with which diazo compounds couple with the wool fibre depends on the structure of the base used, and also on the condition of the wool and of the diazonium salt solution. Different shades are produced by the addition of various salts to the diazo solution, and these are all intensified when the wool has been previously treated with a solution of 3 g. soap and 10 g. sodium carbonate per litre. The shade may also be controlled by adding acids to the diazonium salt solutions. Of the various bases used in dyeing, aniline and the simple methyl-substituted amines show small colour-producing values, compounds containing a methoxyl group produce stronger tints, and the presence of a negative group (nitro, chlorine, etc.) considerably increases the colour strength. A negative group entering a methyl-substituted amine usually produces the same colour intensification, but a nitro group in the *m*-position is less effective than when in the *o*- or *p*-position. The various shades produced by the coupling of naphthols with various bases are discussed. When dyeing wool-cotton unions, a somewhat stronger diazonium salt solution should be used, and it should be buffered with sodium acetate and not sodium carbonate. A wide range of shades can be obtained by varying either the base or the naphthol, and it is found that the methoxyl group strengthens and deepens the shade more than the methyl group, and that compounds containing substituents in the *p*-position yield deeper shades than the *o*-substituted compounds. Alteration of the position of the nitro groups in the molecule also results in colour changes. C.

Cellulose Acetate Rayon: Dyeing with Chrysoidine G. A. H. Burr and S. M. Burr. *J. Soc. Dyers and Col.*, 1934, 50, 42-47.

The authors first describe the properties of Chrysoidine G and two methods for determining its hydrolytic constant. Filaments and films of cellulose acetate rayon were dyed in Chrysoidine G, and tables are given showing the progress of dyeing with time. There is no simple distribution law governing the amount of dye taken up by the material, although stable equilibrium and reproducible results are obtained. In the absorption of Chrysoidine G by cellulose acetate rayon, both base and acid are taken up by the rayon, but the ratio of base to acid in the rayon is greater than in the original solution, and the final dye solution always contains an excess of acid. An electrometric method is described for titrating the chloride in Chrysoidine G. The same results are obtained in the dyeing of films as in filaments, indicating that in this case dyeing is not a surface phenomenon, but a case of selective solution of the different constituents of the dye-bath. The whole behaviour of Chrysoidine G towards cellulose acetate rayon appears to be quite comparable with its behaviour towards benzene, i.e. a case of the distribution of a solute between two immiscible solvents, although adsorption may also occur as an intermediate stage in the mechanism of dyeing. C.

Cellulose Esters : Dyeing Properties. A. Rheiner. *Textilber.*, 1934, 15, 72-74.

Cellulose fibres lose their affinity for direct dyes on acetylation. The fibrous mono-acetate has some affinity for these dyes in the wet and swollen state but loses this affinity on drying. Since dyeing with direct dyes is an adsorption process depending on penetration of the dye particles into the intermicellar spaces it is suggested that acetylation causes a closing up of these spaces. Cellulose acetates, even those of low degree of acetylation, are readily dyed by the special cellulose acetate dyes; the dyeing process in this case is a solution process. Swollen acetylated cellulose fibres of low degree of acetylation may be dyed with either direct dyes or cellulose acetate dyes. Fibres of low degree of acetylation have a lower affinity for basic dyes than the original fibres and a lower affinity for certain acid dyes than cellulose acetate rayon. Immunised cellulose and similar products obtained by esterification of fibrous alkali celluloses with aromatic acid chlorides are only esterified in the surface layers, but the closing of the intermicellar spaces in the ester layers is sufficient to prevent dyeing by direct dyes. Phosphoric acid esters are not dyed by either direct dyes or cellulose acetate dyes. Cellulose fibres may also be reserved against direct dyes by precipitating in them protective substances, such as tannin-tin mordant, which fill up the intermicellar spaces. C.

Cellulose Gel: Affinity for Direct Dyes. K. Atsuki and H. Sobue. *J. Cellulose Inst. Japan*, 1934, 10, (7)-(12).

Dyeing experiments were conducted on stretched and unstretched cellulose fibres and the amount of dye taken up in each case was noted. Various fabrics such as viscose, acetate, and cuprammonium rayon, cotton, calico, and mercerised calico were dyed with Orange, Fast Red, Toluylene Red, Congo Red, and Bismarck Brown. The mechanism of dyeing is considered to be, first absorption of the dye by the cellulose, and then formation of a substitution or addition compound between the dye and the cellulose-water co-ordination compound. The increased affinity for dyes of rayons is attributed to the fact that they possess more free hydroxyl groups. Graphs and photomicrographs are given. C.

Direct Dyes : Substantivity Determinations. P. Ruggli. *Textilber.*, 1934, 15, 68-70.

A numerical value for the substantivity of a dye is given by the difference between the amount of the dye taken up from an aqueous solution by a sample of cotton and the amount of the dye removed from the dyed sample on immersion in distilled water after washing. A 5 g. sample of cotton yarn and 100 c.c. dye solution containing 0.15 g. of dye are used. The amount of dye taken up is determined by titration of the solution with titanium trichloride solution and is expressed as a percentage of the original dye content of the solution. The dyed sample is washed and then immersed in 100 c.c. hot distilled water and left in the cooling liquid for 24 hours. The amount of dye removed by the water is determined colorimetrically and is also expressed as a percentage of the dye content of the original dye solution. For pure dyes two values for the substantivity may be obtained by determining the amount of dye taken up in the presence and in the absence of Glauber salt. For commercial dye preparations the determination can only be made in the presence of Glauber salt. C.

Indanthrene Dyes : Preparation and Constitution. M. A. Kunz. *Bull. Soc. Ind. Mulhouse*, 1934, 100, 3-50.

The author reviews the present state of knowledge of the preparation and constitution of dyes of the Indanthrene type and discusses briefly the injurious action of certain of these dyes on textile fibres when exposed to light. C.

Delustred Rayon : Dyeing Properties. L. Keiner. *Textilber.*, 1934, 15, 118-120.

The author discusses briefly the influence of delustring agents such as titanium dioxide on the properties of rayons, the fading of certain substantive dyes on rayon when exposed to light in the wet state, the difficulty of obtaining dark shades, especially black, on delustred rayons and the strength and fastness of the dyed goods. C.

Immunised Cotton : Dyeing. E. R. Hopkins. *Amer. Dyes. Rep.*, 1934, 23, 147-150.

A general discussion of the production, properties and dyeing of immunised cotton. C.

Dyeing Wool Flocks for Decorating Walls. G. Rice. *Text. Col.*, 1934, 56, 103 and 137.

The preparation and dyeing are described of wool flocks for decorating walls, also the methods of applying them to the walls. W.

Theory and Practice of Cobbling. *Wool Rec.*, 1934, 45, 562-563, and 569.

Various methods of cobbling are discussed, with particular reference to the use of an auxiliary agent, Peregol, for the cobbling of mordant dyed piece goods. W.

Protectol: Uses. *Text. Col.*, 1934, 56, 124 and 128.

The use of Protectol is described in the following applications—in the stripping of woollen rags and shoddy, pure silk, and rayon goods with soda ash and Burmol or hydrosulphite conc. powder; when working with Decroline in an acid liquor; in the stripping of woollen rags with bichrome and sulphuric acid; in the dyeing of fast shades on wool with chrome or metachrome dyestuffs; in union and in silk dyeing. W.

Converting of Mohair Pile Upholstery Fabrics. B. S. Hillman. *Text. Col.*, 1934, 56, 39-41 and 93-94.

The following methods are described in the processing of mohair pile upholstery fabrics for vehicles and household furniture: dyeing ground warp and filling; dyeing skeins on the Obermaier machine; warp dyeing with Naphthol Red; operations preceding scouring; scouring; dyeing the fabric in an acid bath; dyeing solid black without staining the light-coloured back; dyeing mohair-worsted-rayon mixtures; experimental methods (dyeing in the cold; padding using sulphur colours; padding with a paste containing acid alizarine colours); disguising bare spots due to lost tufts; finishing. W.

The Bleaching and Dyeing of Jute. See Section 4G.

(J)—PRINTING

Albumen Colour Prints: Fixation by Formaldehyde. E. Justin-Müller. *TIBA*, 1934, 9, 105-107.

Certain albumen dyes can be made fast to boiling soap solution by treatment, after steaming, in a bath of formaldehyde, followed immediately by drying on drums. This effect is not generally applicable, but is useful to improve the fixation of dyes already fairly well fixed by steaming alone. C.

Cellulose Acetate Rayon: Reserving and Dyeing. P. Barsy. *RUSSA*, 1934, 9, 105-107.

Directions are given for the printing of resin reserves on cellulose acetate rayon fabrics and subsequent dyeing in the cold with oxidation blacks and diazotised and developed blacks. Formulæ are given. Delustring agents such as amyl alcohol may be incorporated in the reserves. Dyeing of shades other than black in the cold and the application of the process to fabrics composed of mixtures of cellulose acetate rayon and other textiles are briefly discussed. C.

Igepon T: Application in Aniline Black Printing. K. Georg. *Textilber.*, 1934, 15, 128.

Dark shades can be obtained with Aniline Black on fabrics composed of fine, hard-twisted yarns by padding with an aniline liquor containing Igepon T. This wetting agent does not cause precipitate formation or changes in shade. A slightly deeper black is obtained if the material is given a preliminary scour. C.

Mixture Fabrics; Production of Multi-colour Effects on—. G. Rudolph. *Kunstseide*, 1934, 16, 51-57.

The author describes in detail the production of white-coloured, two- and multi-colour effects on fabrics of wool, cotton, silk, rayon, and mixtures of these by resist and direct piece dyeing processes. C.

Vat Dyes; Printing with—. *Textilber.*, 1934, 15, 121-122.

The development of processes for the printing of textiles with vat dyes is reviewed and a recent process is briefly described in which the material is printed with a paste containing an indigoid vat dye, gum arabic, acetic acid and ferric chloride, dried and then padded with a suitable hydrosulphite bath. The material is then dried, steamed and washed and finally passed through an acid bath, washed, soaped and dried. C.

(K)—FINISHING

Piece Goods: Steaming. G. L. Atkinson. *Text. Rec.*, 1934, 51, No. 610, p. 49; No. 611, pp. 49-51.

The author describes briefly the methods of steaming piece goods in preparing and finishing, and discusses various faults arising in the steaming operation and ways of eliminating them. C.

Rubber Latex : Application to Felts. F. C. Pratt. *Text. Rec.*, 1934, 51, No. 611, pp. 54-55.

A concentrated dispersion of rubber latex known as Revertex is more easily handled than the solutions of rubber formerly used and may be used with advantage in the felt industry. Vulcanisation is effected by the use of active accelerators. A suitable fabric base can be spread with a mix on a doubling machine, and a felt then doubled on to it. Revertex gives excellent adhesion in double woollen felts. Hair felts are passed through a trough containing a suitable mix and then through two mangles which remove any superfluous mix and facilitate penetration. The single-sided rubberising of felts is carried out in the same way as the rubberising of fabrics. The spreading machine is the most suitable as it enables a thicker spread to be obtained with comparatively few spreadings. This method, however, is only satisfactory when long lengths of felt are to be processed. In the treatment of short lengths, therefore, it is advisable to carry out the rubberising by spraying or by means of a special form of machine which is briefly described. These rubberised felts may be embossed by pressing under a hydraulic press in which the pattern is pressed out by means of press sheets before the treated surface has dried completely. Vulcanisation should be effected simultaneously with the pressing operation. The compositions of suitable mixes are given. C.

Sanforised Fabrics : Properties. A. Bodmer. *Textilber.*, 1934, 15, 71-72.

Various criticisms of the Sanforising process are briefly discussed and it is claimed that this process gives a more satisfactory unshrinkable fabric than any other process recommended for the same purpose. Recent improvements are mentioned and specimens of treated linen and cotton poplin are provided. C.

Tinsel Fabrics : Prevention of Tarnishing. C. Stevenson. *M/cr. Guard. Comml.*, 1934, 28, 257.

Difficulties occurring with tinsel are caused either by the use of cheap tinsel quite unsuitable for piece dyeing, or by the inexperience of British dyers. French dyers sometimes use 3% sodium cyanide to clean tinsel that is tarnished by oxidation, but if this treatment is disliked because of the poisonous nature of the solution, the highest quality of gold or silver must be used. All tinsels tarnish to some extent, however, though coating with patent varnish may defer this. C.

Calender Pressure-releasing Device. C. G. Haubold A.-G. *Textilber.*, 1934, 15, 128.

A diagram is given of an automatic device for temporarily releasing the pressure on the rollers of hydraulic calenders to allow the seam joining two pieces of cloth to pass between the rollers without marking them. C.

Finishing : Use of Steam. G. L. Atkinson. *Amer. Dyes. Rep.*, 1934, 23, 112-114.

In the processes of crabbing, dyeing, drying, decatizing, and steaming in finishing, the advantages and disadvantages of water-laden steam are fully discussed, with reference to the avoidance of cockling and watering of the fabric, and of a thin papery handle. W.

Wool Gabardines : Preventing Faults. G. L. Atkinson. *Canadian Text. J.*, 1934, 51, No. 5, pp. 31-32.

To avoid over-scouring, wool gabardines should be treated in both bowls of the crabbing machine in boiling water, without steaming, and avoiding undue tension. The following scour gives ample cleansing without excessive cover being gained upon the fabric—wash off and run dry, 8 min., scour with soap and soda, 25 min., wash off and run dry, 10 min., scour with soap and ammonia, 30 min., wash off in warm water, 55 min., wash off in aired water, 15 min., total time for scour, 143 min. The dyeing and shearing, and shrinking and decatizing operations are described. W.

Chloramines : Use in the Textile Industry. H. Tatu. *TIBA*, 1933, 11, 883-887.

Toluene is transformed by the action of concentrated sulphuric acid into *o*- and *p*-toluenesulphonic acids, and the para derivative is transformed into *p*-toluenesulphonamide. By the action of chlorine on a strongly alkaline solution of this sulphonamide the monochloro derivative, Aktivin (Chloramine T) is obtained, or the dichloride, Peraktivin. The properties of Aktivin and Peraktivin are described. They are remarkable for the stability of their solutions, which can be caused to liberate chlorine. In the chlorination of wool, treatment is effected in an acid

bath prepared with 10 grm. Aktivin and 100 grm. conc. hydrochloric acid per litre. The bath is turbid at first, but clears when the wool is introduced. It is somewhat more economical to start with Peraktivin. This is dissolved in a sufficient amount of carbonate of soda and the solution added to the acid bath which re-precipitates the Peraktivin. In this case, 5 grm. of Peraktivin per litre of bath is sufficient. Reference is made to Aktivin and Peraktivin in the bleaching of cotton, the solubilisation of starch, and to their non-textile uses. W.

Converting of Mohair Pile Upholstery Fabrics. See Section 4I.

(L)—PROOFING

Rayon Yarns and Fabrics: Waterproofing. H. Roche *Silk J.*, 1934, 10, No. 115, pp. 24-25; No. 117, pp. 21 and 34.

Methods of waterproofing rayon yarns and fabrics with rubber, paraffin wax, aluminium soaps, alginates and various mixtures, and new processes depending on surface esterification or treatment with swelling agents are briefly described. A method of testing proofed fabrics is outlined. C.

Waterproofing Textiles. Herbst. *Rev. gén. mat. color.*, 1933, 37, 307-309, cf. *Deut. Färber-Ztg.*, 1933, 69, No. 12 (through *Chem. Abs.*, 1933, 27, 4932).

Emulsions of Al, waxes, resins, etc., used for waterproofing permit the circulation of air through the fabric. Waterproofing of viscose in the process of manufacture is proposed. W.

Latex and Jute. F. H. Cotton. *India Rubber J.*, 1933, 86, No. 18 A (Special International (Extra) No.), pp. 598-603.

The differences are stated between latex mixings and rubber doughs, and details given of compounding latex as regards vulcanising ingredients, pigments and fillers, and mixes for proofing. Methods of application of latex to jute are described, and uses suggested for proofed jute cloth. W.

PATENTS

Substitute for Olein in the Textile Industry. I.G. Farbenind. A.-G. (M. Luther and H. Beller, inventors). D.R.P. 550,239 of 7/8/1928 (through *Chem. Abs.*, 1932, 26, 4185).

Use is made of unsaturated acids obtained by splitting off H₂O from the oxidation products of higher paraffin hydrocarbons, waxes, etc. The dehydration may be effected by distilling the oxidation products, or the acids separated therefrom, at 100-300°. W.

Dyeing Pelts, Hairs and Feathers. I.G. Farbenind. A.-G. (E. Lehmann, inventor). D.R.P. 559,725 of 2/8/1930 (through *Chem. Abs.*, 1933, 27, 852).

