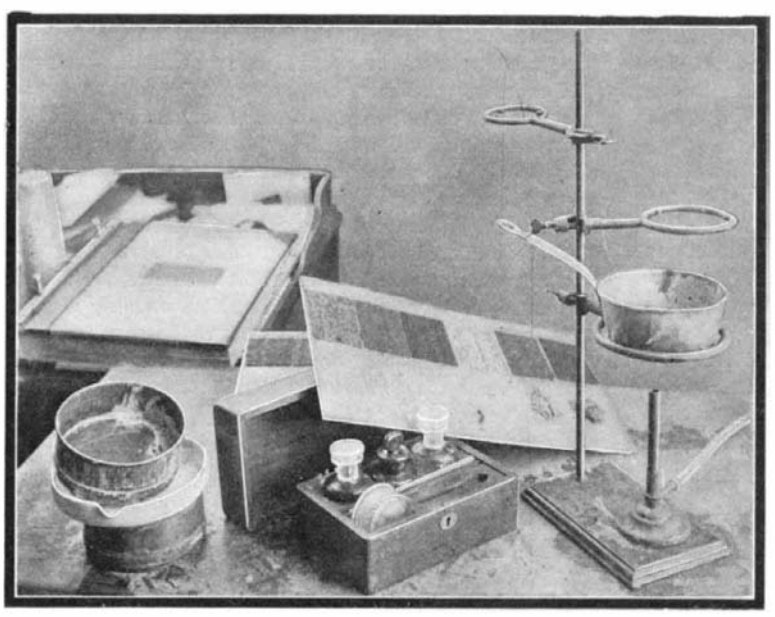
THE MANUFACTURE OF MEN'S CLOTHING ON A LARGE SCALE.

That Thomas Carlyle should have used "clothes" as a peg on which to hang the inimitable essays in "Sartor Resartus," dignified what otherwise might be considered as a rather dull and dry subject. He says:



The Acid Test for Wool.

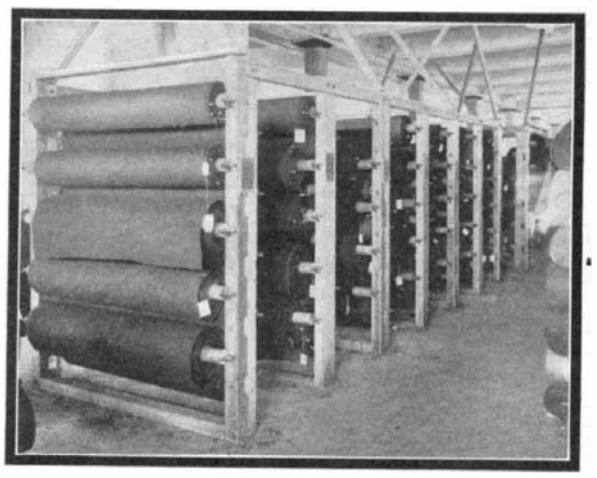
"The hand is ever guided on by mysterious operations of the mind. In all his Modes and habilatory endeavors, an Architectural Idea will be found lurking. His body and the cloth are the site and materials whereon and whereby his beautiful edifice of a person is to be built." With all Carlyle's alleged wisdom concerning clothing, we doubt very much if his researches ever produced so much real knowledge as can be gained by a morning spent in a great clothing manufactory. It will be news to most readers to know that some clothes are designed by a technologist, that the anatomy of a coat is most complex, that the weight of articles carried in the pocket is carried from the shoulder by a sustaining member, that a suit passes through one hundred and forty hands in course of manufacture, and other things equally interesting. Ready-to-wear vs. custom-made clothing has been the subject of millions of debates.

It is the object of the present article to show how a ready-to-wear garment can be designed and "built" with thousands of others, and still continue to have in a marked degree those distinctions which go to make up the garments tailored by the custom merchant. We have selected for the purpose of illustration the plant of A. B. Kirschbaum & Co., of Philadelphia, which offers peculiar advantages as being the largest in the world. This factory is also interesting on account of the peculiar construction of the building, whereby the health and safety of the wage-earners are conserved. The building is located on Broad Street, opposite the Ridgway Library, and is entirely isolated on all sides, so as to give the best of light, which is so essential in this industry—no artificial light being necessary under normal conditions. The building is four hundred feet long and is six stories in height, with a basement having a ceiling seven feet above the street level. Natural light is secured through hundreds of windows of ribbed prismatic glass. Goods are received and goods are shipped with the aid of a private railway switch. Every sanitary precaution has been taken to safeguard the health and comfort of the workers. For example, weekly fire drills are held, and the protection against fire is of the best possible description. In case of a conflagration on any floor, the fusible plugs would burn out and fire doors would close automatically, protecting the elevator shafts. The staircases which lead from floor to floor are entirely outside the building, which would prevent any draft in case of fire. The fire escapes are in a separate tower with walls ten inches thick, readily accessible from any floor. Automatic sprinklers are provided at every portion of the plant, and the number of standpipes is unusual.

The workers are dismissed at the noon hour in two shifts, so that the lunch room may not be unduly crowded at one time. If this department pays its expenses, the company is satisfied. All workers on entering the establishment leave their hats and outside garments in lockers. On the whole, it would be difficult to see how any branch of manufacture could be carried on on more wholesome lines.

