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.

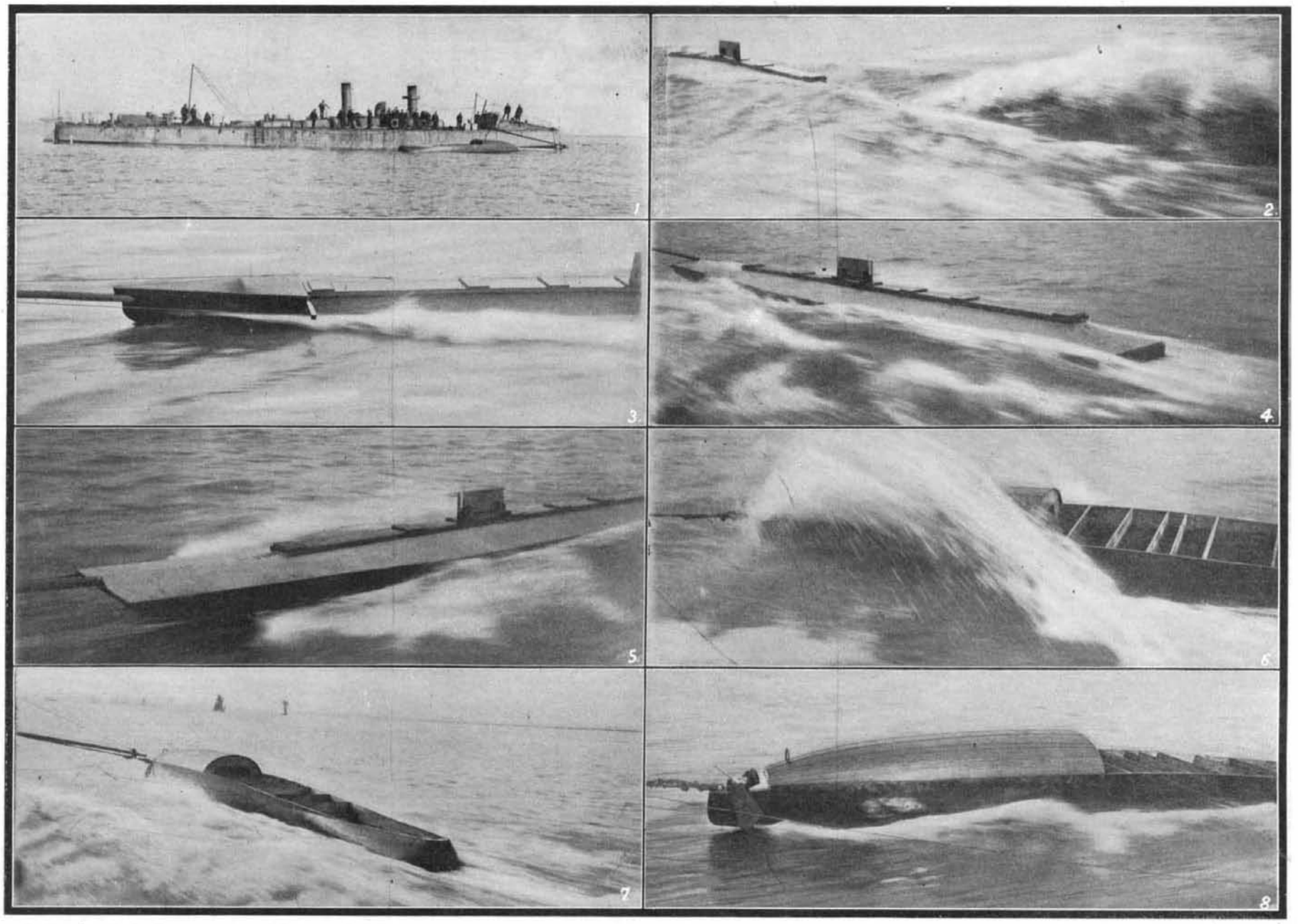
Let us consider the coat alone. For example, we will take a sack coat. The canvas front is, of course, in two pieces, and may be considered as the keel. On this is superimposed the hair-cloth stiffening, which is secured by means of narrow strips of silesia cut on the bias with a cross stitch; the padding 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

torpedo boat would upset the calculations, and for this purpose a specially-designed side-towing system was adopted (see Fig. 1). A special boom was projected from the side of the torpedo boat right forward, and of sufficient length to enable the model attached thereto to escape the bow wave of the torpedo boat itself. To the outward end of this boom the tow-rope and the dynamometer were attached, and the torpedo was run at speeds varying from 20 to 25 knots per hour, so that the results achieved were obtained under varying conditions.

Fig. 2 shows a photograph of the last year's boat at 25 knots, from which it will be seen that the disturbance of water was very great at the stern, and that the model was quite unsuitable for a 25-knot speed.

Fig. 3 shows a development in which a very perfect bow wave was got at 25 knots; but the stern wave was very bad, and the model had to be giveen up.