Use is made of the condensation products of polyhydric alcohols or halo alcohols and compounds of the benzene or naphthalene series containing a primary NH₂ group and other optional substituents. The dyeing is carried out in the presence of an oxidising agent. Thus, white rabbit skins are coloured bluish-brown by treatment with an aqueous solution containing the condensation product from 1, 4-diaminobenzene and 1, 2-dihydroxy-3-chloropropane and H₂O₂, and mordanting with Fe salt solution. W.

Printing Silk with Chrome Dyes. Durand & Huguenin A.-G. (Basel). D.R.P. 583,204 of 23/10/1931.

The dye is made into a paste with water and a mixture of a soluble thiocyanate, an aliphatic polyhydric alcohol or substitution product, e.g. glycerol, and urea or a derivative, e.g. guanidine, and thickening is then added, and the chrome mordant. S.

Protecting Animal Fibres. I.G. Farbenind. A.-G. (O. Falek and H. Seifert, inventors). D.R.P. 583,533 of 5/9/1933 (through *Chem. Abs.*, 1934, 28, 1202).

Animal fibres are protected against harmful influences by treatment with glycine or its salts. W.

Dyeing Animal Fibres. H. Bucherer. D.R.P. 587,361 of 2/11/1933 (through *Chem. Abs.*, 1934, 28, 1548).

In dyeing animal fibres or mixed textiles containing animal fibres with mordant dyes, the unmordanted material is treated with the dye in an acid bath and then at atmospheric temperature with an acidified chromate solution. Cr₂O₃ is then produced on the fibre by treating the material with a cold solution of SO₂, and finally the dye is fixed on the fibre by treating the material with hot water. W.

Sulphur Dye and Vat Dye Liquors: Stabilising. Oranienburger Chemische Fabrik A.-G. D.R.P.589,508 of 12/3/1927: 8/12/1933 (through *Chem. Zentr.*, 1934, **i**, 1715).

Sulphonated condensed products from fats, hydrocarbons, etc. (e.g. the acid obtained by the action of chlorosulphonic acid on oleic acid and benzene) are added as stabilisers to sulphur or leuco vat dye liquors. The addition is recommended for the dyeing of cotton yarn in hanks with indanthrene colours and for the initial dyeing of union fabrics with sulphur colours on the jig. C.

Alkyl Persulphate Bleaching and Scouring Agents: Preparation. H. Th. Böhme A.G. D.R.P.589,778 of 28/5/1932: 20/12/1933 (through *Chem. Zentr.*, 1934, **i**, 1737).

Alcohols from C₈ on, or the corresponding olefines, are treated with persulphuric acid obtained by the action of 100% hydrogen peroxide on chlorosulphuric acid. Thus oleyl alcohol gives C₁₈H₃₅O·SO₂·O₂·SO₂·OH. The products are bleaching agents and enhance the wetting power of scouring and washing liquors. C.

Weighting Regenerated Cellulose. F. W. Weber and E. Schaefer, assrs. to Maywood Chemical Works (Maywood, N.J.). U.S.P.1,898,105 of 3/7/1931.

Viscose or nitrocellulose artificial silk is treated with an aqueous solution containing basic tin and zirconium salts, prepared by adding zirconium carbonate or a basic zirconium salt to stannic chloride solution. It is subsequently washed and treated with a solution of a salt capable of forming insoluble compounds with zirconium or tin, e.g. a phosphate. Dyed artificial silk may be weighted. S.

Weighting Artificial Silk consisting of Cellulose Esters. F. W. Weber and E. Schaefer, assrs. to Maywood Chemical Works (Maywood, N.J.). U.S.P. 1,906,206 of 3/6/1931.

Similar to U.S.P.1,898,105.

Discharge Dyeing. F. H. Smith, assr. to E. I. du Pont de Nemours & Co. (Wilmington, Del.). U.S.P.1,914,536 of 29/4/1930.

To secure white discharge effects on weighted or unweighted silk the yellowish stain resulting from discharge is masked by tinting the areas concerned with a blue or green dye of the naphthophenazine series, either at the same time as or after dyeing with the dye to be discharged, or after, or during, or before discharging. S.

Treating Natural and Artificial Silk. H. L. Bueno (Astoria). U.S.P.1,927,022 of 17/12/1931.

Silk is degummed and artificial silk desized by treatment for 5-30 minutes at 95° with a solution of an alkali salt of a weak acid, e.g. sodium phosphate, previously treated with ozone. The pH of the bath is 7-12 and the salt concentration up to 20%. S.

Bleaching Animal Fibres. J. Müller (to E. I. du Pont de Nemours & Co.). U.S.P. 1,937,710 of 5/12/1933 (through *Chem. Abs.*, 1934, **28**, 1202).

Material to be bleached, such as rabbit hair stumps, is treated with an acid solution containing a soluble Al salt such as K alum and a compound capable of liberating active O, such as H₂O₂. W.

Rendering Fibrous Material (such as Cotton Insulation on Wire) Non-inflammable).

R. Engelhardt (to I.G. Farbenind. A.-G.). U.S.P.1,938,746 of 12/12/1933 (through *Chem. Abs.*, 1934, **28**, 1552).

The material is impregnated with an inorganic salt such as NH₄ biphosphate in aqueous solution, then dried and further treated with dichlorinated naphthalene. W.

Fast Dyeings on Wool. A. Landolt (to Soc. pour l'ind. chim. à Bâle). U.S.P. 1,940,551 of 19/12/1933 (through *Chem. Abs.*, 1934, **28**, 1548).

In producing fast tints on wool by means of unsulphonated diazo-compounds of the benzene series, and unsulphonated arylides of 2, 3-hydroxynaphthoic acid derived from such aromatic amines as, besides one or two amino groups, contain no other groups capable of coupling, such arylides are caused to "rush onto" the wool from baths which contain at least 0.1% NaOH, followed by development with the diazo compounds. W.

Bleaching Rabbit Fur. W. E. Popkin. U.S.P. 1,940,768 of 26/12/1933 (through *Chem. Abs.*, 1934, 28, 1551).

The skins are impregnated with a colourless soluble cyclic oxidising catalyst such as acetone bisulphite or formaldehyde and then subjected to an oxidising bleaching action, as by H_2O_2 or a persalt solution. W.

Coating Fabrics with Metals. S. Epstein. E.P. 396,978 of 17/8/1933 (through *Chem. Abs.*, 1934, 28, 1551).

Socks, stockings, etc. are made from fabric coated with finely distributed metal or are coated, after manufacture, with such metal. Zn, Ag, Cu, Al, etc. may be applied to the fabric or article by the Schoop metal-spatter process. W.

Production of Improvement Effects on Silk. Heberlein & Co. A.-G. (Wattwil, Switzerland). E.P. 397,838 of 25/11/1931.

Silk is swollen with mineral acids, with a resulting increase in transparency, and, by local action, pattern effects. The degradation of the silk by the acid is prevented by addition of alcohols, pyridine and its derivatives, formaldehyde and substances yielding formaldehyde, and ammonium salts. S.

Treatment of Silk. Heberlein & Co. A.-G. (Wattwil, Switzerland). E.P. 397,878 of 23/11/1931.

Silk is permanently swollen by alkalis, mineral acids, zinc chloride, euprammonium hydroxide, or thiocyanates and the swelling agent subsequently washed out. S.

Dyeing Wool. Soc. of Chemical Industry in Basle. E.P. 398,878 of 23/3/1932.

Fast tints are produced on wool by grounding with an unsulphonated arylide of 2:3-oxynaphthoic acid containing no SO_2NHR group, in presence, or absence of an electrolyte, in a bath prepared with the aid of 0.6-1.8 grams. of caustic alkali per litre and developing with a diazotised *p*-aminodiphenylamine containing no solubilising groups. Arylides specified are the anilide, α or β -naphthylamide, 5- or 4-chlor-2-toluidide, *o*-, *m*-, and *p*-anisidide, *o*-, *m*-, or *p*-chloranilide, *o*-, *m*-, and *p*-toluidide, 4-chloranisidide, *m*-xylylidide, *o*- and *p*-phenetidide, *m*-phenylenediamide, a *m*-toluylenetramide, 2:5-dimethoxyanilide and the 4-methoxy-2-methylanilide. In examples wool is grounded with the anilide at 45° C. and developed with 4-amino-4¹-ethoxy- or 4¹-methoxydiphenylamine (blue). Other diazo components specified are 4-aminodiphenylamine, 4-amino-2¹-methoxy-5¹-chlorodiphenylamine, 4-amino-2¹:5¹-dimethoxy- or diethoxydiphenylamine. E.P. 283,838, 310,758, and 313,865 are referred to. The Specification as open to inspection under Sect. 91 comprises unsulphonated 2:3-oxynaphthoic arylides in general, the following grounding conditions, viz. (1) liquor ratio 6:1-50:1; (2) grounding bath not to contain more arylide than amounts to 5% of the weight of the wool; (3) the proportion of alkali hydroxide to be about 1.5-2.5 times that of the amount of arylide and gives a further example of dyeing with 4¹-ethoxy-4-aminodiphenylamine and the α -naphthylamide. This subject matter does not appear in the Specification as accepted. W.

Printing Wool Textiles. Holtmann & Co., Ges., A., and M. Frankfurt, Berlin. E.P. 398,944 of 29/4/1932.

In printing colours other than vat dyes on wool an improved penetration of the goods by the colour is obtained by the addition to the printing paste, in a proportion of at least 4% of the whole paste, of a water-soluble, mono- or di-amido derivative of carbonic, thiocarbonic or imidocarbonic acid, free from substitution of the primary amino group or groups and still retaining at least one of these, which amido derivative remains uncondensed after the printing. Specified amido derivatives are urea, urethanes, thiourea, thiourethanes, guanidine and salts thereof. The following examples are specified: (1) an aqueous paste containing crystal ponceau, British gum, oxalic acid and urea is printed on wool and the printed goods are steamed, washed, and dried. (2) Wool, dyed with Palatine fast green BGN, is printed with an aqueous discharge paste, containing Euchrysin RDX, Phloxin O, British gum, thiodiglycol, glycerine, Rongalite C, and urea, steamed, washed, and dried. (3) Wool is printed with a paste containing an acid dyestuff and 40 grammes of urea per litre of paste. W.

Process and Apparatus for Cleansing Wool with Gypsum. J. F. Paterson (Shepparton, Victoria, Australia). E.P. 399,599 of 23/5/1932.

A method is described for cleansing wool, especially very dirty raw material, by dusting the material with finely divided, dry raw gypsum, revolving it in

drums, discharging it on to an endless, continuously-moving, vibratory, perforated conveyor, from whence it is taken into a conduit and subjected to suctional pressure before being delivered from the machine. The gypsum is dried sufficiently to remove the mechanically-contained moisture, but not enough to render it anhydrous, and after it has been ground into a fine powder it is intimately mixed with the wool, contact being maintained for periods up to about one hour. The powder is separated from the wool by the vibratory motion of the perforated conveyor and by the suction treatment. If the wool is particularly dirty and matted it is first teased to ensure that the powder will permeate the fibrous mass. It is claimed that by these means grease and dirt are eliminated and the condition of the wool is greatly improved, and although intended chiefly for the cleansing of raw wool, the system can be used to clean blankets, carpets, wearing apparel, and so on. The machine is described in detail and a diagram given. W.

Rubber Waterproofing Composition. A. M. Dunstone (Sydney, Australia). E.P. 402,865 of 20/6/1932.

A composition suitable for coating the handles of sporting articles such as tennis rackets and hockey sticks and for application to textiles, leather, and other materials for waterproofing, etc. is composed of the following components in approximately the proportions of 4 parts by volume of casein, 6 parts water, 24 parts normal rubber latex, $\frac{1}{3}$ part concentrated ammonia. If concentrated latex is used the amount is regulated so as to add an amount of rubber equal to 24 parts of unconcentrated latex. The coated articles may be dipped in sulphur chloride to vulcanise, or the latex may be vulcanised before or after admixture with casein and before application to the article. The casein is saturated with water, the latex is added and after mixing, the ammonia is stirred in. C.

Polystyrene Cellulose Acetate Coating Plastics : Application. Celluloid Corporation (Newark, New Jersey, U.S.A.). E.P. 402,877 of 5/7/1932.

Films, sheets, and similar articles made of or containing cellulose esters or ethers are rendered resistant to water, acids, alkalis, gases or vapours and organic solvents, by coating with a material comprising a polymerised vinyl hydrocarbon, in particular, polymerised styrene or its homologues, such as ethylstyrene or *p*-methylstyrene. The method is particularly applicable to articles made of acetone-soluble cellulose acetate, but it may be used with articles made from other organic esters of cellulose, simple or mixed, from nitrocellulose, or from ethyl or benzyl cellulose. Plasticisers, softening agents and pigments may be incorporated in the coating. C.

Cellulose Ester Coated Insect-excluding Screen. E. Sylvester (Weissenfels-on-Saale, Germany). E.P. 402,965 of 2/3/1933.

An insect-excluding blind comprises an openwork textile fabric, for example of hemp, treated with a dilute cellulose ester solution, for instance, in the form known as "Cellon" so as to coat the threads and connect them at their intersecting points without closing the meshes. The net may be reinforced longitudinally, transversely or diagonally by thicker threads or by doubling or multiplying the number of threads. C.

Agglutinated Fibre Fabrics. B. F. Goodrich Co. (New York). E.P. 403,175 of 12/8/1932.

Resilient material is made of flexible fibre, such as hair, maintained in thin open-mesh sheet form by an agglutinant uniting the fibres at their crossing portions. In one form the sheet is formed by spreading the fibres upon a flat surface with or without the aid of a carding machine, coating the fibres partially or wholly by spraying with a flexible glue or nitrocellulose compound, or a rubber composition deposited on the fibres from a rubber cement or from an aqueous dispersion such as latex. After drying the sheet may be further coated with fibres after immersion in a bath of the liquid. C.

Silk and Rayon Fabrics : Treatment with Rubber Latex. Naugatuck Chemical Co. (Naugatuck, Connecticut, U.S.A.). E.P. 403,394 of 11/6/1932.

In the treatment of silk or rayon fabrics, such as stockings, with an aqueous dispersion of rubber, e.g. rubber latex, to produce a deposit of rubber on the fabric which is imperceptible to the sight and touch and prevents laddering, etc. the stockings are first scoured in a soap solution heated to boiling. After scouring, the liquid may be removed and replaced by a dilute soap solution, together with

an aqueous dispersion of rubber and a dye, preferably composed of 75% acid dye and 25% direct dye. Heating at 110° F. is continued till the dye is set, the latex being thereafter coagulated by the addition at intervals of a 5% solution of potassium or ammonium alum. The bath may also contain carbohydrates, gums, oils, etc. After coagulation the articles are freed from liquid and placed on heated forms. Specific delustring effects are obtained by varying the nature and amount of the additions so as, for example, to deposit insoluble soaps in the fabric. Insoluble compounds, for example, barium sulphate, may be deposited on the fibres by adding barium chloride prior to the addition of the alum. C.

Dyeing Apparatus. L. S. J. Thompson and W. A. Tatton (Leek). E.P.403,520 of 5/12/1932.

Vats, tanks or vessels, for example, dye vats, having a circulating duct, are provided with a transverse rotatable pipe having a row of perforations through which steam or steam and air can be injected into the duct to direct the flow of liquor therein, either from the bottom of the vat to the top, or from the top to the bottom, according to the position of the pipe. C.

Imitation Leather Fabric: Production. Magyar Ruggyantaarugyar Reszvenytársasag (Budapest). E.P.403,556 of 18/4/1933.

Imitation leather presenting a leather-like appearance on both surfaces is made by rubberising fabric, which may be of close or open texture, on both sides and coating the thinner rubber layer successively with an adhesive and vegetable or animal fibres, for example cotton powder. The rubber layers may be applied by spreading on solutions or dispersions, or thick layers may be formed by pressing a sheet of rubber on to the fabric, which may be dyed. The rubber compositions are preferably coloured to match the fibres. The adhesive may be a decomposition product of rubber. The thicker rubber layer may be vulcanised and given a shiny or patterned surface in the press prior to the application of the thinner layer, which may be subsequently vulcanised. C.

Azo Dyes: Production on Textile Fibres. British Celanese Ltd. (London), E. W. Kirk, and G. H. Ellis. E.P.403,621 of 12/5/1932.