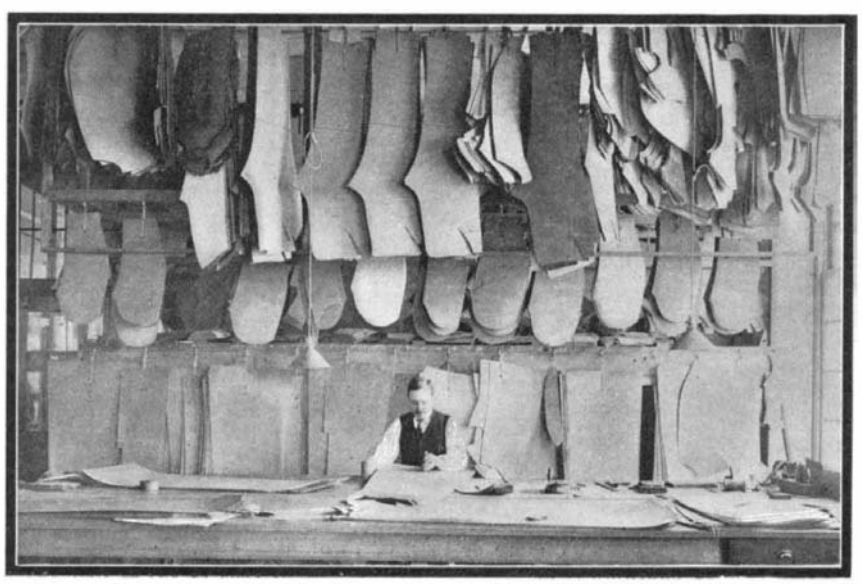
The manufacture of ready-to-wear clothing is of comparatively recent date. The industry started in 1835. At first almost all the clothing was made to supply the trade in the South and West. Gradually the wholesale houses began to manufacture better grades of ready-to-wear clothing. From this obscure beginning has grown the present enormous industry. Such a growth was rendered possible only by the introduction of labor-saving machinery; notably the sewing machine and the cloth-cutting machine. Many factories simply cut the cloth and give out the goods and trimmings in bulk to workers who labor in unsanitary workshops often located in tenements. It stands to reason that clothing made in light, airy rooms will be less susceptible to contamination. In the Kirschbaum plant the clothing never leaves the building, and is therefore subject to inspection at all times.

A designer in a wholesale clothing house is what we almost might term a "general." He is responsible for style, fit, and finish. All the creations or modifications in garments are made or passed upon by him. No one city or master-designer can set the fashions, but a combination of them can. Style and the subsequent developments as to sizes are in his hands. He is a creator, his minute touches may make or unmake a style, it may be only the turn of a collar or the cut of a lapel.



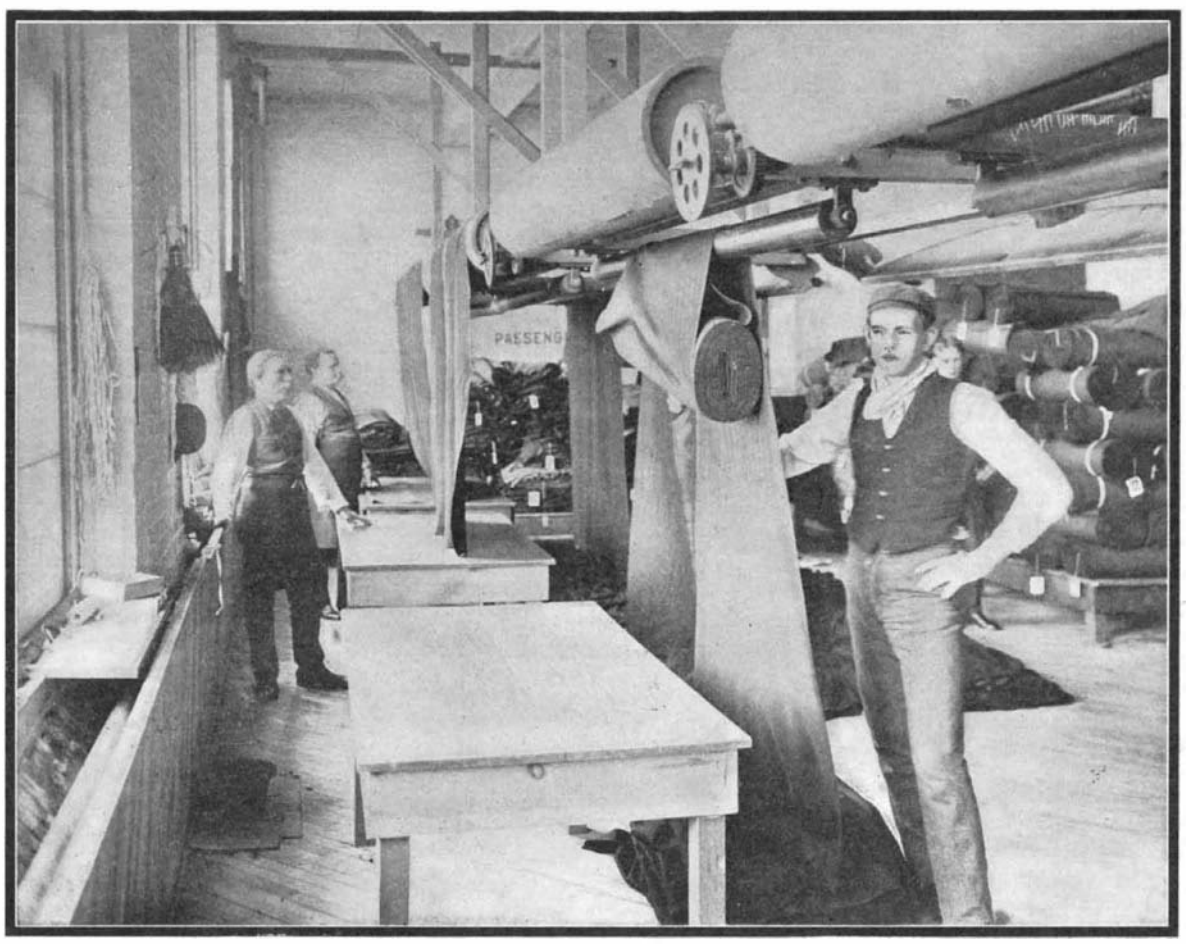
Cooling the Cloth.