Fig. 4 shows a model which gave most excellent results so far as bow waves were concerned, and a clean run from the stern, but, unfortunately, while being very perfect in absolutely smooth water, as can be seen from the photograph, the model in the end was found quite hopeless in rough water. It would not steer properly and other defects became apparent.

Fig. 5 shows the same model. In the center will be noticed the water indicator for showing whether the boat kept a level keel or not.

Fig. 6 shows what Messrs. Edge thought was a fine model, until they got her at speed, and then it was found, although it took very little power to pull her (and all the pull was registered by a dynamometer, so that it was known exactly what each model took to move through the water), that the great arch of spray sent up by the bow made the boat useless, as it would have been very difficult to steer her, and exceedingly damp for the people steering. The methods adopted by Messrs. Yarrow & Company in the series of towing experiments are, we believe, entirely new, at least on the scale on which they were carried out. The construction of full-sized models and the towing of them at the actual speed aimed at, presents ideal conditions, and the results will be watched with close interest.

Success was attained with the next attempt, and the last two illustrations (Figs. 7 and 8) show the model that has been adopted for this year's competing craft. The bow wave is very slight, as is also the stern wave, and what little there is, is very clean. Curiously enough, the lines in this accepted model are somewhat coarser than in the preceding models, but they have proved far more successful. At 25 knots speed, which is equivalent to 28.788 miles per hour, she proved far more satisfactory. The bow wave became almost nonexistent, while an extraordinarily clean run from the stern was achieved.

The construction of the accepted model is now well advanced by Messrs. Yarrow, who have the contract in hand. The hull is being built of steel throughout. The craft will be propelled by a four-cylinder Napier motor, developing 80 nominal horse-power. One very important improvement will be incorporated this year in the Napier motor boat. In last year's contest the motors exhausted direct into the open air, and the noise was deafening. This year the gases will be exhausted into a special exhaust, carried under water at the stern of the boat. By this means almost complete silence will be obtained, while no noxious gases or smoke will be emitted into the air. It has been found that by means of the special exhaust principle that has been devised in this connection, the boats will be just as unimpeded in traveling as if the motors exhausted direct into the air.

LIFE-SAVING APPARATUS IN BRITISH SCHOOLS.

BY WILLIAM C. FITZ-GERALD.

Ever since the serious fire in one of the master's "houses" at the world-renowned college of Eton, near Windsor, there has been great activity among the principals of the leading British colleges, both for young men and young ladies, in the direction of providing the most efficient possible means of fighting fire and saving life. The principal of many a school, looking around him, may find that there is no more elaborate protection in the case of an outbreak than a few dusty old hand grenades, which may be worse than useless, or a little hand pump, which throws but the feeblest and thinnest of jets. This state of affairs has been radically improved of late.

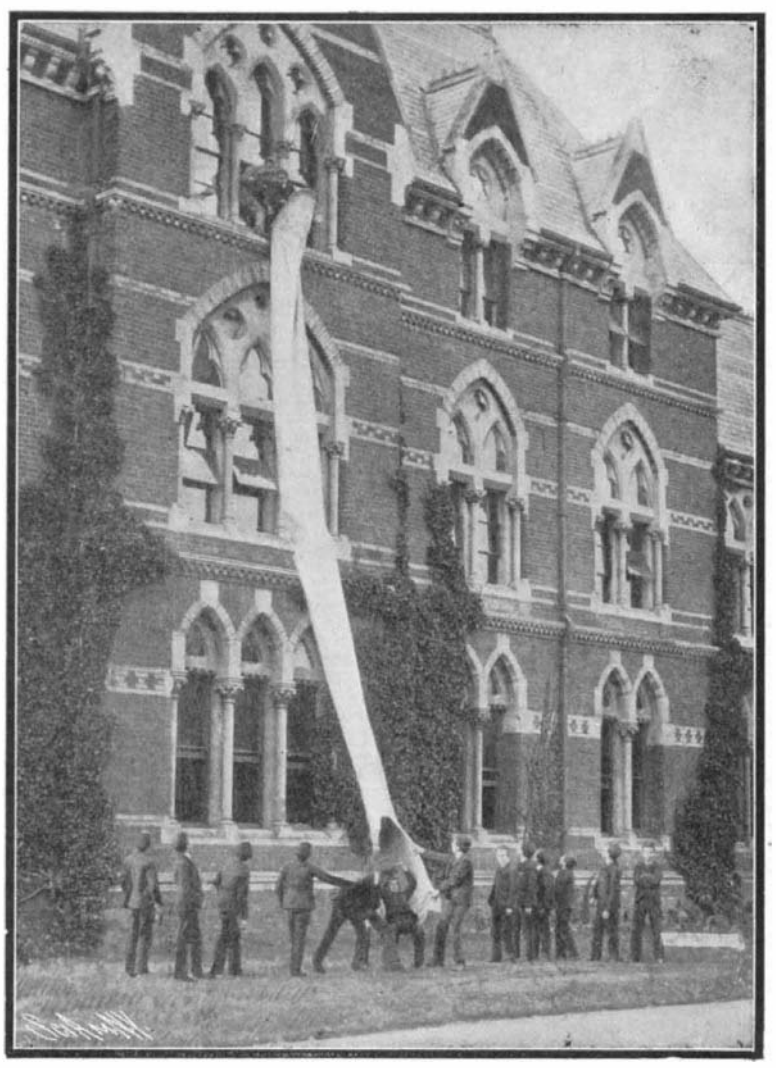
The most favored type of fire escape in Great Britain at present is undoubtedly the canvas chute, of which thousands are in use in public buildings, theaters, hotels, warehouses, asylums, hospitals, private mansions, and schools. One of these is capable of emptying a school dormitory fifty feet from the ground, costs little more than $50, is exceedingly light, and may be kept just under the window-sill in an unobtrusive manner.