Mixed shades are produced on textile materials, and especially on materials made of or containing cellulose esters or ethers, by applying thereto or incorporating therein a diazotisable amine, a coupling component, and a free leuco compound of a vat dye or a salt of such leuco compound and thereafter affecting diazotisation and coupling and development of the vat dye by oxidation. The amine, coupling component and leuco vat dye may be applied from a single bath, padding liquid or the like, or they may be applied separately. The oxidation of the leuco compound may be effected by exposure to air or by the action of nitrous acid employed for diazotisation. Following the nitrous acid treatment a weak alkaline treatment may be applied to complete the coupling. C.

Compound Insulating Tape: Production. F. H. M. Bennett (Purley). E.P.403,688 of 18/6/1932.

In electric conductors of the type composed of longitudinal wires enclosed between tapes or bands of insulating material secured by adhesive, the tapes are of woven fabric coated with a material which remains plastic or "tacky" at normal temperatures for a considerable time. More than one layer of wires with tapes between them may be enclosed between the outer tapes and several arrangements are described. Apparatus for making such a conductor is shown and a machine for making two tapes at once is described. C.

Agglutinated Fibre Fabrics. R. Muller (Milan, Italy). E.P.403,858 of 1/5/1933.

Artificial leather or imitation parchment is made by impregnating a preformed fleecy web of cellulose or wood pulp with an aqueous dispersion of rubber on an endless metallic band, expressing surplus liquid if necessary, drying the impregnated web whilst still on the endless metallic band, and finally stripping the product from the band. C.

Organic Sulphide Softening Agents: Preparation. Henkel et Cie Ges. (Dusseldorf, Germany). E.P.403,882 of 20/12/1932.

Organic sulphides are obtained by treating with organic hydrosulphides or their alkali metal derivatives, esters derived from non-aromatic halogen carboxylic acids and aliphatic, hydroaromatic or aliphatic-aromatic compounds containing at least six carbon atoms and at least one hydroxyl group. In examples, dodecylchloroacetic ester is treated with sodium phenylmercaptan or is condensed with

mercaptoacetic acid and with β -oxy- γ -mercaptopropane- α -sulphonic acid. Dichloroacetic acid, succinic acid and α -bromolauric acid may be used for the formation of the halogen esters, and the following hydroxy compounds are mentioned—paraffin alcohols, benzyl alcohol, β -phenylethyl alcohol, polyhydric alcohols, hydroxy-fatty acids and their esters and amides, oxyalkyl esters of fatty acids and oxyalkyl ethers of higher alcohols. The insoluble products may be used as softening agents for textiles. The soluble products have saponaceous properties and may be used alone or with soaps, fillers and compounds giving off oxygen. C.

Amino Ester Softening Agents: Preparation. Henkel et Cie Ges. (Dusseldorf, Germany). E.P.403,883 of 20/12/1932.

Amino esters are prepared by treating ammonia or its organic mono- or di-substituted derivatives with esters which are derived from non-aromatic carboxylic acids containing at least two carbon atoms by esterification with monomeric aliphatic, cycloaliphatic or aliphatic-aromatic compounds containing hydroxy groups and having at least six carbon atoms. The soluble products are stated to have saponaceous properties and the insoluble products are useful as softening agents for textiles. C.

Fabric Pressing Apparatus. A. D. Heaton and J. O. Lang (Liversedge). E.P. 403,939 of 23/5/1932.

Three vertically movable papering, etc. tables are mounted on a carriage which can be moved to bring any table opposite to any of a series of presses. C.

Cellulose Ester Rayons: Treatment to Improve Resistance to Hot Ironing. British Celanese Ltd. (London), G. H. Ellis, and A. J. Wesson. E.P.403,966 of 4/6/1932.

Materials consisting of or containing cellulose esters are improved in their resistance to hot ironing or like operations by subjecting the ester to surface saponification, and thereafter incorporating in the surface layer a substance which melts, if at all, at a higher temperature only, that is, at a temperature above 300° C. The saponification may be effected in such a way as to lead to a loss in weight of 4-8%. The incorporation of substances having a high melting point in the saponified layer may be effected with aqueous solutions of the desired substance, applied by padding, spraying or like treatments, the material being afterwards dried. The substances employed are preferably inorganic salts, and include borates, phosphates, sulphates, and fluorides or other halides. C.

Sulphonated Cyclic Amidine Wetting Agents: Preparation. A. G. Bloxam, London (Society of Chemical Industry in Basle). E.P.403,977 of 31/5/1932.

Products with wetting, softening, emulsifying, levelling, washing and similar properties are obtained by sulphonating cyclic amidines which are derived from *o*- or *peri*-diamines of the benzene or naphthalene series, and which are substituted in the μ -position by an aliphatic residue containing at least three carbon atoms or a hydroaromatic residue. Before sulphonation the cyclic amidines may, if desired, be subjected to alkylation, aralkylation or arylation. In a further modification the same products are obtained by condensing a sulphonic acid of an *o*- or *peri*-diamine, in which one amino group may be substituted by an alkyl, aralkyl or aryl group, with an acidylating agent capable of introducing the residue of an aliphatic carboxylic acid containing at least four carbon atoms or the residue of a hydroaromatic carboxylic acid. The cyclic amidines are obtainable by condensing aliphatic carboxylic acids containing at least four carbon atoms with *o*- or *peri*-arylenediamines. C.

Ropes and Cords: Impregnating Fibres. W. H. Wilkinson c/o British Ropes Ltd., D. P. Frost, F. Smith, and British Ropes Ltd. E.P.404,001 of 28/6/1932.

In a process for making ropes and cords from fibrous organic materials such as manilla, sisal, hemp, and coir, the ropes or cords, or some at least of the strands or yarns from which they are formed, are, without previous treatment, impregnated with an aqueous rubber dispersion such as latex, containing mineralising agents such as chalk, carbon, zinc oxide, diatomaceous earth and china clay, and vulcanising agents including accelerators such as hexamethylene tetramine and di-orthotolylguanidine, the rubber is coagulated by passage through a bath of dilute acetic acid or through a chamber containing formaldehyde, and finally is vulcanised by heat or storage. Glue, gelatine, or casein may be added to the rubber dispersion to prevent premature coagulation and to increase the resistance

of the rubber to the action of solvents and mineral oils, and oxidation of the rubber may be retarded by the addition of pine tar or pine oils. E.P.250,167 is referred to. W.

Bleaching Animal Fibres. Roessler & Hasslacher Chemical Co. E.P.404,019 of 6/7/1932.

Animal fibres, especially raw wool from which grease and dirt have been removed, are bleached by treating them with dilute aqueous hydrogen peroxide, preferably of a concentration of 0.03-3% by weight of pH 3.6-5, preferably 5.5-6, the material after separation from the bleaching solution being dried without washing so that hydrogen peroxide is present during the drying process. In an example, wool is fed from an opener (consisting of an endless belt in which steel points are embedded) into a bowl containing a solution of soda ash at 120° F., thence through a squeeze roll into a second bowl containing a solution of soda ash and soap, thence through squeeze rolls into a third bowl containing soap solution, a fourth bowl containing water alone for washing out part of the alkali and finally into the bleach bowl containing aqueous hydrogen peroxide at 120° F. adjusted to pH 5.4 by addition of sulphuric acid. On leaving the bleach bowl the wool is squeezed as dry as possible and dried on an endless belt dryer at 120-140° F. E.P.347,292 (*J.T.I.*, 1931, A626) is referred to. The Specification as open to inspection under Sect. 91 comprises in general the bleaching of animal fibres by means of dilute aqueous hydrogen peroxide of pH 3-6.5. This subject-matter does not appear in the Specification as accepted. W.

Coalesced Artificial Threads: Preparation. Heberlein & Co. A.-G. (Wattwil, Switzerland). E.P.404,268 of 8/4/1932.

Artificial threads composed of a number of individual filaments are subjected to the action of swelling agents so that the filaments are welded together. The treatment may be such that coalescence is complete, or so that the outer filaments of the bundle are welded together to form a covering round the filaments in the interior. The threads may be of regenerated cellulose or of a cellulose ester, and they may contain continuous filaments or staple fibres. Crinkled effects are obtained when the components behave differently towards the swelling agent. Differential dyeing effects may also be obtained. The products may be used as artificial horsehair or straw. C.

Azo Dyes: Production on the Material. I.G. Farbenindustrie A.-G. (Frankfort). E.P.404,304 of 11/7/1932.

In the production of azo dyes on the fibre by impregnation with a solution of a substantive coupling component and subsequent development with a solution of a diazo compound, the material is passed, immediately after the treatment with the diazo solution, through a space heated substantially above the atmospheric temperature in order to accelerate and complete the coupling operation. Processes in which the material is impregnated with an ω -methylsulphonic acid of an aromatic amine in addition to a substantive coupling component are excluded. The method is of particular advantage in using diazo compounds which couple slowly and in the production of resist effects. C.

Cellulose Ester and Ether Rayons: Dyeing. British Celanese Ltd. (London), G. H. Ellis, and E. W. Kirk. E.P.404,327 of 3/5/1932.

Materials made of or containing cellulose esters or ethers are dyed, printed, stencilled, or otherwise coloured by applying thereto a coupling component in the free state and thereafter coupling with a diazotised amine of the general formula $R_1 \cdot NH \cdot R_2$, wherein R_1 and R_2 represent aromatic residues of which at least one contains a diazotisable amino group and wherein such residues are or are not further united by a direct linkage or through an atom or group, such as —S—, —O—, —CH₂— or —CO—. C.

Ropes and Cords: Proofing Permeable Materials. W. H. Wilkinson, T. C. Davis c/o British Ropes Ltd., F. Smith, and British Ropes Ltd. E.P.404,329 of 6/5/1932.

Ropes and cords comprising cellulosic fibres or strands adapted for use in their manufacture, or the fibrous constituents of wire ropes having a core of cellulosic fibre, are rendered more resistant to the action of water by treatment with cuprammonium solution or a solution of ferric chloride, zinc chloride or sulphuric acid. An example describing the use of cuprammonium solution is given. The

treatment may be applied to the finished rope or cord or to the unspun fibres or to yarns or strands prepared therefrom; when unspun fibres or yarns are treated, they are afterwards worked up in the usual way to ropes or cords or strands adapted for use in their manufacture. The treatment may be followed by treatment with an alkali-metal soap (cf. E.P.404,330—following Patent). The process is particularly useful in the manufacture of rope or cord from sisal. W.

Ropes: Treating Sisal and Permeable Material. W. H. Wilkinson, T. C. Davis c/o British Ropes Ltd., F. Smith, and British Ropes Ltd. E.P.404,330 of 6/5/1932.

Sisal in the form of fibres, yarns, cords, or like products, or ropes, is rendered more resistant to the action of water by impregnation with a water-insoluble soap. Ropes formed of vegetable fibres in general, or wire ropes having a vegetable fibre core, may be treated in the same way, the treatment being applied to the finished rope or to the unspun fibres or to the yarns or strands from which the rope is to be made. The treatment may be effected by impregnating the material in turn in either order with a solution of alkali metal soap and a solution of a salt of a metal which forms a water-insoluble soap, e.g. a salt of magnesium, calcium, aluminium, copper, iron, or zinc; alternatively, the material may be treated with a solution of a water-insoluble soap in a volatile or non-volatile solvent or a mixture thereof; the non-volatile solvent may then act as a lubricant. The soap may be derived from a fatty acid or a resin acid or a mixture thereof. E.P.404,329—see previous patent, is referred to. W.

Cellulose Ester and Ether Rayons: Dyeing. British Celanese Ltd. (London), G. H. Ellis, and E. W. Kirk. E.P.404,363 of 26/10/1931.

Materials made of or containing cellulose esters or ethers are dyed, printed, stencilled, or otherwise coloured by applying, in the free state, and in the form of an aqueous dispersion, an arylamine of an aromatic hydroxycarboxylic acid, other than an arylamide of an oxynaphthoic acid, and coupling with a diazo component. C.

Sulphonated Acetylated Castor Oil Wetting Agents. Imperial Chemical Industries Ltd. (London) and R. Greenhalgh. E.P.404,364 of 18/7/1932.

Sulphonated products useful as wetting agents are prepared by dissolving acetylated castor oil or acetylated ricinoleic acid in liquid sulphur dioxide and treating the solution with sulphur trioxide or oleum. C.

Moiré Fabric: Production. British Celanese Ltd. (London), A. Mellor, and R. J. Mann. E.P.406,322 of 23/8/1932.

A moiré effect is produced by subjecting a ribbed fabric to pressure from a surface having ribs thereon which are spaced from each other at continuously varying intervals. The spacing variation of the ribs on the surface may proceed uniformly and continuously from minimum to maximum and back to minimum, the simplest form of pressure device having ribs whose spacing varies in the manner just indicated, the ribs running parallel to each other, generally in the direction of the ribs in the fabric. The fabric then has its ribs displaced into curvilinear form and on being subjected to pressure by the ribbed surface receives a pattern due to the formation of pressure points where the fabric ribs cross the ribs on the surface. If the spacing of the ribs on part of the surface is less than the rib spacing of the fabric to be treated and varies until on another part of the surface it is greater than the rib spacing of the fabric, the resultant moiré pattern contains closed "eyes" as in "Moiré Française". On the other hand, if the spacing of the ribs on the surface is wholly greater than or wholly less than the rib spacing of the fabric, the pattern consists of wavy lines or bands running transverse to the fabric ribs, i.e. along the length of the fabric when the ribs are formed by the weft, as is usual. The spacing of the eyes or wavy lines across the fabric is determined by the distortion of the fabric ribs, and may be controlled, as by means of a "scratch board" to give any predetermined pattern. The spacing of the ribs on the pressure surface need not vary regularly, and, moreover, portions having varying spacing may alternate with portions having uniform spacing to give corresponding variations in the patterns obtained. C.

Zinc Plated Printing Roller: Application. H. A. Wolinski (Bombay, India). E.P. 406,393 of 26/9/1932.

A process for the printing of coloured designs on textile fabrics is characterised in that the fabric to be printed contacts with a printing roller, comprising a thin

steel or brass shell with electrolytically deposited zinc on its surface, and fitted on a hollow cylinder, the printing surface of the roller being coated with a special printing ink. This printing ink consists essentially of a mixture of curd soap, heavy lithographic varnish and a dye powder which is soluble in oil or fat but not in water. The zinco-graphic printing roller, after being grained with a sand blast if desired, is covered or coated evenly and uniformly with the colouring compound by means of a series of subsidiary revolving rollers, which transfer the colouring compound from vats or trays to the printing roller. The fabric to be printed is inserted between the printing roller and a pressure or guiding roller and as the former continues to rotate in the same direction the cylindrical design plate which forms the circumference of the printing roller will impress the coloured design on the entire length of the fabric. C.

Rubber Latex Pile Fabric Backing: Application. R. F. McKay, Birmingham (International Latex Processes Ltd., St. Peter's Port, Guernsey). E.P. 406,619 of 25/10/1933.

A method of applying a backing to a layer of fibres arranged substantially parallel to each other to produce a pile rug or the like comprises applying an adhesive preparation to one face of the layer of fibres and bending and flexing the fibres in divers planes to work the adhesive preparation into the fibres. Whilst any suitable adhesive preparation may be used it is preferred to use rubber latex. C.

Thiuram Sulphide Antiseptics: Application. E. I. Du Pont de Nemours & Co. (Wilmington, Delaware, U.S.A.). E.P. 406,979 of 26/5/1932.

A process for the preservation of wood or the protection of textiles, paper and similar materials against fungoid growths, etc. comprises treating the material with a thiuram sulphide in an aqueous medium, or in an organic solvent, or in an aqueous emulsion of its solution in an organic solvent, with or without the addition of other active ingredients, wetting, penetrating, and/or emulsifying agents. C.

5—ANALYSIS, TESTING, GRADING, AND DEFECTS

(A)—FIBRES

Brazilian Cotton: Length Frequency Curves. A. M. de Azevedo. *Industria Text.*, 1933, 2, No. 22, pp. 17-21.

Frequency curves are given and discussed for cotton of the 1929 and 1932 crops of the states of Rio Grande do Norte, Parahyba, Pernambuco, and São Paulo, classified according to type and length. The 1932 curves for the São Paulo and Parahyba crops show higher proportion of long fibres compared with the corresponding 1929 crops, whilst in the other two states the proportions of long fibres were lower in the 1932 than in the 1929 crops. C.

Textile Fibres: Stress-strain Relations. R. L. Steinberger. *Physics*, 1934, 5, 52-60.