The sartorial artist is not bound by hard-and-fast rules, but by his careful assimilation of exact information he is able to forecast the styles. In the plant which we are describing, the head-designer works in a "studio," and his approximations to the human figure are based on living models at his disposal. His systems are really based upon those relating to engineering. He obtains a base line, and from this develops the various sizes mathematically. This results in economy both as to labor and material. His workroom is one of the most confidential in the establishment, and is naturally one which is usually closed to visitors.



Making the Patterns.

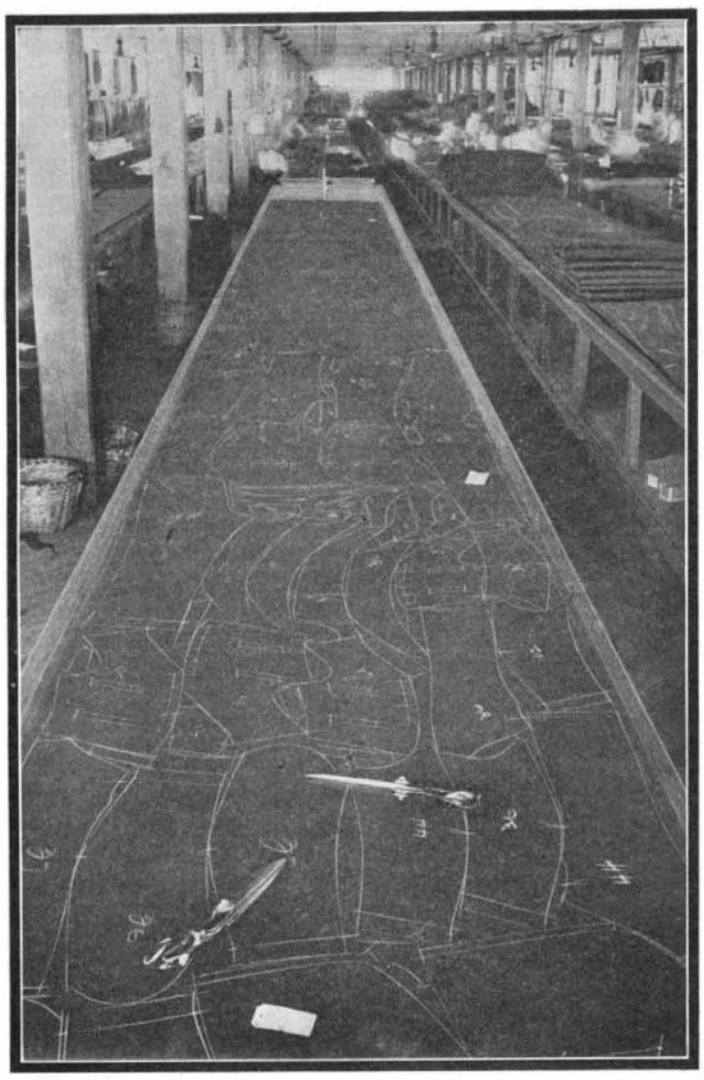
The cloth is bought from samples, and when the goods are received they are not only compared with the sample, but each piece is submitted to physical and chemical tests. A small sample is taken from the bolt, and is inserted into a pair of jaws, which can be tightened so that a firm grip is maintained at both the top and bottom of the sample which is being tested. Means are provided for separating the jaws until the cloth breaks—a dial indicates the breaking strain, which varies according to the weight and quality of the fabric. Cloth which cannot endure a tensile strength test of thirty pounds to the square inch is almost useless in clothing manufacture; it is nothing unusual to find even a flannel which will not be ruptured until the one-hundred-pound limit is reached. The sample is then submitted to the "wool-test," in order to find out if there is an admixture of cotton. It is subjected to a hot solution of caustic potash. The animal matter, or the wool, boils out, leaving the cotton, or vegetable matter, as a residue. The acid tests are used for determining the quality and permanence of the dye; sulphuric, nitric, and hydrochloric acids are employed. Samples are also dated, numbered, and exposed to light and air for months. It is owing to such thorough tests that the integrity of the future garment can be guaranteed.



Cloth Examining and Measuring.

THE MANUFACTURE OF MEN'S CLOTHING ON A LARGE SCALE.

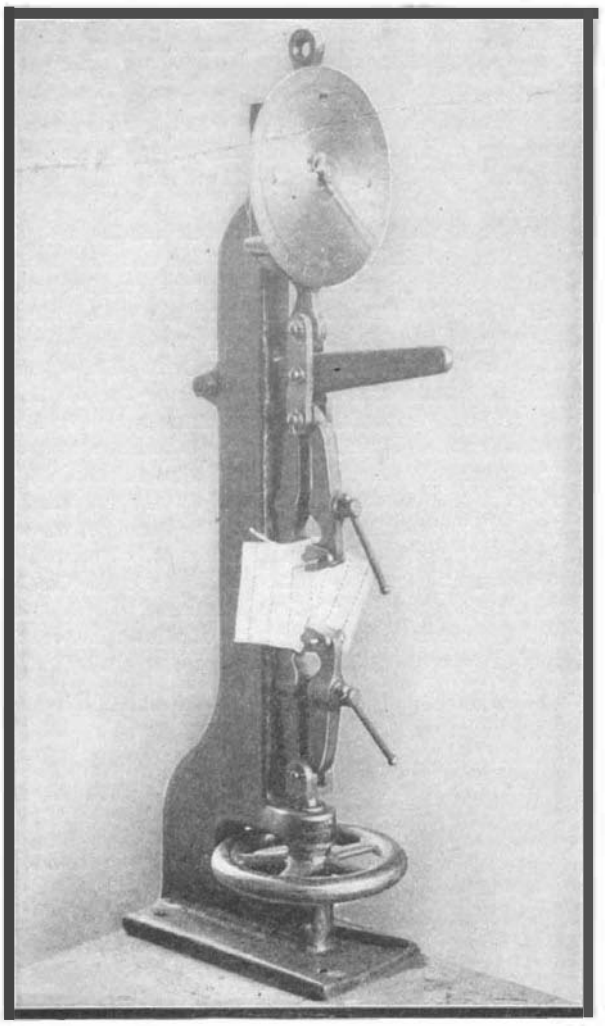
A special balance scale is used, which shows the exact weight of every yard in the bolt, and the weights are computed in "ounces to the yard." There is hardly a piece of cloth that has no imperfection, and it must