Other escapes in use at schools include the canvas sling, the canvas bucket (which is provided with any required length of the finest Manila rope), and a gun-metal brake, by which the person escaping from a burning building can control the speed of his descent at will.

When once the installation is complete at the school —and very perfect fire-fighting and life-saving apparatus are now to be found at Eton, Harrow, Rugby, Winchester, and Stonyhurst—the work of organization is systematically begun.

Nor are the women's colleges behindhand; for at the Royal Holloway College at Egham, near Ascot, there is one of the most perfect amateur fire brigades in Great Britain, the young ladies being so expert as to be in request for outside fires at farmhouses and cottages in the rural districts round about.

A Type of Fire Escape Used in English Schools.



The Chute Fire Escape.

LIFE-SAVING APPARATUS IN BRITISH SCHOOLS.

Practice with the canvas chute fire-escape is taken very seriously by the young persons in schools, department stores, and other establishments, and praiseworthy attempts are made to make "records" in the way of emptying the supposed burning building against time.

The moment the alarm is given, it is arranged that the first person to slide down the chute shall be especially expert. This is because there is no one at the bottom to hold the chute out at an angle, and so break the fall. Therefore, the first person down uses his or her elbows and knees in such a way as to retard a too speedy descent; and arrived at the bottom, he or she promptly takes hold of the lower end and walks out a little way with it, so that the descent of the others may be a swift slide.

It is both curious and interesting to see a great school being emptied by a series of these canvas chutes, the boys dropping like so many divers at the upper end, and literally pouring out at the other end on to the lawn.

Naturally, to stand the strain, the canvas has to be especially strong. This reminds one that accidents have happened from such slight causes as a projecting nail in the shoe of one of the sliders, causing the canvas to rip and let the unfortunate slider through. As these canvas chutes are made up to one hundred feet in length, it will be seen that a fall through a hole in one of them might well mean certain death.

The same practice is gone through in the department stores; and it is no unusual sight to see a great crowd in the busy London streets watching the canvas chute escape practice of hundreds of young men and shop girls. It may be well to point out that in London all the young persons employed in the big stores sleep on the premises, so that some system of rapid escape in the event of fire is absolutely necessary.

The canvas belt or sling fire-escape is also much favored, and is, if anything, still simpler in its working than the canvas chute already described. It lies coiled up just inside the window; one end of the rope, which is carefully calculated to reach the ground, being made fast to steel staples in the wall just beneath the window.

In the event of an alarm, one rushes to the window and opens it, buckles in a moment the canvas sling or belt about the body, and then proceeds to lower one's self out of the window, regulating the speed of descent by means of the very simple brake which is also provided with the apparatus.

When the first person has reached the ground, it is only the work of a moment or two to draw the escape up again for the second person. Obviously, the canvas sling is not so fast in its operation as the chute, which provides for the escape of an unceasing stream of imperiled persons.

A New Damask Jacquard Loom.

A Finnish inventor has designed a mechanical damask Jacquard loom effecting the same saving of pattern cards, pattern drawings, and work, without the employment of so-called "forward healds," as is obtained in the ordinary damask-weaving looms operated by hand. Another advantage claimed for this invention is the possibility of producing an almost unlimited number of large patterns. It consists in the arrangement of a number of wires or hooks for every needle corresponding with the number of threads desired in a warp unit. These wires or hooks are acted upon by lifting blades, the position of which is adjusted by cam grooves round a cylinder, the cam grooves being arranged in such relation to the speed of the cylinder that the required binding or combination is determined by the adjustment of the wires affected by the blades, so that those rows of wires which are to remain down are moved out, while others which are to be raised are not affected, and this whether the wires or hooks are pressed back by the pattern cards or not.

The United States Coast and Geodetic Survey is now making a survey of the coastline and harbors of the Philippine Islands. The extent of it is shown by the statement that the coast-line of the islands is over 11,400 miles, or double that of the United States. There is a mile of coastline to every square mile of area, while in the United States the proportion is 1:555. There are nearly 1,700 islands having names, and it is possible to count 3,000 islands and islets on the chart.