The stress-strain relations for four rayons, silk, wool, cotton, and ramie are given under known humidity conditions. The method consists in pulling the lower end of the vertical fibre by means of a screw, while the upper end pulls a lever which twists a pair of parallel horizontal wires, the rotation of the lever being measured optically by telescope and scale. In each experiment the section area was determined on the specific fibre under test, and the elongation was made in steps, with a relaxation interval of 30 seconds between stress observations. The rayons exhibit an accurately linear initial curve, from which Young's modulus can be determined, followed by a yield point, and a long region of plastic flow. The curves for cotton and ramie are linear, with no plastic yield in the range examined. In silk and wool there is no proportionality between stress and strain. Cellulose acetate exhibits the phenomena of "cold working" and marked increase of total and elastic energy with falling relative humidity. The application of Maxwell's relaxation equation is examined. C.

Textile Fibres: Structure. K. Hess. *Textilber.*, 1934, 15, 29-32 and 65-68.

A review of recent research, especially of X-ray studies. C.

Cotton Hair: Length Irregularity and Spinning Quality. N. Ahmad and H. Navkal. *J. Text. Inst.*, 1934, 25, T49-T59.

Textile Fibres : Microscopy. E. R. Schwarz. *Amer. Dyes. Rep.*, 1934, 23, 61, 144.

Recent advances in textile microscopy, including the preparation of stereoscopic photo-micrographs, the application of motion picture technique and the development of improved systems of illumination, are briefly discussed. C.

(B)—YARNS

Twist and Twist Contraction Tester. *Textile Research*, 1934, 4, 140-141.

The thread to be tested is placed between two clamps, and its untwisting causes a vertical pendulum to swing across a graduated scale so that the increase in length when the thread is untwisted is shown. Recommended tension weights to swing the pendulum for various weights and types of silk and rayon yarns are given. C.

Yarn Regularity Examining Device. R. Bosi. *Revue Text.*, 1934, 32, 113.

A support for use in the study of yarn regularity has a bi-convex section. A paper tube fits over this support and a layer of yarn is wound round it. An adhesive substance is applied to the paper surface to cause the yarn to adhere to it. The paper with the adhering layer of yarn is cut across, removed from the support and spread out into a flat sheet and protective strips are pasted over the two ends. Samples of yarn in this form are more easily packed and stored than samples wound on the usual plush-covered plates. C.

Eliminating Neps and Twits from Woollen Yarns. S. F. *Text. Mfr.*, 1934, 60, 96 and 102.

Three faults in woollen yarns are unlevelness, neps and twits. Sources of the last two are indicated, and remedies for their occurrence described. W.

Sipp-Eastwood Densimeter. Sipp-Eastwood Corp., New Jersey. *Rayon and Melliand Text. Monthly*, 1934, 15, 143.

This device measures the density of cops, quills, spools and other packages. A saddle attached to a dial is pressed firmly against the package to be tested. A $\frac{1}{4}$ in. thick plunger projecting about $\frac{1}{8}$ in. from the centre of the saddle presses into the package and registers the density on the dial. W.

(C)—FABRICS

Carpets : Wear Tests. H. F. Schiefer and R. S. Cleveland. *Bur. Standards J. Res.*, 1934, 12, 155-166.

The nature of the wear on the wool fibres was studied microscopically. The wool fibres from a worn carpet are frayed at the tips and spindle-shaped fibrils whose dimensions correspond to cortical cells are worn off. Some of the fibres are fractured, others are broken off near the base by the repeated bending and compression. The carpet wear test furnishes a new and easy means of obtaining and isolating the cortical cells of the wool fibre. A wear index which is applicable to all kinds and qualities of pile carpets and which is believed to give a good representation of their relative durability in service has been selected and used. The effect of the quality of pile wool, height of pile, density of pile, type of pile anchorage and carpet underlays on the durability was studied. The density of the pile appears to be the predominant factor of a carpet which affects wear. The height of pile is a factor of lesser importance. The quality of pile wool has a measureable effect. The types of pile anchorage studied have no appreciable effect. In general, the wear index is approximately proportional to the product of pile density squared and pile height. All underlays increase the durability of carpets. The increase in wear index depends upon the underlay and the carpet. The composition, thickness, density and compressibility of underlays are factors which contribute to their effectiveness. An underlay appears to be more effective when it is used with carpets of short pile than when it is used with carpets of long pile. C.

Cloth : Regain (Crimp) and Yarn Contraction Testing. (1) H. Pomfret. (2) Anon. (3) H. Pomfret. *Text. Weekly*, 1934, 12, 641 and 670; 1934, 13, 71.

(1) The difference in the length of a section of yarn in a cloth and when withdrawn and straightened is discussed. This difference may be expressed either as cloth regain (crimp), i.e. as a percentage of the length in the cloth, or as yarn contraction, i.e. as a percentage of the length of the straightened yarn. From a knowledge of the cloth regain or yarn contraction it is possible to calculate the warp length, reed width and ends per inch in the reed. Examples are given. (2) The use of the term "crimp" for length regain is suggested, and an expression is derived for the length of a pick. (3) This is criticised by Pomfret. C.

Knitted Textiles : Consumers' Standards. J. G. Williams. *Text. Mfr.*, 1934, 60, 50-51.

A general discussion of the standards of fastness, strength, and shrinkage required of knitted textiles. C.

"Telecolor" Machine : Application. C. E. Hays. *Amer. Dyes. Rep.*, 1934, 23, 124-126.

The Telecolor machine is used for comparing the colours of dyed, coated or liquid materials. The comparison is made by means of photo-electric cells. With the aid of colour filters it is possible to analyse the colours and determine at what points in the spectrum the differences are greatest. C.

Cotton Fabrics : Stiffness Testing. W. G. Bickley. *Phil. Mag.*, 1934, 17, 603-622.

Tables are given of accurate numerical data for use in reducing the observations made in the B.C.I.R.A. "cantilever" and "heart loop" tests of the stiffness of cotton fabrics. The tests are treated mathematically as cases of heavy elastica. C.

Cotton Shirts : Price and Quality Relationship. M. E. Griffith and D. M. Siegert.

Ohio Sta. Bul., No. 164, 1933, 130-132 (through *Exp. Sta. Rec.*, 1934, 70, 139).

Six qualities of white English "broadcloth" (? poplin) shirts were examined for cloth and yarn particulars before and after laundering ten times with one day's wear between launderings. All the shirts were "guaranteed pre-shrunk" but the cheapest lost 9.4% in warp length and 4.7% in weft length and the dearest 5.2% and 4.7% respectively. C.

"Lilu" Thread Counter. H. C. Ulrich. *Spinn. u. Web.*, 1934, 52, No. 13, pp. 4-5.

A new thread counter which is particularly useful for the examination of cloth on the loom or on other machines at points where the light is not good consists of a thread counter of the usual type giving a tenfold magnification combined with a small electric lamp which directs light similar to daylight on to the cloth from the side. C.

Extensibility and Strength of Miller's Gauze as a Measure of its Serviceability.

T. Schreus. *Z. ges. Text.-Ind.*, 1933, 36, 200 (through *Textilber.*, 1933, 14, 514).

In assessing the quality of miller's gauze the resistance to abrasion is of especial importance. It is suggested that the testing of a gauze should include—(1) determination of extensibility and strength for the purpose of judging the quality of the constituent threads, (2) optical examination of the closeness of the warp and weft, and (3) testing of the resistance to abrasion. No satisfactory apparatus for (3) exists, and the only thing to do seems to be to compare the wear of the sample on a sifting machine with the wear of samples of other gauzes. S.

Perching Woollens and Worsteds. G. L. Atkinson. *Text. Mfr.*, 1934, 60, 120-121.

The practice of perching and its uses is described in detail, with particular reference to woollens and worsteds. W.

Poor Fastness to Rubbing : Cause and Prevention. *Wool Rec.*, 1934, 45, 737-739.

The production of insoluble soaps by the use of hard water in rinsing, and failure to remove oxidised oil in scouring of piece goods, lead to impaired fastness to rubbing. If olive oil is applied as a wool cream during spinning, it will also facilitate the removal of the oil during scouring, provided that the cream obtains its dispersion wholly or partly from compounds insoluble in water. Blue-dyed piece goods are also subject to poor fastness to rubbing, whether dyed with mordant dyestuffs or with these in conjunction with Indigo. Solvent scouring agents are useful as an aid in the removal of matter which is not easily removed by soap. W.

The Microscope in the Dyehouse. *Wool Rec.*, 1934, 45, 621-623.

An article dealing with the types of objectives, mountants and stains for microscopes to be used for the detection of faults in dyed cloth, of damage to wool by chemical means, of attack by mildew, and of oil stains. If a piece shows that a single end, or weft bars, are dyed a lighter colour than the remainder of the cloth, the quality of the wool as a possible cause of this fault can be measured by means of the microscope, when only a small amount of material is available. In this connection, reference is made to the analysis of the U.S. Government Wool Top Standards by Potsdamer and Schenker (see *J. Text. Inst.*, 1930, A380).

W.

Faults Due to Iron. *Wool Rec.*, 1934, 45, 501-503.

In the ferrocyanide test for iron, the fabric is first spotted with dilute nitric acid or pure dilute hydrochloric acid. A drop of potassium ferrocyanide is then added, when a blue colour develops if iron is present. In the thioglycolic acid test, the fabric is treated as above with nitric or hydrochloric acid. A drop of a solution of the thioglycolic acid in water is added, then a drop of 50% by volume ammonia, to ensure the alkalinity. A pink colour develops if iron is present. Cobalt, nickel, manganese, and uranium are the only other metals giving a colour under the conditions of the test. A modification of the test enables traces of iron in water to be detected. For the removal of local iron stains, a mixture of oxalic acid with glacial acetic acid is stated to be more efficient than salts of lemon or either acid separately. W.

Inspecting, Measuring and Plaiting, etc. of Fabrics. Butterworth & Dickinson Ltd., Burnley. *Text. Mfr.*, 1934, 60, 20-21.

Machines for combined inspecting, measuring, and plaiting, rolling or lapping fine and delicate fabrics such as dress goods, have been made on the Nanterme design. In the M25 machine, the measuring motion comprises a driven rubber-covered metal drum, preceding which is a smoother bar of special shape. In contact with the measuring drum behind is a smaller heavy cloth-covered roller. The arrangements are such that the cloth passes through without creases and the measurement is exact and invariable with any texture or weight of cloth. The measuring roller is driven through a friction clutch which may be adjusted by a handle to give any required limit of tension on the cloth. The M27 machine comprises an alternative arrangement for inspecting and measuring whilst the cloth passes from roller to roller. In this case, the measuring roller is turned by the cloth. The cloth is tensioned after leaving the measuring roller by four bars, two of which are lever mounted to give constant tension; when the end of the piece runs out the movement of the tensioning bars stops the measuring dial. Illustrations are given of these two models. W.

A New Method of Testing the Permeability of Clothing Materials to Air. E. Chuchrina. *Arch. f. Hyg. u. Bakt.*, 1933, 111, 43-48 (through *Bull. Hyg.*, 1934, 9, 288).

A quick and cheap method, accurate enough for its purpose, was found to be the measurement of the rate of passage of air from an electric blower through the material. Results were reckoned as the amount of air passing through per sq. cm. of a single thickness of material, at pressures of both 1.0 mm. and 0.43 mm., so that comparison could be made with Lubner's data. Readings were taken through ten places, so as to detect and avoid locally bad patches. T.

Recommendation from Consumers' Advisory Board of N.R.A. for Revision of Silk Textile Code with Reference to Weighting and Fabric Identification of Silk. See Section 10.

(D)—OTHER MATERIALS

Instrument for Examining Textile Products and Parts of Machinery. Soc. Genevoise d'Instruments de Physique. *Rayon and Melliand Text. Monthly*, 1934, 15, 80 and 104.

A description (with an illustration) of a projection microscope attached to a desk, and similar to the well-known Vickers microscope. W.

6—DESIGN

(B)—STRUCTURE OF FABRICS

Designs and Fabrics. *Text. Mfr.*, 1934, 60, 102.

"Merlin" is a "half-linen" fabric made from a mixture yarn containing bast fibres, and possessing similarities to linen properties in appearance, wear and washing. In another dress fabric (matelassé) the weft is arranged two picks acetate yarn, two picks finer crêpe viscose. One pair weaves plain with 11 ends, and the other weaves plain with the alternate 11 ends. The last two of each 12 soft acetate picks weaves plain with all the warp in the cord giving a tight flat end to the cord, and the cords are then alternated for the next 24 picks. The more rounded cord made by the fuller weft causes it to stand out and the surface has thus plenty of "figure". There are 144 ends and 96 picks per inch, forming a fabric excellent in handle and draping qualities, with a complete absence of lustre on the acetate. Specimens are given of these two fabrics. W.

7—LAUNDERING, AND DRY-CLEANING

(A)—CLEANING

Detergents: Washing Power Determination. A. van der Werth. *Allgem. Oel u. Fett.-Ztg.*, 1933, 30, 588-594 (through *Brit. Chem. Abs. B*, 1934, 208).

Actual washing tests are considered complicated and unsatisfactory for general purposes, and the suggestion is made that it should be possible (and might be better) to get a useful comparison of the washing value of washing agents by measuring the three properties which are regarded as the essential factors conditioning their detergent action, viz. the adsorptive and dispersive properties and the wetting power of the solutions. Accordingly, it is proposed to determine (1) lathering number after 1 and 3 minutes, (2) lowering of interfacial tension (drop number) towards a water-insoluble liquid, and (3) the sinking time of a fabric (cotton, wool, silk, etc.), using in each case an aqueous solution of the detergent to which oil and carbon black have been added, in order to match practical conditions. The tests are to be made at, e.g. 20° and 80°, and the results grouped synoptically for comparison. C.

Trichlorethylene: Toxicity. K. Roholm. *Ugeskr. f. Laeger*, 1933, 95, 1183-1187 (through *Bull. Hyg.*, 1934, 9, 106).

Trichlorethylene is extensively used as a cleaning agent, and in 1931 one German worker reported on 284 cases of poisoning, including 25 deaths. Roholm reports a few acute cases from Denmark. Containers of trichlorethylene sold in Denmark must be marked with warning labels. C.

Laundering: Effect on Fabrics. R. E. V. Hampson. *J. Text. Inst.*, 1934, 25, P23-P32.

Soap Solutions: Properties. G. Jander and K. F. Weitendorf. *Angew. Chem.*, 1934, 47, 197-200.

The authors have investigated the properties of soap sols and gels and show that these contain soap crystals of colloidal dimensions arranged in a definite way and formed from truly dissolved monomolecularly dispersed soap. The concentration of the soap determines the degree of association and aggregation, and the bimolecular stage of aggregation is particularly important in the construction of the more highly aggregated soaps. C.

PATENTS

Cleansing Composition. R. F. L. Wille. F.P.747,708 of 22/6/1933 (through *Chem. Abs.*, 1933, 27, 5207).

A cleansing composition for the skin is composed of wool felt impregnated with a mixture of a solution of soap and an agent favouring the evaporation of water, such as acetone or "spiritus saponatus". W.

Cleaning Agent for Spots on Fabrics. E. H. Riesenfeld. D.R.P.584,515 of 22/9/1933 (through *Chem. Abs.*, 1934, 28, 1204).

A non-inflammable agent for cleaning spots from fabrics consists of up to 30% C₆H₆ or benzine mixed with CH₃Cl or chlorinated aliphatic hydrocarbons such as CHCl₃, CH₂Cl₂, CCl₄, etc. W.

8—BUILDINGS, AND ENGINEERING

(A)—CONSTRUCTION OF BUILDINGS

Timber: Protection against Moisture and Steam. C. D. Young. *Text. Mfr.*, 1934, 60, 61.

Tar and creosote can be used to protect woodwork against moisture and steam in such places as dyehouses, bleachworks, etc. Tar used alone must be applied hot, and preferably to a hot surface. Creosote alone varies in shade from the palest, which hardly stains wood at all, to one which gives a good brown. A range of shades is obtained by mixing in varying proportions. Modifications of the shade towards blues, greens and reds are obtained by dissolving in the solution suitable oil-soluble colours. Thickeners such as slaked lime, cement and flue dust may be added to tar-creosote mixtures. Solutions of tar and creosote with or without paraffin wax are suitable for application to floors. C.

(B)—FIRE PREVENTION

Fire Extinguishing Solutions: Composition. *Z. ges. Textilind.*, 1933, 36, 625-626 (through *Chem. Zentr.*, 1934, i, 1533).

The following mixtures are recommended as fire extinguishers for textile mills—(1) Salt 60 parts, alum 30, soda 10, made up as a 10% solution; (2) ammonium sulphate 1 kilo, aluminium sulphate 1 kilo, water glass 0.75 kilo, in 50 litres of water. C.

Cutting Fire Losses in Silk and Rayon Plants. Anon. *Amer. Silk J.*, 1934, 53, No. 2, pp. 43, 44, and 50.