Patterns Removed, Showing the Layout.

chine consists of a steam box for the diffusion of steam. The cloth passes over the box as it is reeled, and is wound on a perforated cylinder, also filled with steam, which is allowed to permeate the roll of cloth. Every piece of woolen fabric shrinks from two to four yards in the sponging process. This removes the mill gloss, and serves to finish the material for a non-shrinkable garment. The warm and moist roll is then placed in a rack, and is allowed to cool for some twenty-four hours. The cloth is then folded and rolled by a special machine. We now have a double piece of cloth about 46 to 48 yards long and 28 inches wide. This folding is very essential, in order to insure a better match in the garment, and is especially necessary in blues and plaids. Before the goods go to the cutter, they are laid on tables in lots of two to one hundred pieces, and each piece is compared in shade, so as to give the customers uniform shading in every style, regardless of the quantity bought.

The cloth is now taken to the cutting floor, where it is unrolled on immense tables covered with linoleum. Only one piece of cloth may be unrolled at a time, or fifteen or sixteen pieces may be superimposed. The cutter now takes the pressboard patterns, and arranges them with such cunning that a uniform shading is attained and no cloth wasted. One of the immense tables covered with cloth on which the layout has been marked is a most interesting sight. All garments above three in number, which are to be cut at the same time from the same pattern mark, are cut by a machine, the first of which was introduced about 1870. The earliest of these had long knives operating perpendicularly like saws, and cutting



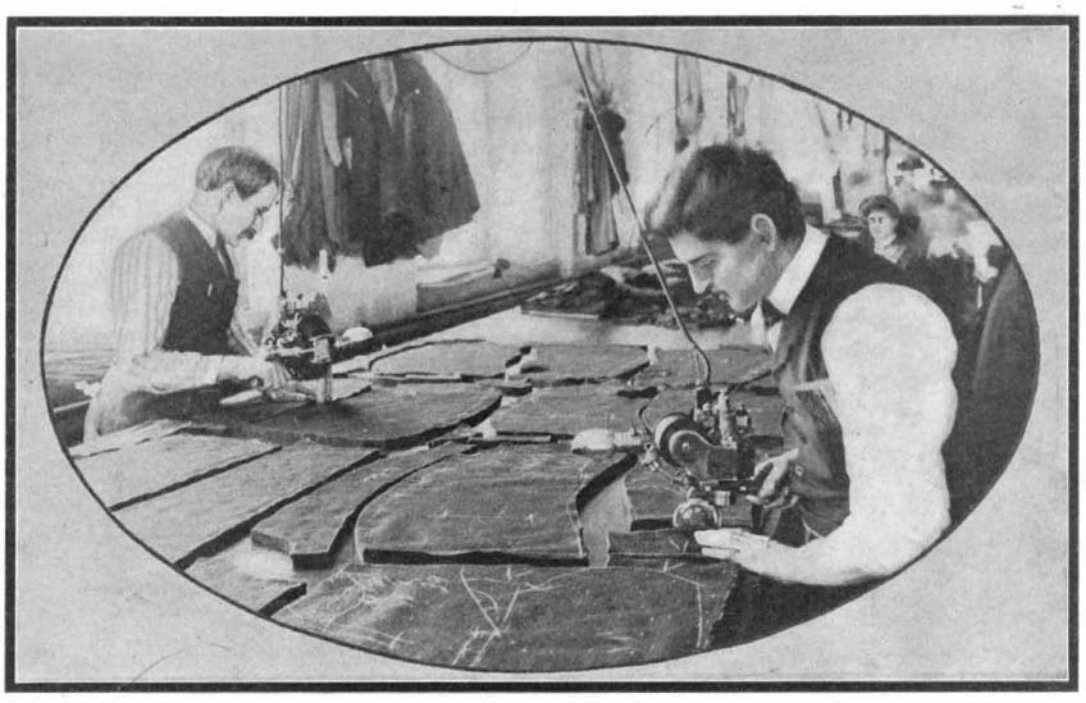
Cloth-Testing Machine.

through a number of thicknesses of cloth. These are still in use for certain classes of work, but circular disks rotated with a high rate of speed are now also very largely used. These cutters rest upon a flat bedplate, which is adapted to pass under the cloth. The knife is rotated at a high rate of speed by an electric motor, and an electric light forms part of the equipment of the machine, the latter being used when natural light fails. The various parts of the clothes bear a "lot" number, and all the pieces belonging to this lot are gathered up and sent to the distributing department on the floor below.

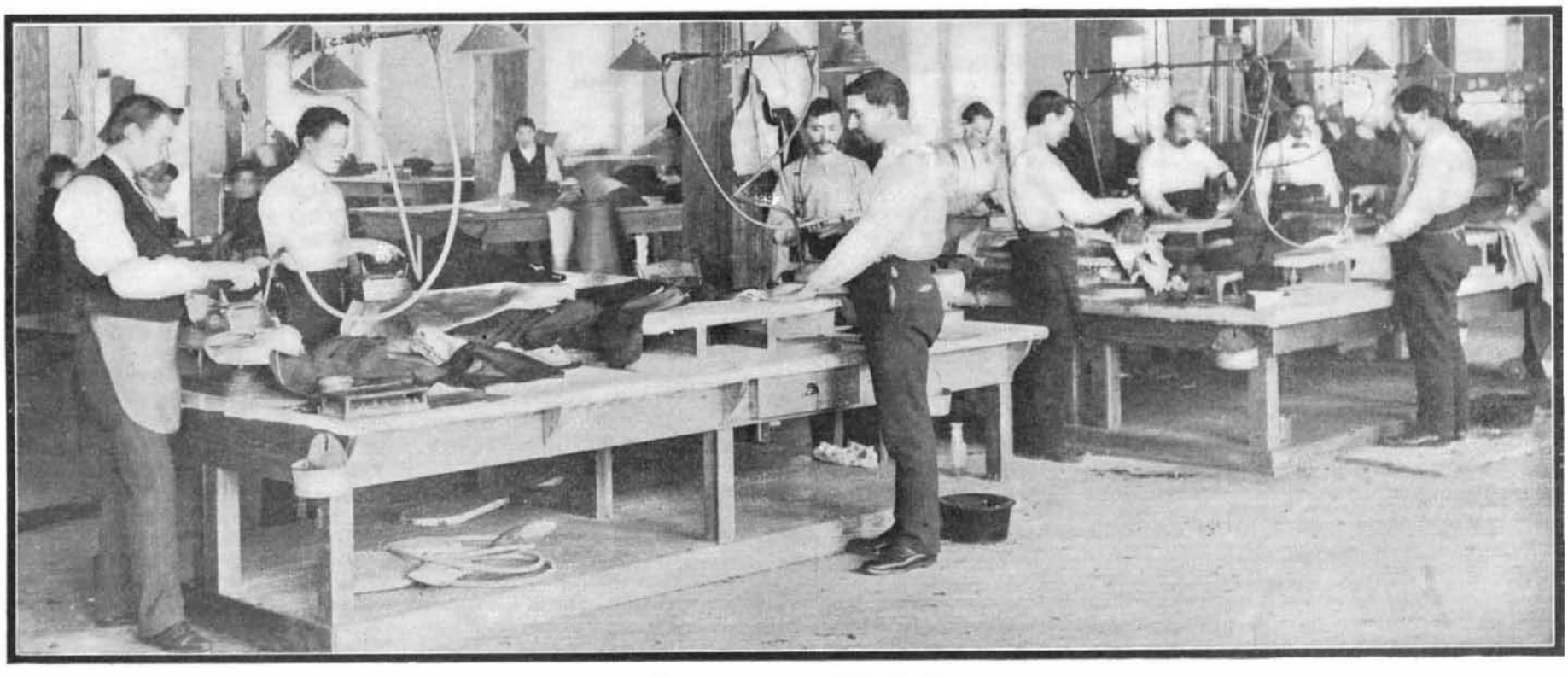
Meantime the trimmings for the articles of clothing have been selected in the same quantity, great attention being given to a proper matching of these materials with the goods. The cloth and the trimmings are now combined in one bundle, which is ready for the tailor

therefore be humored by the cutter. To the lay person these imperfections are hardly noticeable, but to the expert cloth examiner they are painfully real. The cloth is reeled from the bolt over rollers which are geared to a dial, which measures the length of a piece of goods. As the cloth passes down it is carefully inspected by the cloth examiner, who marks the imperfect places with tailor's chalk, and at the same time ties a piece of narrow tape in the selvage. This is a warning to the cutter that he must so impose his patterns that the uniform shading may be maintained; a hundred suits may be shipped to a customer, and each will be of exactly the same shade as the others.

The goods are now ready to be "sponged." This is really a misnomer, for it is practically a shrinking process. The ma-



Cutting Sixteen Thicknesses of Cloth by Electric Cutters.



Pressing With Irons Heated by Gas.

THE MANUFACTURE OF MEN'S CLOTHING ON A LARGE SCALE.

shops on the floor below. But before passing to the room where the actual sewing and finishing is done, it will be interesting to consider, for example, the complex nature of a coat. This may contain as many as thirty different articles, all of which are structurally necessary to what we might term the "skeleton construction" of the garment. These are termed the "vitals."

How it is that a forty dollar suit can be sold for twenty-five dollars, or a twenty dollar suit for twelve, is an interesting problem; but this is readily understood when the systems of a large wholesale clothier are understood. We have already watched the cloth which has been tested, sponged, and cut. The various pieces of a suit consist of three parts—the coat, the vest, and the trousers. A large blank properly filled in gives specific directions for the trimmings and the finishing of the same. This blank is perforated, and a portion of it is attached to each of the three garments.