Analysis of failures of automatic sprinklers shows the most common causes of failure to be closed gate-valves, faulty air-pressure, faulty water-level in the pressure tanks, and low temperature in exposed tanks. Satisfactory sprinkler operation can be practically guaranteed by fitting to the vital parts of the system contrivances which transmit a warning to a central station as soon as conditions become such as might prevent correct operation. Where sprinklers are not installed a system which automatically sends an alarm to a central station may be fitted. Circuits of narrow copper tubing are fixed along or round the ceiling or under the roof and the expansion of the air in the tube caused by a sudden rise of temperature operates an alarm; normal changes of temperature such as may be caused by heating systems do not work the alarm. Many of the buildings of the Century of Progress Exhibition in Chicago were protected in this way. Protection by night watchmen is at best uncertain, but the efficiency is greater when the watchman is supervised from a central station. S.

(C)—STEAM RAISING AND POWER SUPPLY

Dyehouses: Use of High or Low Steam Pressure. E. Praetorius. *Rayon and Melland Text. Monthly*, 1934, 15, 77-78 and 129-131.

The question as to which is the most economical pressure for the dyehouse is a debatable one. Technically, the pressure reduction down to 7 lb. per sq. in. is possible without affecting dyehouse operation, provided that sufficiently large steam pipes are chosen, and, in indirect heating, sufficiently large heating areas are provided. Generally, dyehouses which operate on live steam pressures of 20 to 30 lb. per sq. in. are most economical. With back pressure turbine arrangement, 7 to 15 lb. per sq. in. pressures are more suitable, even if a replacement of the entire pipe system is necessary. Large steam pressure variations and higher water content of the steam used for heating must be avoided. The safest method is the use of an accumulator. Changing a dyehouse to low pressure steam with direct heating of the dyevats is comparatively simple. With indirect heating of the dyevats the exchange and replacement of larger and longer pipes and coils cause difficulties and high costs. For already existing dyehouses with direct heating of the dyevats, a low pressure installation is not always economical and advantageous. W.

(D)—POWER TRANSMISSION

"Keepcool" Grease Box Lubrication Device: Advantages. *Text. Merc.*, 1934, 90, 254.

In a method of grease box lubrication, pads are made with "Keepcool" greasy yarn and are placed down the sides of the grease box resting on the shaft. The remaining aperture in the box is filled with "Keepcool" grease which comes into direct contact with the journal. The feed of grease is in direct proportion to the area of the journal exposed, which is determined by the thickness of the yarn pads. The advantages of this method include a decrease in running friction, no rotting of pillars and foundations as with oil, and no damage to goods by dripping. The filling of lubricant lasts more than a year and the cost of maintenance is only a fraction of the cost of oiling by the old method. C.

Power Transmission Belt: Theory. L. Houben. *L'Ingen. Text.*, 1934, No. 293, 46-63.

A historical survey of the development of theories of power transmission by belts. C.

(G)—HEATING, VENTILATION, AND HUMIDIFICATION

Air-conditioning Apparatus. Chapman Engineering Co. *Text. Weekly*, 1934, 13, 44-45.

Modern air-conditioning chambers of the spray type, the wet scrubber, or the combination spray and scrubber types, are available in units capable of dealing

with rooms from 20 feet square up to the largest installations for a complete textile mill. These can be worked either from one plant located centrally, or from individual units installed in each department, in accordance with particular requirements of each room. The temperature of the air can be automatically controlled and is raised by passing the incoming air through a chamber which contains the steam-heated element made of gilled copper tubing, which is controlled by a thermostat, giving any predetermined temperature or constant relative humidity. After passing through this heater, the air comes in contact with atomised water in the form of a mist, set up by a battery of water sprayers, the water being circulated from a galvanised tank in the base of the chamber. The water is filtered before it goes back to the pumps. Where floor space is limited, apparatus can be fitted by girders to the ceiling. In the case of large installations, the water is drawn off along piping to a tank, from which it is filtered and pumped back in a number of chambers supplying the conditioned air to the room. Series of filter cloths with screening arrangements are provided for the elimination of fog. The filter cloths can be easily removed for cleaning or renewal. Apparatus is also made for dust removal from raising machines, and for steam removal in dye-houses. C.

Dyehouse Ventilation System. *Deut. Färber. Ztg.*, 1934, 70, 100-101.

It is essential that drop in temperature and the entry of cold air be avoided in order to keep dyehouses free from mist. The best method of preventing the latter is by blowing in preheated air through a ventilator, thus keeping up a slight excess of pressure. The apparatus is arranged so that the steam from the dye vats is carried up by the hot air currents to prevent further mist formation. Some of the hot air should be directed on to the walls and ceilings to prevent condensation of the fog thereon. Diagrams are given of dyehouses (a) with a single apparatus, and (b) with a centralised composite apparatus. C.

Buildings: Heating and Ventilating. F. C. Houghten. *Mech. Eng.*, 1934, 56, 144-148.

A discussion is given of heat transfer data for boilers, commercial radiators, and mechanical air circulation heating units, heat transfer rates through common types of building construction, the effect of heat capacity of the building structure on instantaneous rate of heat transfer, and complications arising from the effects of heat from solar radiation. C.

Pneumatic Transport Centrifugal Fan: Loading. M. P. Kalinuschkin. *Trans. Centr. Aero-Hydrodyn. Inst.*, 1933, No. 168, 1-48 [in Russian] (through *Zbl. Mech.*, 1934, 1, 371).

Experiments are described on the influence of the amount of impurity in the air (shavings, sawdust and peat litter) on the load on centrifugal ventilating fans. The ratio of the weight of solid transported in unit time to that of the air, designated μ , was 1:20, 1:15, 1:10, and 1:5 in different experiments. If the power consumption of the fan for pure air is given by N_p , that for impure air under comparable conditions is roughly given by $N_s = N_p(1 + \mu)$. Rotors with widely spaced blades are recommended. C.

Quiet Propellor Fans: Development. K. D. McMahan. *Gen. Elec. Rev.*, 1934, 37, 82-86.

Numerous tests have shown that noise in any propellor fan depends upon the maximum axial velocity of the discharge air stream and the effective width of the blade. A formula expressing the relation between noise and these quantities is given. The requirements for quiet operation are outlined and the special features of a fan designed to meet these requirements are described. Noise and efficiency in a fan are not connected by any energy relation but features which reduce noise of operation also increase efficiency. Equations for the complete performance of a pressure-type fan, operating at its maximum efficiency, in terms of speed and diameter only, are given, together with a performance chart for pressure-type fans at maximum efficiency. C.

Influence of Air Circulation on Psychrometric Data. H. Bongards. *Z. f. Instrumentenk.*, 1934, 54, 19-21 (through *Rev. Sci. Instr.*, 1934, 5, 132).

A review of the subject of the influence of air circulation on the reading of a wet-bulb thermometer. An extensive bibliography is included. W.

Humidity Control. Minneapolis Honeywell Regulator Co. *Canadian Text. J.*, 1934, 51, No. 4, p. 37.

The hygroscopic element, composed of multiple groups of human hair, actuates a lever mechanism which transmits the motion to a mercury switch, which, in turn, operates the humidifying or de-humidifying equipment. The setting pointer, constructed for a range of 20% to 80% relative humidity, is internal. A variation of not more than 2% relative humidity is claimed. W.

Some Accurate Methods of Determining the Number and Size-Frequency of Particles in Dusts. H. L. Green. *J. Indust. Hyg.*, 1934, 16, 29-39 (through *Bull. Hyg.*, 1934, 9, 230).

A sedimentation method is described for estimating the number and size-frequency of dust particles. It is intended for fundamental research purposes in the laboratory when testing the efficiencies of dust-sampling apparatus. A sedimentation cell is used, consisting of a brass cylinder 5 cm. deep. This is waved up and down in the air to be examined. Then a swivel lid is applied to the top and the bottom is closed by a brass slide in which two $\frac{1}{2}$ -in. cover-slips are mounted. The cell is next left for some three hours for the dust to settle on the slips; after which each slip is mounted by placing spots of Canada balsam on it and then bringing a slide down on it. The particles are counted through the agency of a graticule; the one used was exactly similar to the one used by Patterson and his co-workers in their work on smokes. The method is most suitable for clouds containing not less than 1,000 particles per c.c. and is useful down to 100 particles; it covers the whole size-range down to 0.2μ diameter, below which size particles do not exist in industries to an appreciable extent. T.

(I)—WASTE DISPOSAL

Effect of Precipitants on Textile Waste Liquors. H. F. Chrisco, A. M. White, and H. G. Baity. *Sewage Works J.*, 1933, 5, 674 (through *Water Poll. Res. Bd. Abs.*, 1934, 7, 141).

The factors to be considered in estimating the treatment required by a waste before discharge into a stream, i.e. use of stream, dilution afforded and biochemical oxygen demand, and acidity or alkalinity, colour, odour, and suspended solids content of the waste, are briefly discussed. Experimental data are then given of coagulation tests made with 29 different textile wastes, including indigo and sulphur dye wastes, processing wastes and other dye wastes, using varying amounts of different reagents, mainly alum, lime, copperas, calcium chloride, ferric chloride, sulphuric acid or mixtures of these, to determine the optimum amount of each reagent. The pH and colour of each waste were measured before and after treatment and the ratio of sludge volume to volume of supernatant liquor after 24 hours' settling was determined. An effluent with a colour of 100 or less based on the platinum-cobalt standard and a pH of 8.0-6.0 was considered satisfactory. In general the combined use of copperas and lime seems to produce the best colour removal. The precipitate formed varies in consistency and speed of settling with the ratio of copperas to lime used. Copperas generally produces a relatively slow-settling gelatinous sludge while lime yields a granular free-settling precipitate. The ratio of sludge volume to volume of supernatant liquor after 24 hours' settling seems to be an index of the settling speed of the slurry. A study of each of the component wastes is frequently necessary for the satisfactory treatment of a composite effluent. Sulphur wastes can be clarified best by strong acids such as sulphuric, nitric, or hydrochloric. A highly acid milky effluent is produced which can be mixed with alkaline liquors produced elsewhere in the mill so that the discharge of acid material is avoided and the treatment of the other wastes facilitated. W.

The Heating Effect of Artificial Lighting. W. Sturrock and J. H. Walker. *Trans. Illuminating Engineering Soc.*, 1934, 29, 23-45 (through *Bull. Hyg.*, 1934, 9, 265). T.

PATENTS

Centrifugal Separator. C. H. W. Cheltnam (London). E.P.406,036 of 19/8/1932.

The invention relates to centrifugal separators for separating and collecting dust or other solid particles from dust-laden air and gases, of the class in which the dust-laden air or gas is propelled tangentially by one or more inlets into the head of a vessel of circular or approximately circular section, the more or less dust-free air or gas being discharged axially from the same end of the vessel, whilst the dust,

after separation, is discharged axially from the opposite end of the vessel. In the arrangement described in E.P.327,703, a secondary separator is arranged coaxially with the primary separator. According to the present invention, variations are provided in the shape of the dual separator, all characterised in that the wall of the primary separator meets that of the secondary separator at an angle, externally, of less than 180° , so that a major portion of the conveying fluid, in spirally descending the primary separator, overshoots the entrance to the secondary separator; whilst the dust, by reason of its superior centrifugal force, together with a minor portion of the conveying fluid, enters the secondary separator.

C.

Purifying Dry-Cleaners' Solvents. R. G. Walker, assr. to De Laval Separator Co. (New York). U.S.P.1,919,644 of 13/1/1930.

The solvent flows over a decolorising agent and then the heavier impurities are centrifuged out, these two operations being worked in an endless ring. High-boiling hydrocarbons are removed by by-passing and distilling.

S.

Clarifying Used Dry-Cleaning Fluids. R. A. Morgan (Kansas). U.S.P.1,926,813 of 28/7/1930.

Siliceous materials, such as natural silicates from the Creede formation in Colorado and a dehydrated clay, are used to adsorb dissolved impurities and soaps from the solvent, adsorption being promoted by addition of a solid mild alkali, such as sodium silicate, phosphate, or carbonate.

S.

9—PURE SCIENCE

Rod-like Colloids : Diffusion Coefficients. R. O. Herzog and H. Kudar. *Z. physikal. Chem.*, 1934, A167, 343-353.

The authors discuss various methods for determining the particle size of colloids by diffusion experiments, and show values obtained for the C_{34} paraffin hydrocarbon, polystyrol in chloroform, cellulose acetate in methyl glycol, and ethyl cellulose in benzene. The method provides another means of estimating the particle length of rod-like colloids, when the molecular diameter is known.

C.

Colloid "Bound Water": Determination. R. A. Gortner and W. A. Gortner. *J. Gen. Physiol.*, 1934, 17, 327-339.

A new method of calculating the true freezing point of a solution is proposed. With gum acacia in aqueous sucrose solutions, the data indicate a positive amount of bound water, 0.6 to 0.7 g. per g. of gum, but in aqueous solutions of potassium chloride or bromide the values are slightly negative, indicating a preferential adsorption of the solute rather than the solvent by the gum.

C.

Membrane ; Diffusion through——. C. Barnes. *Physics*, 1934, 5, 4-8.

An exact solution is obtained for the problem of diffusion through a membrane separating two stirred solutions of different concentrations. For a diffusion cell in which the two liquid containers have the same volume and for which the ratio λ ("effective" volume of membrane: volume of liquid) is small compared with unity, the solution gives explicit expressions for the concentrations at any time in terms of the initial distribution of concentration in the membrane. Two cases are treated—(1) zero initial concentration in the membrane and in one of the two liquids; (2) an initial linear concentration gradient connecting the concentrations in the two containers. The usual assumption of a linear gradient across the membrane during the whole course of diffusion will not lead to an appreciable error in a determination of a diffusion constant unless λ exceeds 0.1 or the time of diffusion is much shorter than in the usual practice. Since λ is about 0.02 in the usual type of diffusion cell the use of the simple expression based on a linear gradient cannot be in error. If, however, the preliminary treatment of the membrane fails to yield an initial linear gradient in it, an appreciable error will be made even with λ less than 0.02.

C.

Powders : Particle Size Determination. R. T. Knapp. *Ind. Eng. Chem. (Anal. Edn)*., 1934, 6, 66-71.

A system is described for determining the size distribution of particles in fine powders from a sedimentation curve in which the time of settling is the abscissa and the weight of material is the ordinate. The apparatus consists of a series of

settling jars in which changes in hydrostatic pressure just above the bottom of the column are transmitted by means of bellows inside a pressure cell. Movement of the bellows results in the tilting of a mirror so that a spot of light moves across a photographic plate, leaving a track which can be analysed when the plate is developed. An operator should be able to complete 18 analyses in an 8-hour day. C.

Falling-sphere Viscometer. B. A. Jones. *Ind. Eng. Chem. (Anal. Edn.)*, 1934, 6, 80-84.

An automatic modified falling-sphere viscometer for very viscous liquids (e.g. rubber cements and petroleum products) consists of an inclined guide immersed in the material to be tested. The ball is released from an electromagnetic member immersed a short distance beneath the surface of the sample, and at the same time an electric clock is automatically started. The ball moves down the guide for a fixed distance in the liquid until it comes into contact with a sharp edged electrode (the guide itself being the other electrode). When the ball strikes the other electrode, the electric clock is automatically stopped and the reading of the clock is a measure of the viscosity of the liquid. Results are rapid, reasonably accurate, and operation is of the simplest. C.

Flour Suspensions : Viscosity. R. K. Larmour and H. R. Sallans. *Canadian J. Res.*, 1933, 8, 364-374.

Measurements of viscosity with the MacMichael instrument on unleached suspensions of wheat flour are shown to provide a trustworthy and quick guide to baking quality. C.

Rotating Sphere and Cylinder Viscometer. G. Duffing. *Z. angew. Math. u. Mech.*, 1933, 13, 366-373 (through *Physikal. Ber.*, 1934, 15, 248-249).

The author discusses the drawbacks to viscometers of the flow, co-axial cylinder and falling-sphere types and develops the laws of flow for a sphere moving co-axially with a cylinder. This is shown to be a simple case and, provided the dimensions of the sphere and cylinder are accurately known, it should be possible to construct an absolute viscometer of this type in a compact form suitable for industrial use. C.

Synthetic Resins : Photo-elastic Properties. R. B. Carleton. *Rev. Sci. Instr.*, 1934, 5, 30-32.

Glass, celluloid, cellulose acetate, hard and soft rubber and seven synthetic resins have been tested to determine their suitability for photo-elastic investigations. The stress-strain relations, photo-elastic coefficients and annealing temperatures are recorded and the conclusion is reached that Phenolite, Bakelite, and L'Orca resins are among the most satisfactory materials for photo-elastic purposes. C.