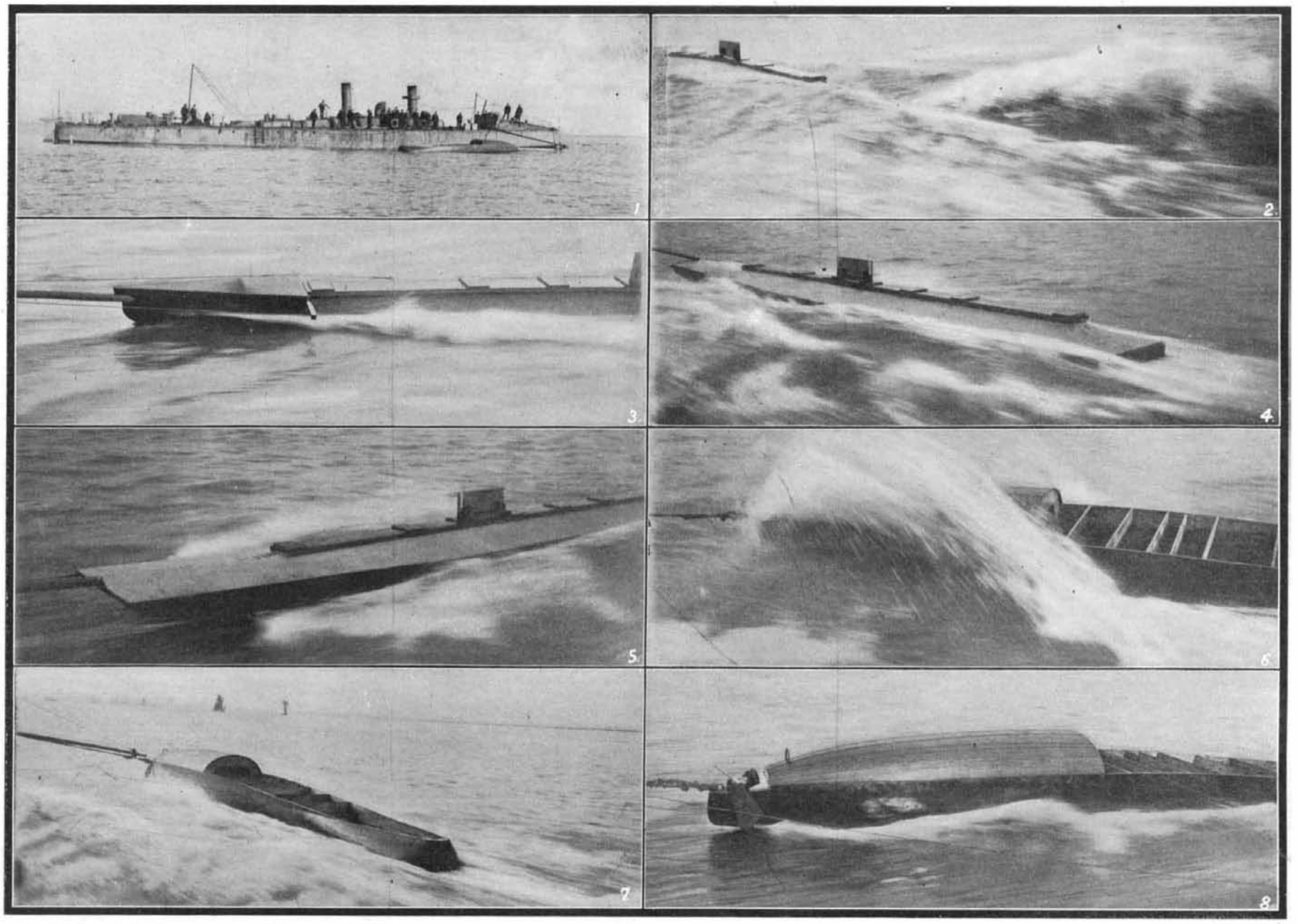
Let us consider the coat alone. For example, we will take a sack coat. The canvas front is, of course, in two pieces, and may be considered as the keel. On this is superimposed the hair-cloth stiffening, which is secured by means of narrow strips of silesia cut on the bias with a cross stitch; the padding is also attached to the hair cloth with a cross stitch. The button stay, which is also of silesia, starts at the bottom of the lapel and extends to the lowest button. Every coat has a shoulder-pad of various thicknesses made of wadding. It may be ten-ply in the center and grade down to nothing at the end. In conjunction with the shoulder pad there is an arm pad, which is attached to the shoulder pad and extends toward the elbows. The pockets are stayed by imposted two-inch linen strips, which extend from the fore part of the coat across the lower pockets, if any. Strips of the same material cut one inch wide run from the top of the pockets up into the arm hole. This is a suspension stay, and is intended to help sustain the contents of the pocket. There is a body lining which covers the vital trimmings. There are also sleeve linings, buttons, a hanger, besides a ticket to show the name of the maker. The trimmings vary with the cost of the suit.

From the trimming-stock room complete bundled trimmings in lots of from two to four hundred meet the cut cloth at the distribution department, whence the assembled semi-finished materials go to the tailoring shops. Sizes are compared, and the coat is put together by tailors; in reality we might say "parts of tailors," for each man knows his own particular branch of the tailoring business much better than the average tailor can ever expect to. This naturally increases the individual capacity for work, and decreases the cost to the consumer, whereas the quality is enhanced. Hand and machine sewing are both used, the higher-priced garments being sewed by hand. Button holes are made both by hand and by machine.

The pressing is done by large irons heated internally and uniformly by gas, the Bunsen flame being used. Powerful foot-power irons heated in the same manner are also used to press certain kinds of clothing. A person weighing one hundred pounds can exert by his weight a pressure of 2,500 pounds.

Vests, trousers, overcoats, rain coats, and other garments are made along similar lines. The finished suits or garments are kept on a stock floor, or if made for an order they are taken to the "lay-out" floor. Here are long aisles of platforms, and the goods of three thousand customers may be assembled at one time. Each customer has a number, and the clothes are brought to a similarly numbered platform. As the pile rises, it is formed into a cube adapted to be placed in the lined cases. This prevents double handling, and possible creasing of the pressed clothing. This is only one of the many things which show that system, attention to detail, and economy of resources tend to effect success much more than we ordinarily suppose.

As a result of the modern method of clothes-making, thousands of men who once wore only custom-made are now buying ready-to-wear clothing.



1. Torpedo boat with boom for towing models. 2. he bad stern wave of 1903 model. 3. Good bow wave, bad stern wave from this model. 4. Model good for smooth, poor for rough water. 5. Same as No. 4, showing water indicator for keeping boat on even keel. 6. A bad failure, heavy wash from bow. 7. The accepted model, small bow wave, clear run. 8. Accepted model at 25 knots. Very slight bow wave.

FULL-SIZE MODEL TESTS BY TOWING FROM TORPEDO BOAT.

INTERESTING EXPERIMENTS TO DETERMINE THE CORRECT LINES FOR GASOLINE MOTOR BOATS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A prolonged series of exacting experiments, to discover the most suitable lines for a speedy motor-propelled boat or launch, has been carried out conjointly by Messrs. Yarrow & Company, Ltd., the eminent shipbuilding firm on the Thames, and S. F. Edge, Ltd., the manufacturers of the Napier gasoline motors. Hitherto the gasoline motor-propelled launch has been almost entirely devoted to pleasure purposes; but during the last twelve months considerable progress has been made in the utilization of this system for other marine purposes, and in view of the fact that they are exceptionally fast-running and reliable, the British Admiralty has been seriously contemplating the advisability of attaching this type of craft to battleships for certain purposes, such as dispatch boats, pinnaces, or even reconnoitering. In view of this awakened interest and progressive development, several naval constructing firms in Great Britain are conducting the most searching investigations and tests.

Yet although the reliability and efficiency of the gasoline motor have been established for marine purposes, the details of the design of the hull or boat itself have not been as scientifically developed as they should have been, in order to combine the maximum of efficiency of the boat with the maximum efficiency of the motor. When therefore it was decided to construct another Napier craft to defend the international cup presented for annual competition among gasoline motor-propelled boats, Messrs. Yarrow & Company suggested to the designers of the motor the inauguration of a series of trials with full-sized models, in order to obtain the best possible lines for the hull of the craft.

The suggestion was adopted, and for several months past these tests have been in progress. No restrictions were placed upon the Messrs. Yarrow, with the exception of the beam of the craft and its length, which was to be 40 feet. The stipulation as to the beam was essential, owing to the space having to be adequate to accommodate the gasoline motor. The draft and displacement were left to what the practical trials determined as the most perfect.

The question of the correct lines for the hull is most vital. It is essential that the bow wave should be reduced to the minimum, and that the bow of the boat should be kept down in the water when traveling at the maximum speed. To demonstrate the importance of this detail, it may be mentioned that the bow of the Napier boat which secured the international trophy last year, when traveling at full speed, was out of the water for almost half the entire length of the craft.

For the purposes of these experiments, a number of full-sized model hulls were designed and constructed of wood, including one of the Napier which proved successful last year, and with which tangible results were obtained, thereby enabling some comparative data to be available. It was decided to carry out the trials in as practical a manner as possible. Tank experiments were discarded, as they do not furnish sufficiently reliable practical data, and accordingly the trials were carried out in the open water under actual and natural conditions. In order to impart as nearly as possible the same speed as would be available to propel the boats when the motors were installed within them, a turbine-propelled torpedo boat was requisitioned for the purpose of towing the models. Rear towing, however, was quite out of the question, as the stern wave from the