Experimental Data : Analysis. Hilda Geiringer. *C. r. Acad. Sci.*, 1934, 198, 696-698.

A method is described, applicable to statistical problems of two or more dimensions, for studying the hypothesis that a series of results $x_1 \dots x_m$ can be interpreted by a law of probability $p(x)$ of known form, but with k unknown parameters $a_1 \dots a_k$. C.

Experimental Data : Correlation. B. Germansky. *Z. Instrumentenkunde*, 1934, 54, 37-45.

A general graphical method is discussed in the theory of correlation of observations, using the method of least squares. C.

Latin Square Experimental Plans. F. Yates. *Empire J. Exper. Agric.*, 1933, 1, 235 (through *Empire Cotton Gr. Rev.*, 1934, 11, 67).

The conditions which must be fulfilled in selecting Latin-square arrangements for agricultural field trials are discussed. Examples of squares up to size 12×12 are given, from which experimental arrangements may be derived by simple processes of permutation. All squares up to size 6×6 have been enumerated elsewhere, and the totalities of these squares are presented here in compact form. C.

Random Sampling Numbers : Use in Agricultural Experiments. P. C. Mahalanobis. *Indian J. Agric. Sci.*, 1933, 3, 1108-1115.

A short list (selected from Tippett's work) is given of 2,000 random numbers arranged in 500 sets of 4, together with examples indicating the ways in which they may be used in agricultural experiments. C.

“Heavy Water” : Influence on Mildew Growth. S. L. Meyer. *Science*, 1934, 79, 210-211.

The nutrient solution used in the experiments was Pfeffer's three-salt solution, with sucrose as the source of carbon. Two groups of nutrient solutions were prepared, one with ordinary distilled water (H^1), the other with distilled heavy water (H^2). Inoculations were made from a pure, bacteria-free culture of *Aspergillus sp.* on bread by means of a platinum loop. The fungus was grown in an incubator for five days at a temperature of $37^\circ C$. The mycelial felts were then removed from the flasks, placed on weighed filter paper and dried for three days at $65^\circ C$., and then weighed. The fungus grown in the ordinary water—Pfeffer's medium—was in the form of a flat and evenly fruited felt. The felts grown in the heavy water medium exhibited every indication of stimulation. They were markedly convoluted and cratered below, resembling a brain-coral; the fruiting was greatly diminished, and the distribution of spores on the surface of the felts was irregular and occurred in localised regions. The average weight of these felts was approximately 16 times that of the felts grown in the ordinary distilled water medium. It is concluded from these results that deuterium, when used in dilute concentrations, may have a decided effect in stimulating vegetative growth and development. C.

Sodium Fluoride Hide Preservative : Application. M. E. Robertson, R. H. Marriott, and F. E. Humphreys. *J. Soc. Chem. Ind.*, 1934, 53, 83T-89T.

The addition of sodium fluoride or sodium fluosilicate to salt used in the cure of hides inhibits the growth of “Red Heat” on cured hides and, in general, gives better preservation than salt alone. Gelatins made from hides so treated did not appear to contain appreciably more fluorine than the normal edible gelatines. The fluorine was determined by evaporating and ashing the gelatine after treatment with lime water and titrating the residue with thorium nitrate, using the zirconium alizarin sulphionate complex as indicator. C.

Copper : Catalytic Micro-determination. F. L. Hahn. *Mikrochemie*, 1934, 14, 280-282.

A graph is given showing the quotient t_0/t_c for the decolorisation of ferric thiocyanate with thiosulphate (where t_0 is the time for decolorisation in the absence, and t_c in the presence, of copper as catalyst), plotted against increasing small concentrations of copper. Curves are drawn for various concentrations of iron and thiosulphate, and can be used in the detection of copper by this reaction. C.

Copper : Detection. R. J. McIlroy. *Analyst*, 1934, 59, 103.

When a few drops of a mixture of potassium thiocyanate solution and 2 or 3 drops of an aqueous solution of *p*-phenylenediamine are added to a solution of a copper salt a black precipitate of copper thiocyanate phenylenediamine is produced, containing 25.08% of copper. The test is capable of detecting 1 part of copper in 100,000. The precipitate is formed in ammoniacal or neutral solutions; it is soluble in acid, giving a black solution. C.

Flour Ash : Determination. E. B. Working and E. J. Anderson. *Cereal Chem.*, 1934, 11, 94-98.

The sample of flour is placed in a platinum dish, moistened with an alcoholic solution of magnesium nitrate, and ignited, the dish resting on a cold porcelain dish to keep the temperature below that likely to cause sputtering. The ash is tapped off from the dish into a balance pan and weighed directly. The blank of the magnesium nitrate solution is determined by determining ash on one or two samples by the ordinary method, or by burning a sample without using the solution. C.

Aminocelluloses : Properties. S. Malowan. *Kunststoffe*, 1934, 24, 53-55.

A review of literature and patents relating to the introduction of amino, amido, and cyanide groups into cellulose. The amido-celluloses coupled with heterocyclic rings are more rapidly and intensely dyed by acid dyes than wool. C.

Cellulose ; Absorption of Caustic Soda by— W. D. Bancroft and J. B. Calkin. *Textile Research*, 1934, 4, 119-140 and 159-182.

A critical review of data on the system caustic soda-cellulose incorporating some new results on the absorption of caustic soda and water by cotton, cellophane, and viscose rayon. A simple equation has been deduced by means of which the Vieweg change-in-titer data can be calculated from total adsorption data. It is

shown that the constant composition part of the curves obtained by the Vieweg method is the result of a balance between increased caustic soda and decreased water taken up and that a compound of the composition $(C_6H_{10}O_5)_2 \cdot NaOH$, which Vieweg and others claim to be formed in mass, does not exist and, therefore, cannot cause mercerisation. There is no definite proof that mercerisation is caused by the formation of any definite compound in mass, but it should be considered a process of adsorption. Mercerisation results in an increased adsorption surface of the fibres. C.

Cellulose Pulps: Hydration and Beating. W. B. Campbell. *Ind. Eng. Chem.*, 1934, 26, 218-219.

The author discusses the causes of the attraction of cellulose for water and attributes it mainly to its hydroxyl groups. The length of the molecule prevents its being dissolved by water, although the crystallites are separated by water so that swelling occurs. The swollen cellulose structure is then fibrillated by the beating process. The compacting force of the surface tension of the concave menisci between the fibres is proportional to the amount of fibre in the surface and is, therefore, increased by fibrillation, so that beating produces a paper of increased density and tensile strength. C.

Rapid Electric Dialyser. H. Brintzinger, A. Rothaar, and H. G. Beier. *Kolloid Z.*, 1934, 66, 183-188.

A rapid electric dialyser is described with a specific surface of $F=1.40$ instead of the usual $F=0.34$, and with a capacity of 1,000 c.c. Stirring is effected by rotating the outer-membrane holder, so that a special device is unnecessary. The speed of operation is superior to that of Pauli's apparatus, and optimum efficiency may be obtained by choice of suitable membranes and maintenance of appropriate temperature. C.

Proteins: Influence of Electrolytes on Spreading. E. Gorter. *Proc. K. Akad. Wetensch.*, 1934, 37, 20-22.

On the acid side of the isoelectric point (pH 3) the effect of univalent anions on the spreading of ovalbumen is in the order $CNS > I > Br > Cl$. With univalent cations on the alkaline side of the isoelectric point (pH 2.85), the influence on the spreading of pepsin is in the order $Na > K > Li > NH_4$. No difference in the behaviour of bivalent cations could be observed. C.

Wetting Agents: Effect on Paraffin. P. Rehbinder, M. Lipetz, and M. Rimskaja. *Kolloid Z.*, 1934, 66, 212-219.

Tables are given of the wetting action on paraffin of the following substances—Fatty acids, phenols, alcohols, aqueous solutions of xanthates, aromatic amines, and sodium oleate and sodium palmitate. The method of observation generally employed is that of measuring the angle of contact. Isotherms are determined and various effects of chain length in homologous series are discussed. C.

Drying Agents: Comparative Efficiencies. J. H. Bower. *Bur. Standards J. Res.*, 1934, 12, 241-248.

The various types of drying agents and their different modes of functioning are discussed. The method employed for determining the comparative efficiencies of the more common commercial drying agents as well as some newer drying materials recently introduced, was to aspirate properly conditioned air through a train of U-tubes containing the drying materials in the order of their increasing drying powers. After a measured amount of air had passed through the system, the increase in the weights of the U-tubes following any one U-tube indicated the residual water escaping that tube. The materials studied (with the amount of residual water in milligrams per litre of air dried), in the order of increasing efficiency at $30^\circ C.$, follow— $CuSO_4$ (anhydrous) (2.8); $CaCl_2$ (granular) (1.5); $CaCl_2$ ("Technical anhydrous") (1.25); $ZnCl_2$ (sticks) (0.98); $Ba(ClO_4)_2$ (0.82); $NaOH$ (sticks) (0.80); $CaCl_2$ (granular) (dehydrated) (0.36); $Mg(ClO_4)_2 \cdot 3H_2O$ (0.031); Silica Gel (0.030); KOH (sticks) (0.014); Al_2O_3 (0.005); $CaSO_4$ (anhydrous) (0.005); CaO (0.003); $Mg(ClO_4)_2$ (0.002); BaO (0.00065). C.

Cellulose Sheet: Adsorption of Electrolytes and Swelling. K. Kanamaru. *Kolloid Z.*, 1934, 66, 163-175.

The author has investigated the behaviour of sheet cellulose in solutions of caustic soda, hydrochloric acid, sulphuric acid, potassium chloride, and aluminium chloride by determining changes in pH and weight of solution taken up.

It appears that adsorption is relatively greater in dilute solutions, and that in more concentrated ones it tends towards a maximum. In the acid range the p_H of the supernatant liquid is greater than that of the original solution, while in the alkaline range the reverse is true. A maximum of swelling is found at a definite p_H in both acid and alkaline regions. The author defines as "hylotropic adsorption" the point at which solvent and solute are taken up by the cellulose in the same proportions as they are contained in the solution, and this occurs at a definite p_H according to the previous history of the cellulose. Measurements in solutions of potassium chloride and other electrolytes show a relation between swelling and the corresponding ζ potential of cellulose, both of which pass through a maximum.

C.

Clay: Deformation. G. L. Pokrowski and W. G. Bulytschew. *Kolloid Z.*, 1934, 66, 137-139.

A mathematical expression can be found for the relationship between force and deformation by pressure and traction in highly concentrated disperse systems. No marked change is observed in the modulus of elasticity during transition from pressure to traction and vice versa. These theoretical results were confirmed experimentally for clays. An apparatus is described and illustrated in which the direction of the force can be altered, so that traction experiments can be carried out with a pressure device.

C.

Cellulose Ester Films: Electron Diffraction Diagrams. J. J. Trillat. *C. r. Acad. Sci.*, 1934, 198, 1025-1027.

Films from 50-100 Å thick may be prepared by pouring on to clean mercury solutions of nitrocelluloses or cellulose tributyrate, triacetate, etc. in appropriate solvents, and allowing the solvent to evaporate. These have been used to obtain diagrams of single crystals of cellulose acetate and nitrocellulose. The diagrams of the cellulose esters obtained with an electronic pencil perpendicular to the film show identically placed diffraction spots of equal intensity, whilst characteristic interference figures occur when the angle of incidence is varied. The author concludes that the cellulose chains are parallel and laid flat on the surface of the film, and the equivalent atoms are at the junctions of a rectangular central network, the sides of which are $a=7.10$ Å, $b=4.68$ Å, and $c=2.5$ or 5.0 Å, the mesh probably being monoclinic.

C.

Animal Amylase: Inactivation by Sistoamylases. T. Chrzaszcz and J. Janicki. *Biochem. J.*, 1934, 28, 296-304.

Experiments on salivary and pancreatic amylase have shown that plant sistoamylase inactivates not only plant but also animal amylase. Dried sistoamylase inactivates amylases more powerfully than undried. In the place of origin of amylases as well as in their solutions natural paralyzers, the so-called animal sistoamylases, are also found. The system sistoamylase-amylase is thus formed, in which the amylase is partly inactivated. Usually about one-third of the salivary and about one-fifth of the pancreatic amylase is not adsorbed. In the system plant or animal sistoamylase-animal amylase, in which the amylase is inactivated, the amylase can be reactivated by the aid of eleuto-substances such as peptone. Certain forms of dried sistoamylase are of such adsorbing power that the amylase cannot be eluted by the use of peptone. The increase of amylolytic action of amylase on the addition of certain substances is explained as an elution of amylase, which in this manner is rendered free to act.

C.

Determination of Organically Combined Sulphuric Anhydride in Sulphonated Oils.

R. Hart. *Amer. Silk J.*, 1934, 53, No. 2, pp. 47, 48, 58, and 60.

Second report of the Sub-Committee on Sulphonated Oils of the American Association of Textile Chemists and Colourists. The method of analysis depending on hydrolysis with sulphuric acid at the boiling point and determination of the resulting increase in acidity is unreliable in presence of titratable salts such as sodium acetate. An alternative method consists in dissolving in ether, decomposing the soaps with mineral acid, washing with saturated salt solution, evaporating the ether extract, and determining the ash, which represents half the combined sulphur trioxide in form of sodium sulphate— $2\text{ROSO}_3\text{Na} = \text{Na}_2\text{SO}_4 + \text{SO}_3 + \text{etc.}$ This method is applicable to all types of sulphonated oils which may be completely extracted from salt solution without causing troublesome emulsions, and therefore to sulphonated oils not decomposed on boiling with mineral acids, including sulphonated mineral oil. Sulphonated oil is least

soluble as its monosodium compound and in that form is completely extracted from saturated solutions of sodium chloride or sulphate. Therefore the amount of acid added before extraction should be little greater than is required to decompose the soap. Such substances as sodium acetate do not interfere. S.

Action of Certain Volatile Substances and Gases on the Growth of Mould Fungi.

R. G. Tomkins. *Dept. Sci. and Indus. Res. Report Food Invest. Bd. for the Year 1932*, pp. 62-65, 1933 (through *Rev. Appl. Mycol.*, 1934, **13**, 117). W.

Antioxidants for Fats and Oils. G. R. Greenbank and G. E. Holm. *Ind. and Eng. Chem.*, 1934, **26**, 243-245.

Of the phenols, only the ortho and paratypes are active as antioxidants for fats and oils. Some unsaturated polybasic aliphatic acids, notably maleic, are also antioxidants for fats and oils. W.

pH Control. E. Cannity. *Hunter Counselor* (through *Canadian Text. J.*, 1934, **51**, No. 4, pp. 35-36).

A general article dealing with the meaning of hydrogen ion concentration. pH values are given of one-tenth normal solutions of sulphuric, acetic, carbonic and boric acids, and of alum, sodium bicarbonate, ammonia and sodium carbonate, also the approximate pH values of some common foodstuffs and beverages and of wool. W.

Determination of Cystine. B. J. Krigsman and E. F. Bouman. *Arch. néerland. physiol.*, 1933, **18**, 458-471 (through *Chem. Abs.*, 1934, **28**, 1730).

The determination of cystine by the method of Folin and Looney is not satisfactory for blood. By means of the step photometer the Sullivan method for the determination of cystine-cysteine has been elaborated for use with blood. Only the total cystine values, however, are free from objections. Blood from hungry rats contains only traces of cystine. After feeding, the cystine content may increase to 14 mg. per cent. Twenty-six references are given. W.

The Glass Electrode and Sulphated Oils. Part I. (Committee on Oils, Fats and Waxes. No. 9.) D. Burton and G. F. Robertshaw. *J. Inter. Soc. Leather Tr. Chem.*, 1934, **18**, 19-22.

A table is given showing the pH values, at different solutions, of a commercial sulphated cod oil (containing 66% mineral oil and 7.5% water), determined by the glass electrode, colorimetric, bubbling hydrogen electrode, Wulff, and quinhydrone methods. All these methods, with the exception of the bubbling hydrogen electrode, indicate that the pH falls with dilution instead of rising as might, at first sight, be expected. Results with two sulphated castor oils show the same change of pH on dilution, and therefore that the pH of an oil should be determined at the dilution at which it is to be used in practice. In order to investigate the effect of the presence of mineral oil two types of sulphated products were prepared from Newfoundland cod oil, the results showing that the addition of mineral oil increased the pH in nearly every case. W.

The Proteins of Grasses. III—The Cystine Content of Certain Grasses and other Pasture Plant Proteins. A. Pollard and A. C. Chibnall. *Biochem. J.*, 1934, **28**, 326-335.

The cystine content of several typical grasses and other pasture plant proteins has been determined by Prunty's modification of Sullivan's colorimetric method. The grass proteins all contain cystine, in amount varying from 0.3 to 0.95%. Lucerne leaf protein is particularly rich in cystine and contains 1.2%. The gravimetric method of Vickery and White gives in all cases a much higher value for cystine-sulphur than the amount shown to be present and must include the sulphur of an unknown amino-acid. The protein-cystine content of the grasses and other pasture plants at various protein levels has been calculated, and it appears that pasturage contains ample cystine for the wool-protein requirements of the sheep which it normally carries. (For Part II see *J.T.I.*, 1934, A157.) W.

Research and the Jute Industry. W. H. Gibson. *Text. Mfr.*, 1934, **60**, No. 710, pp. 71-72.

Reference is made to the question of research for the jute industry, and how this section of textiles is behind other major textile industries in this respect. A brief survey is given of the benefits obtained from research on linen, and the writer states that the linen and jute industries have much in common. L.

PATENTS

Colorimeter N. V. Philips' Gloeilampenfabrieken (Eindhoven, Holland). E.P. 406,890 of 17/5/1933.

A colorimeter is described in which by the superposition of three primary colours a colour impression is obtained which is equal to that of the colour to be measured. The primary colours are monochromatic and are obtained by filtration of light emitted by so-called spectrum tubes. A neon lamp and two mercury lamps are used as light sources from which by filtration the spectrum lines 637 m μ , 546 m μ and 435 m μ are obtained. The intensities may be varied by varying the position of each lamp relatively to the photometric screen and by varying the amount of light from each lamp by means of a diaphragm. The three primary colours are superposed by means of selective semi-transparent mirrors formed by applying thin coats of intensely coloured substances such as indigo-carmin, methyl violet and toluidine blue to plate glass. C.

Extraction of Proteolytic Enzyme from Fig, Mulberry, Papaya, Pineapple, or Banana Trees. C. Wada (Tokyo). E.P. 379,205 of 11/1/1932.

The expressed juice of the branches, leaves, stalks, or green fruit, after suspended matter has settled out, is acidified with acetic acid and concentrated under reduced pressure until it has become syrupy and the density is not less than 30° Bé. Acetone is then added, and after 24 hours the white precipitate which separates is removed and washed with methyl alcohol. The product is odourless and non-hygroscopic. The optimum temperature for its activity is 37°, and the optimum pH 4-5. S.

10—ECONOMICS

Cotton Trade Index Numbers, February 1934. W. H. Slater. *Text. Weekly*, 1934, 13, 67.

The cotton trade indices for February 1934 are—*Raw Cottons*, American 93.07 (+69.5); Egyptian 75.12 (+52.7). *Cotton Yarns*, American 104.9 (+30.0); Egyptian 92.5 (+22.7). *Cotton Piece Goods*, 122.5 (+12.5). *All Cottons*, 107.3 (+24.4). *All Commodities*, 105.3 (+5.8). The numbers in brackets indicate the percentage change since leaving the gold standard. C.

Rayon: Output 1933. R. Flint. *Wirtschaftsdienst*, 1934, 19, 318-321.

The chief feature of the rayon industry for the last four years has been the rise of Japan to second from sixth place as a producer. Nevertheless, only a small fraction of European imports come from Japan and the United States, since only those yarns are imported that cannot be produced at home. Production, export, and import tables are given for the chief countries of the world between 1930 and 1934. It is argued that England was the only country to prosper during 1933, the success of Japan being only apparent on paper. Production costs generally have been lowered while prices remained constant, only Courtaulds lowering their prices. C.

Costing and Control of Raw Material in Silk Weaving. A. R. Steudtner. *Textilber.*, 1934, 15, 60-61. S.

New Provisions for Regularity in Italian Silk Industry. *Silk and Rayon Digest.*, 1934, 26, No. 10, pp. 9 and 10.

Text of the Decree of 19th October 1933, covering regularity in production of silkworm eggs, in baking cocoons, in operating silk conditioning houses, and in exportation of silk. The raising, with the object of breeding or crossing, of any type of cocoon strain not pure or recognised as a newly established strain is forbidden. Each year only eggs the quality of which was determined in the preceding year may be sold. The preparation of quarters for reproduction purposes will be controlled by establishments officially authorised. Establishments for baking and drying cocoons may operate only if officially approved. The enforcement of these regulations is to be in the hands of a Commission including representatives of the government and the research stations. Silk testing establishments and conditioning houses may be operated only if officially authorised, and the surveillance of such institutions will be in the hands of the Royal Silk Experimental Station of Milan. The export of silk simply treated and not accompanied by a

certificate of classification from a testing and conditioning house is prohibited. A tax not exceeding 10 centesimi per kilogram will be levied on simply treated silk presented for inspection at the conditioning and testing houses. S.

Recommendation from Consumers' Advisory Board of N.R.A. for Revision of Silk Textile Code with Reference to Weighting and Fabric Identification of Silk.

Silk and Rayon Digest., 1934, 26, No. 12, pp. 7, 12, 18-20, and 22.

The question of the correct description of weighted silk material offered for sale is discussed and the results of the examination of silk goods purchased at shops are described. Researches carried out recently in America and in part unpublished are briefly summarised, and investigations being carried on at present are enumerated. Weighted silk so aged as to have lost much strength but still having measurable breaking strength goes to pieces in dry cleaning, whereas pure silk aged for the same time under similar conditions is not appreciably affected by dry cleaning. Perspiration causes greater loss in breaking strength in weighted silks than in unweighted silk, and following ageing the weighting process causes partial hydrolysis of the proteins of the silk. Breaking strength and tear resistance losses in silk fabrics increase with the amount of stannic chloride-sodium phosphate weighting in the silk. Some of the nitrogen of the silk is converted into a water-soluble form during ageing, the amount being increased by either treatment with artificial perspiration or exposure to indoor daylight, and usually exceeding the amount of tin weighting on the silk. Consumers are unable to judge weighting and durability by feel. The desirability of incorporating in the Silk Textile Code a clause calling for standards dealing with weighting, fabric identification, colour fastness, and quality identifying labelling is urged. S.

Paper from Flax Châff. N. N. Orlov and K. A. Dolgov. *Bumazhnaya Prom.*, 1933, 12, 56-61 (through *Chem. Abs.*, 1933, 27, 5185). L.

Bengal Jute Inquiry Report. *Irish and Scottish Linen and Jute Trades Journal*, 1934, 21, 35.

The report recommends that a Jute Committee should be established by Statute, its functions being advisory. It should carry out agricultural, technological and economic research such as the improvement of crop forecasting and statistics, the production, testing, and distribution of pure seed, marketing, etc. It is proposed that technological laboratories should be established with chemical, physical fibre-testing and microscopic sections. L.

Trends of Technical Change in Jute Manufacture. A. Brand. *Text. Mfr.*, 1934, 60, 12-14.

This article refers to developments arising out of post-war conditions, which have compelled close examination of all the means of production of jute yarns and goods. At present the jute manufacturer has a greater choice of machinery and methods than ever before. The technique of the whole industry is at present in a state of flux, but probably the next few years will see a definite movement towards one or other of the systems now being installed in several mills. L.

Jute and Indian Jute Manufacture. *Text. Mfr.*, 1934, 60, 69-70.

Refers to the Indian jute industry expansion. Competition from Continental and other (non-British) countries is engaging the serious attention of those connected with the jute trade of Bengal, while the question of substitutes has not been overlooked. The U.S.A. compensatory tax on jute to safeguard the American cotton industry is also mentioned. It is suggested that scientific research should be applied to the jute industry to counteract potential sources of loss, improve quality, establish better standards and to enhance efficiency in production. L.

Jute Trade in India. *Text. Mfr.*, 1934, 60, 62.

Mr. H. H. Burn, Chairman of the Indian Jute Mills Association, presiding at the annual meeting, on January 31st, said the world consumption of jute products was healthier than in 1932, while exports generally were satisfactory. Referring to the increased export of jute cloth from the United Kingdom he said "It behoves us to keep a watchful eye on overseas competition to see that the position does not so develop, that competitors in other countries get a grip on the trade that we are unable to shake off, because of the restricted working to which we are now keeping." He also referred to the possibility of new competition from Japan. L.

Belgian and British Flax and Cotton Conditions. *Text. Mfr.*, 1934, 60, 62.

A delegation of Belgian textile leaders recently visited Lancashire and Belfast to investigate working conditions. M. A. Segier, the General Secretary of the Belgian Union of Textile Workers, said that Lancashire and Belfast wages were 30% higher than Belgium. Unemployment was not as bad as in Belgium, where 52% of the textile workers were out of work. Lancashire and Belfast conditions were more hygienic than Belgium. Lancashire production is higher than Belgium, because the material is better prepared, and good quality material is used. Belgian mills try to compete with inferior material, but Lancashire proves that the better quality material is better competitively. L.

The Jute Industry in Dundee. J. Ernest Cox. *Text. Mfr.*, 1934, 60, 63.

As the position and prospects of Dundee are controlled by the competition of other industries, this article states that prosperity must depend upon efficiency in production. Mention is made of the competition met with in the jute industry mainly from Calcutta and Bengal and the growth of the industry in Dundee. The problem which demands the closest attention is that of cost of production, and the writer states that Calcutta and other foreign countries can undercut us considerably in price. A prosperous future for Dundee would seem to be in the installation of modern machinery, a combined effort to eliminate non-productive labour wherever possible and in the realm of research. L.

The Growing and Marketing of Jute. See Section 1C.**South Carolina Cotton, 1930-31 and 1931-32: Price—Quality Relationships.** See Section 1C.**Cotton Shirts: Price and Quality Relationship.** See Section 5C.

11—INDUSTRIAL WELFARE, INDUSTRIAL PSYCHOLOGY, AND EDUCATION

Weavers: Adaptation to "More Looms" System. E. D. Smith. *Mech. Eng.*, 1934, 56, 73-80.

A preliminary report is given of a study of some human problems in the management of a technological change consisting in an increase in the number of automatic looms per weaver. In this "stretchout" the entire process of weaving was systematically subdivided into functions on the basis of the types of skill required, and these functions were assigned to different workers who together performed the single task of operating the looms. Charts showing the standardisation of operating conditions, consequences of the introduction of the stretchout system, distribution and timing of typical measures, etc. are given. The importance of comprehensive adaptation, preparation and stabilisation, and the need for scientific management and the training of executives are discussed. It is suggested that a far-reaching change in technological methods is a major disturbance of human relations and may have serious human and social consequences. The human problems of change in methods, moreover, are greater than those of the introduction of labour saving mechanism. The dangers also are far greater if, instead of a series of small changes, an accumulation of lesser developments are concentrated into one abrupt major change. They are greater also if the change occurs in a period of depression. For all these reasons, the human distress and economic failures arising out of technological change will be reduced if scientific study and progress are continuous instead of occurring in such spasms as are prompted by economic adversity. Good, systematic management is essential, and all aspects of the change and the adaptation of all functions of management to it must be thought out in advance. C.

Prevention of Mineral Oil and Tar Dermatitis and Cancer. C. C. Twort and J. M. Twort. *The Lancet*, 1934, 226, 286-287.

From experiments on animals it is concluded that, on the whole, the textile grades of mineral oil are the most carcinogenic. A great variation was found in the yield of tumours according to the geographical area from which the oil originated. Broadly, the more fully hydrogenated an oil the less is its carcinogenic activity. It has been found that by suitable treatment of oils with sulphuric acid and with a variety of extractives, their carcinogenicity can be reduced to an extent running more or less parallel with the severity of the treatment used, until the carcinogenic potency becomes zero. From the commercial point of view

the sulphur dioxide treatment (Edeleanu process) appears to be the most practicable. Five such commercially treated oils have up to the present yielded no tumours among the animals tested. In general terms any process which tends to hydrogenate or saturate the oils, such as oxidation-reduction, polymerisation, or selective extraction, will decrease the carcinogenic activity of such oils. As regards the possibility of supplementing the animal test by an examination of the physical and chemical characteristics of mineral oils, it has been found that the refractivity constant of a given mineral oil is, within limits, closely related to the carcinogenic potency of that oil. As a protective measure in the commercial production of mineral oils, it is recommended that exposed parts of the body should be smeared with a mixture of equal amounts of anhydrous lanolin and olive oil before commencing work in the morning and after the evening bath. The use of lanolin is also recommended provisionally (pending further experiments) for preventing dermatitis and cancer arising from exposure to gas tars and their products.

W.

The Place of the Nurse in Modern Industry. L. P. Lockhart. *Industrial Welfare*, 1934, 16, 18-23 (through *Bull. Hyg.*, 1934, 9, 229).

The direct cost of ill-health due to accidents, industrial diseases, and incapacitating sickness among the insured population of Britain amounts to some £18,000,000 annually, with a loss of over half a million years of working time. In addition there is all absence under 3 days' duration. In the prevention of this great mass of ill-health lies the work of the industrial nurse. Where the number of employees exceeds 500 the law calls for a qualified nurse in charge of the ambulance room; she should treat all injuries however slight; and she will find herself fully occupied with many minor ailments as well as accidents. A nurse should be kept entirely for her work in the ambulance room and not be given welfare work, for which she is not trained. She may carry out dressings and massage under the directions of the home doctor, and so shorten convalescence. Indeed, she needs access to medical advice. She should also have direct access to the works manager who should instruct all department heads to support her authority. She must be well paid and well equipped, or her work will fail. Industrial nursing is worth doing well; it is not philanthropy to be jettisoned in times of economic pressure. On the lowest grounds of industrial economy a nurse is essential to a factory.

T.

A Memorandum on Asbestosis. E. R. A. Merewether. *Tubercle*, 1933 and 1934, 15, 69-81, 109-118, and 152-159 (through *Bull. Hyg.* 1934, 9, 230).

This memorandum reviews the subject of asbestosis in the light of all the recent knowledge obtained concerning the disease.

T.

The Hygiene of Winter Clothing. H. Habs. *Deut. Med. Woch.*, 1933, 59, 1828-1830 (through *Bull. Hyg.*, 1934, 9, 288).

In Berlin the average temperature of the warmest month is 18.8° C. and that of the coldest —0.8. It is necessary therefore to pay some attention to varying the clothing according to the season. Of recent years, the tendency has been for women to wear less heavy clothing in the summer than formerly. Before the war, a woman's summer clothing weighed about 3 kilos, but now under 1 kilo. While this is to be welcomed, there is the danger that the change to warm clothing for the winter is not carried out early enough and various ill effects may result. In addition to the usual catarrhal conditions, cystitis, which has become more frequent among women in the winter, has been attributed to insufficient clothing. A rheumatic neuritis affecting the legs of women and girls, and chilblains and chronic erythema are attributed to the wearing of thin silk stockings in winter, and it is recommended that in winter woollen stockings dyed flesh colour should be worn. This would be more effective than high-topped boots, gaiters, or over-socks. The idea of hardening the body by light clothing often causes injurious effects. In the figures for the cost of living in Germany for 1925 the index figure for clothing was 173 and as this had sunk in October 1933 to 112.4 better clothing may be expected to be seen in Germany in the winter.

T.

NOTES—In the references to publications abstracted the name of the publication is followed by the Year, Vol., Issue No., or Date if necessary, and Page No. (or Nos.).

Literature relating to the composition and manufacture of dyestuffs is not dealt with in the abstracts of this *Journal*.