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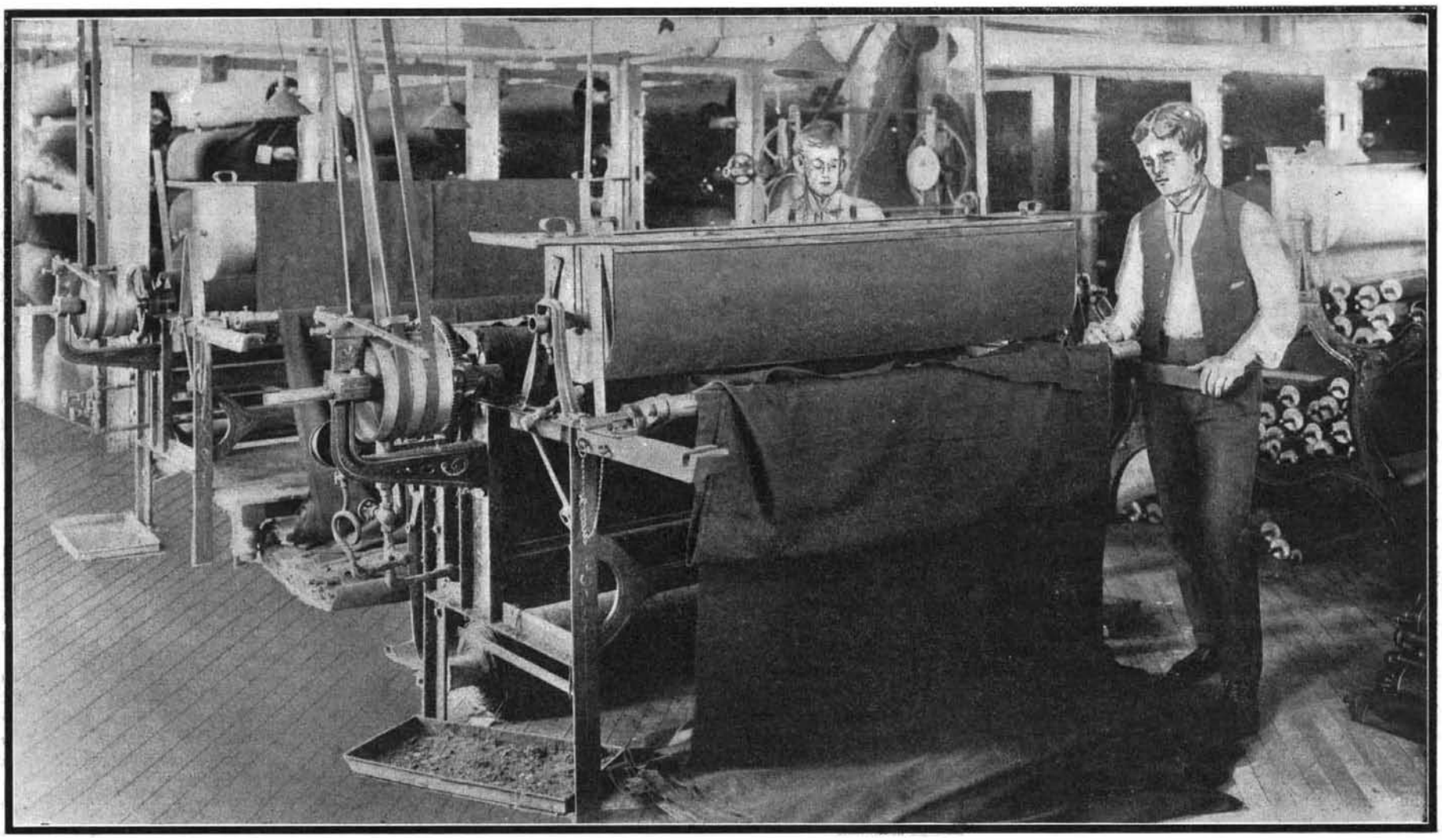
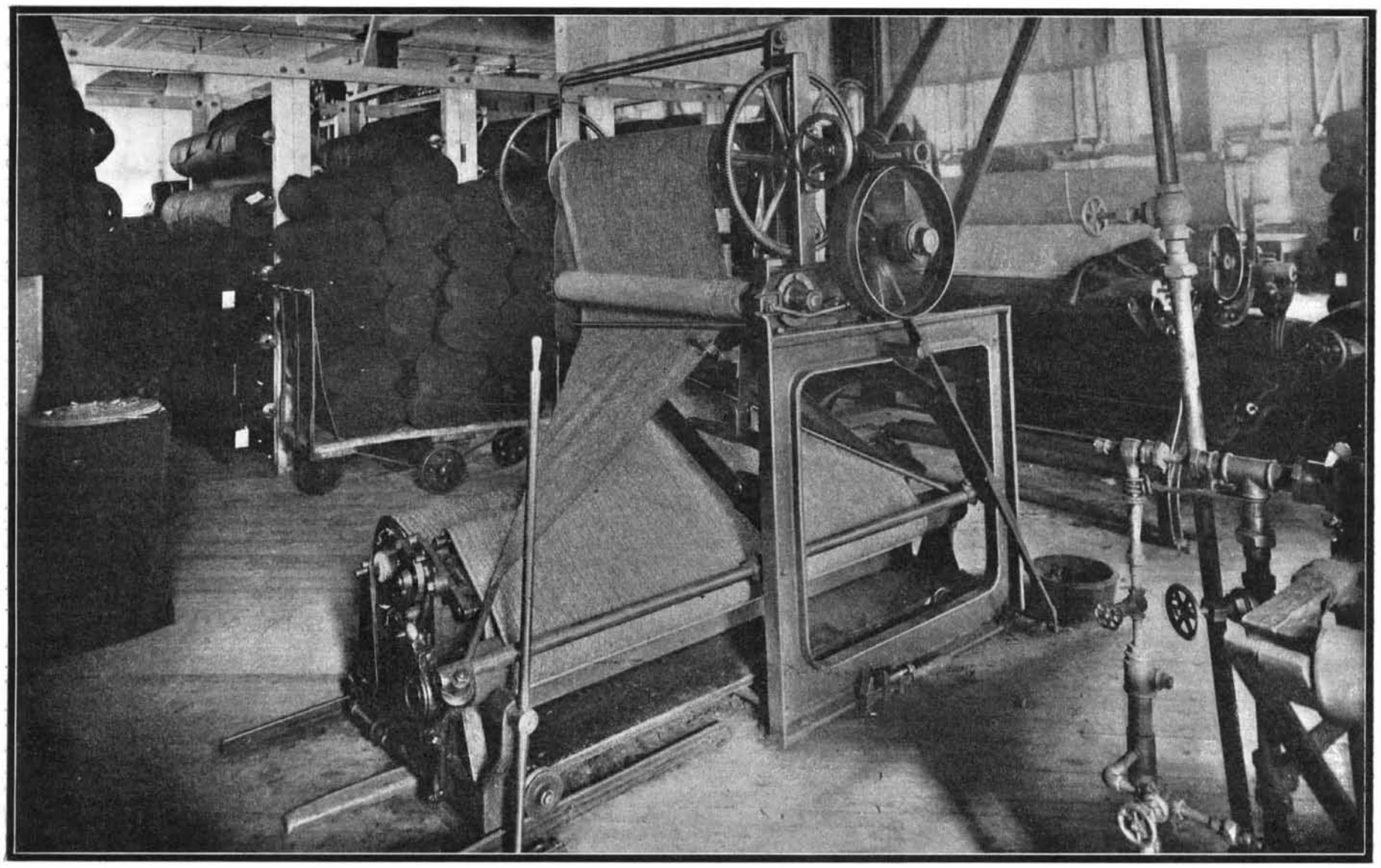


Cloth "Sponging" or Shrinking by the Aid of Live Steam.



Cloth-Folding Machine for Doubling the Cloth.

THE MANUFACTURE OF CLOTHING AS CONDUCTED ON A VERY LARGE SCALE.—[See page 404.]