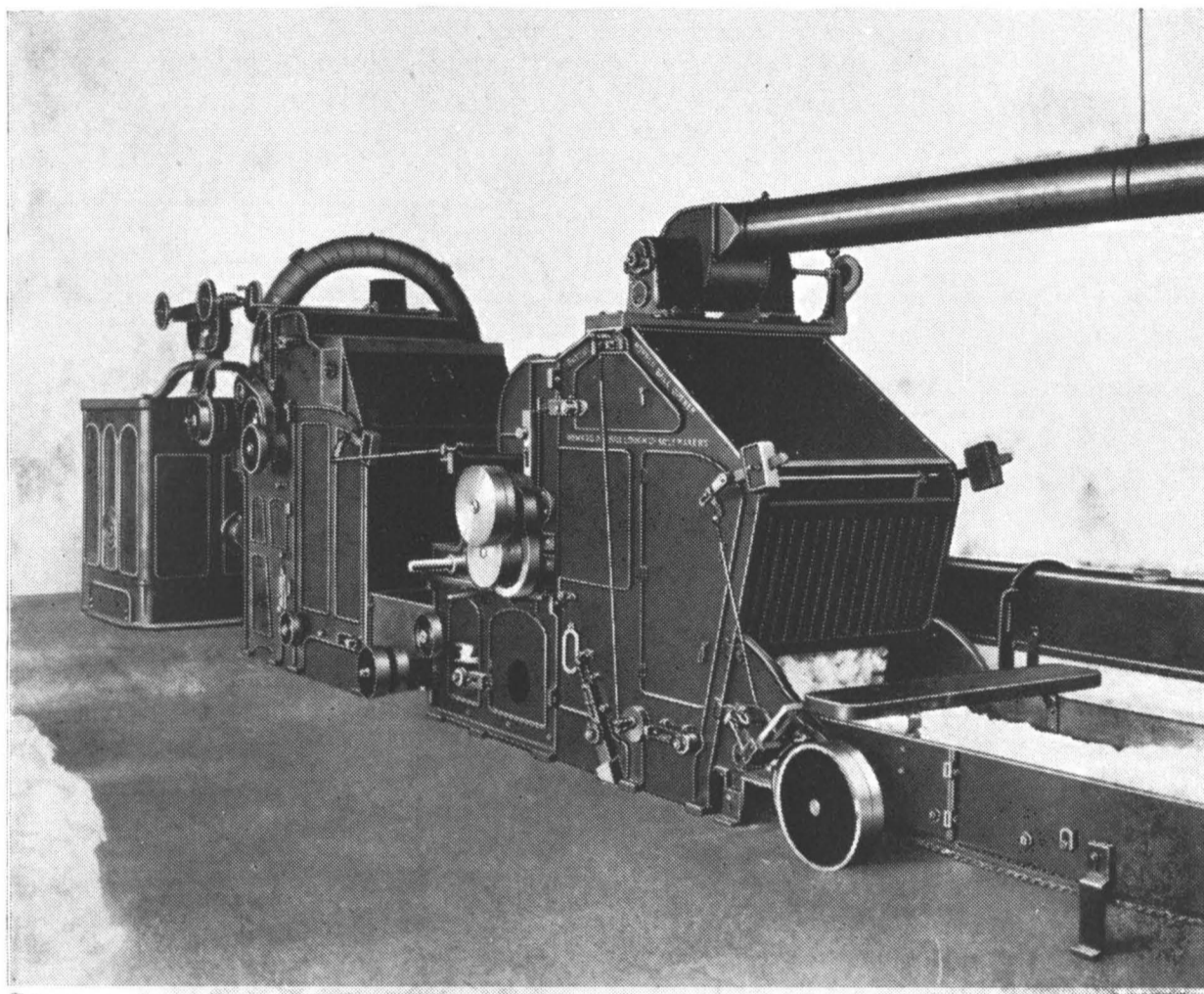
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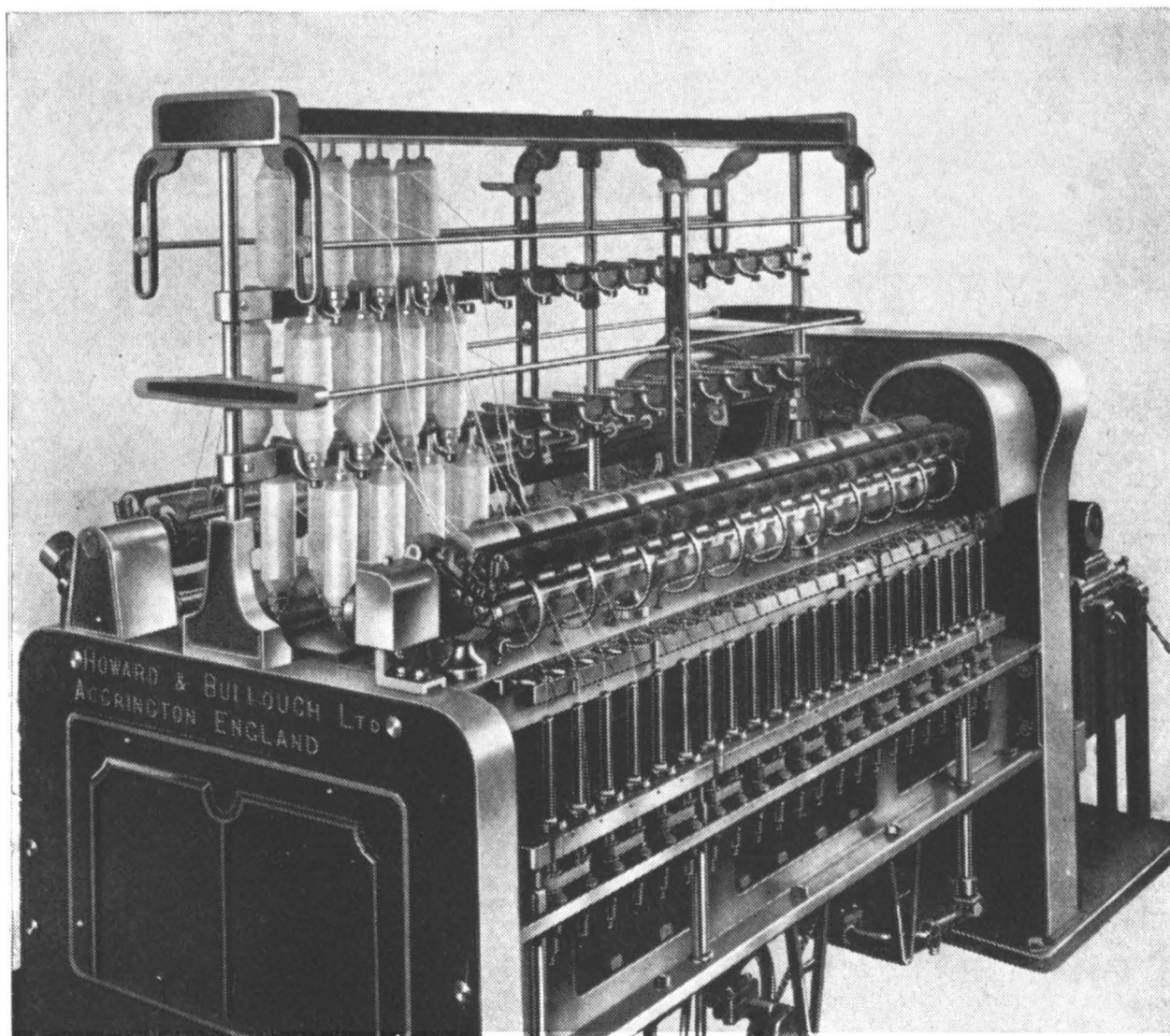
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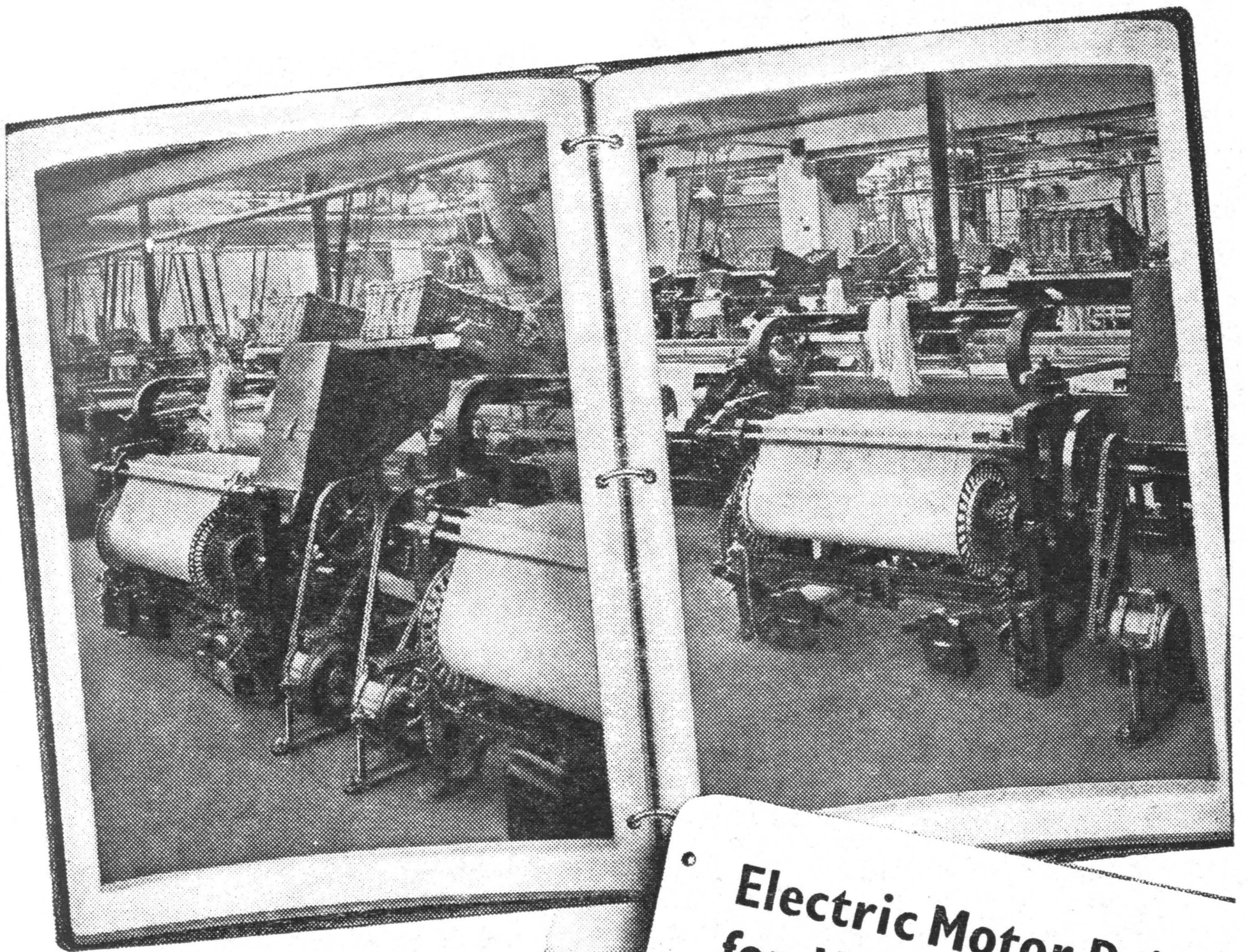
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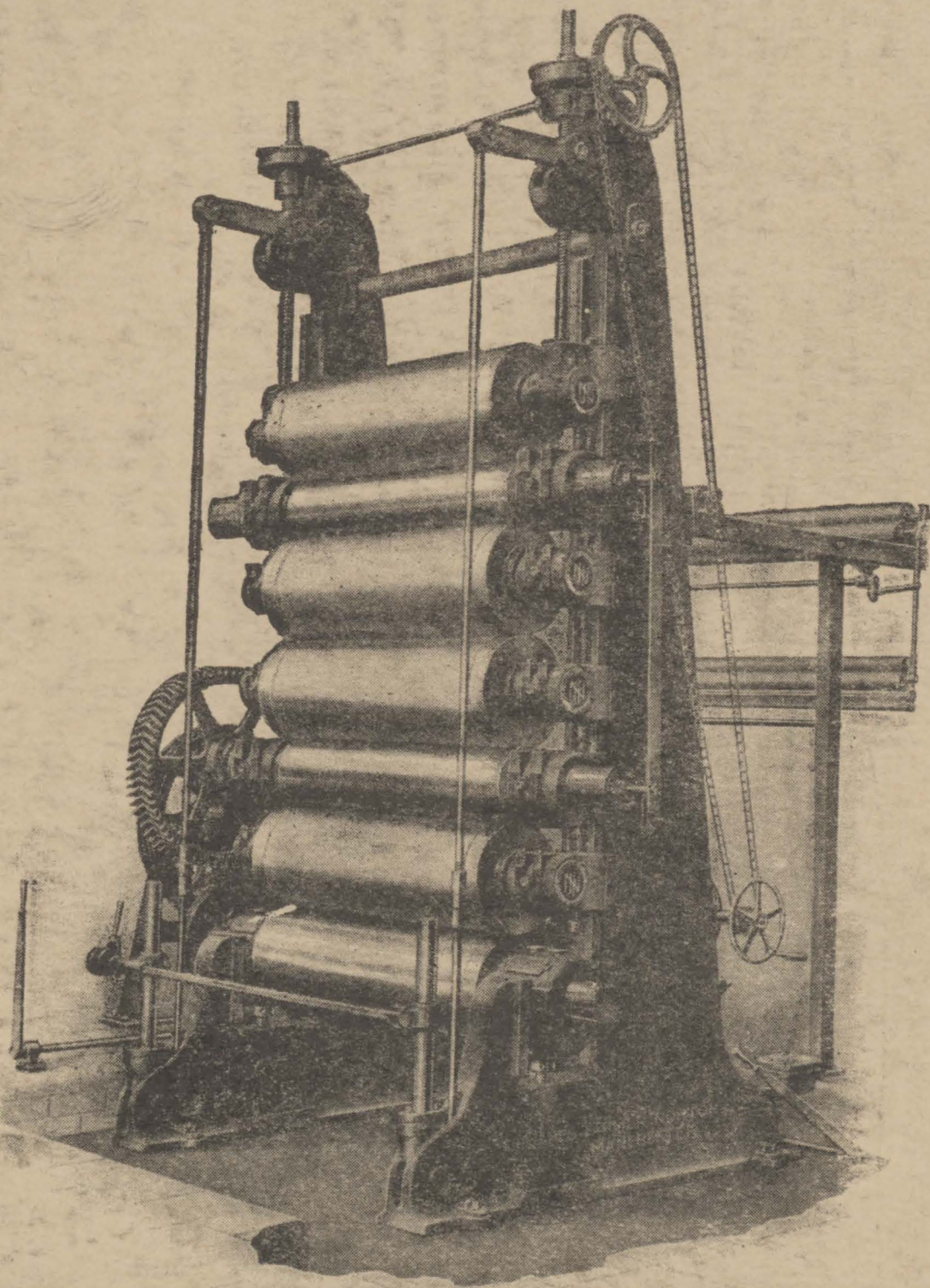
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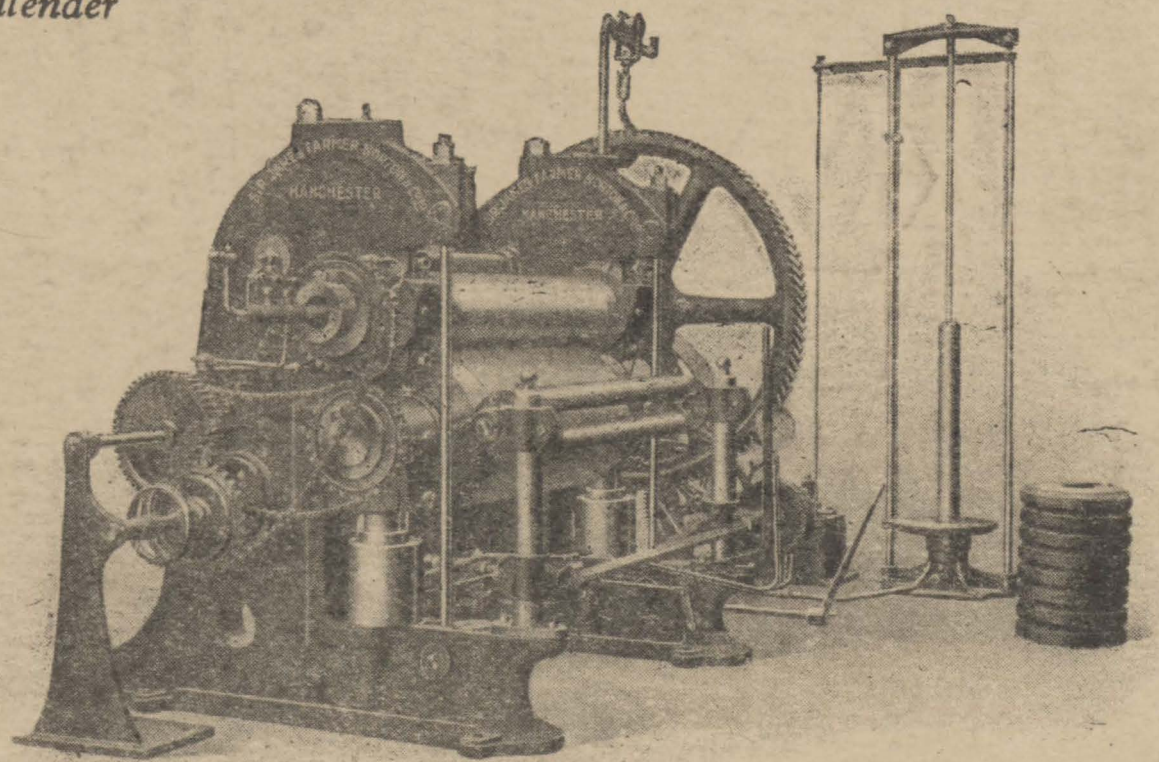


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