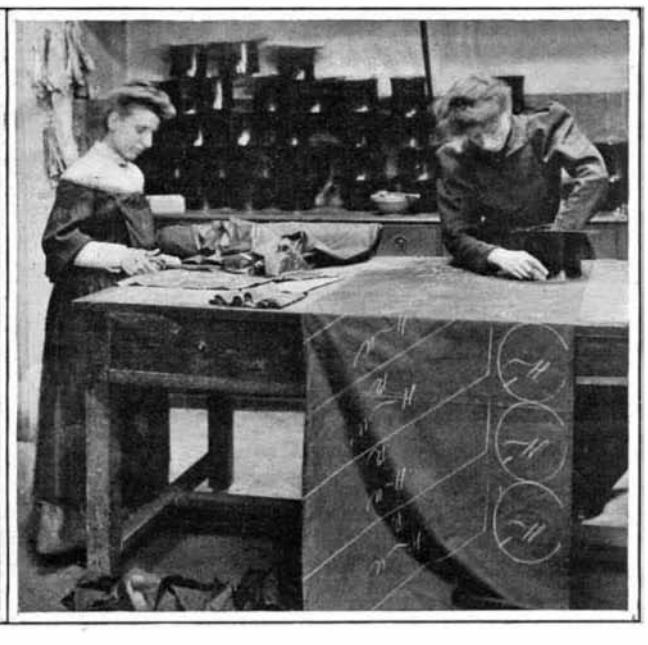
the reservoir, *f*, with compressed air until the latter is continually discharged through the safety valve f_1. The flying machine, whose supporting surfaces and rudder are arranged in the direction of the propeller axis, is then slowly lifted through 4½ feet by allowing air to enter through k_2 into the cylinder or cylinders *g*. The propeller is next adjusted for forward running, while compressed air is introduced through k_1 into the cylinders *m*, thus unfolding the wings suddenly. As the whole wing surface remains parallel to the ground, the flyer is drawn by the propeller at a speed of 10 to 12 yards a second. At this very moment the direction of the air in the lifting cylinder *g* is reversed by turning the cock k_2, thus causing the legs of the airship to be pulled upward, and allowing the machine to fall freely 4½ feet. It actually falls some distance while being launched forward, and even if this distance be only half a yard, an increase in speed of about 3 yards will be derived therefrom, thus giving an initial flight speed of 13 to 15 yards per second. If the center of gravity of the whole machine be so placed in regard to the wings that the former, while transmitting its load to the wings, is rotated, e. g., to a certain extent lifted in front and lowered backward, the flight is bound to continue, the rudder being actuated in the case of a permanent operation.

In landing, the speed of the propeller is reduced while adjusting the wings to a steeper inclination by lifting the two back rudders; then the whole airship slowly drops upon its rear legs, and in a half-flying and half-rolling motion falls on its fore legs. By reversing k_1, the compressed air in the cylinder *m* is immediately controlled in such a way as to draw the wings abruptly to the body, thus ending the flight.

As regards the performance of this kite flyer in bad weather and winds, a special point has been made of imitating the behavior of birds. It should be remembered that all birds in their tails possess approximately horizontal surfaces, by means of which all horizontal and vertical motions as required in flying can be obtained.

If now the bird unexpectedly is taken sideways by a sudden gale, it is struck behind its center of gravity by a far greater number of air particles than in front of the center of gravity. It thus quite automatically turns toward the wind, thereby eliminating any danger. For this reason the inventor has provided his machine with rear rudders and an intermediary stationary vertical keel, in the place of the front rudder used by Santos Dumont, which on the above theory would be rather dangerous.

Covering Hat Bodies with Silk Plush.



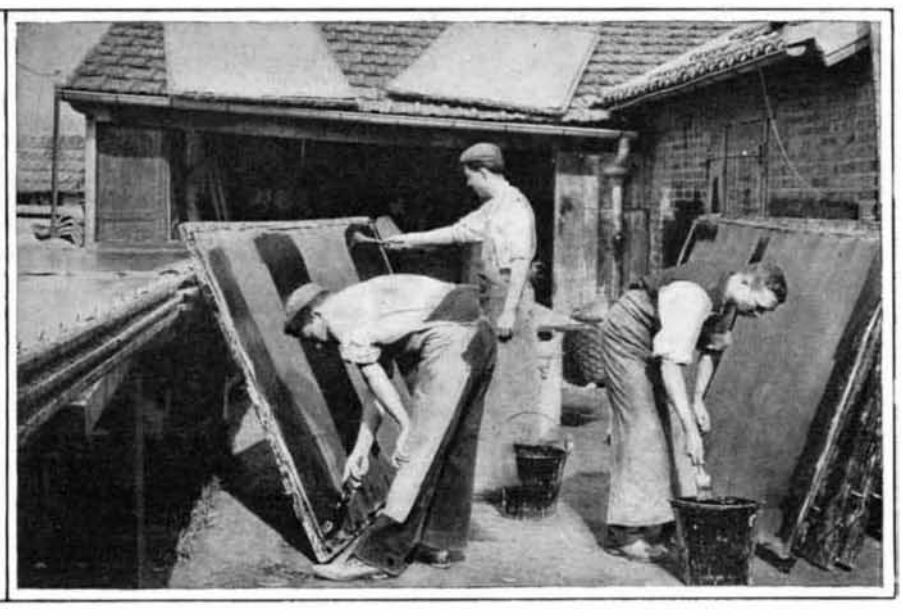
Cutting Out Plush Hat Covers.

THE STORY OF A SILK HAT.

BY JACQUES BOYER.

In the making of the silk hat, that indispensable accessory of fashionable masculine attire, comparatively little use is made of the marvels of modern machinery that play so important a part in most of the arts and manufactures. The construction of a silk hat includes five stages: making the foundation or body (called in French *galette*, that is, "pie crust"), covering, shaping, sewing the silk plush cover, and, finally, lining and trimming. The body is composed of several thicknesses of very fine muslin which are wrapped around wooden forms (blocks) representing the styles of the season. The muslin, before it is put on the blocks is stretched on frames brushed with a solution of shellac in alcohol containing a little ammonia, and dried in the open air or in well-ventilated rooms, according to the season and the weather. The foundation, or body, thus constructed is varnished. It is as hard as wood, very light and absolutely water-tight. If it is thrown on the floor it will rebound without becoming deformed. In order to make the foundation exactly fit the wooden block, which is smaller in the middle than at the ends, the first strip of muslin is cut bias. The innermost layer of the top of the hat consists of satin or watered silk. To this the prepared muslin is applied in one or more layers. The foundation of the brim is made of two or three layers of stouter muslin coated with shellac, which are pressed together and smoothed by a machine which consists essentially of

Shaping and Curling the Brim.



Coating Muslin with Shellac for Foundation.

Making Brims.

Shaping Hats After Covering.

THE STORY OF A SILK HAT.

two cast-iron rollers mounted on a heavy iron frame and heated by gas. This machine is rolled several times over the still flat brim foundation to which it gives the required stiffness. The brim is then clamped between a wooden plank and a zinc plate, in each of which is a hole slightly larger than the inside of the finished hat, and the inner edge of the brim which projects beyond the plank and zinc plate is bent at right angles by the application of a hot iron of peculiar shape and trimmed with knives to remove the irregularities produced by this operation. The short tube thus formed inside of the brim foundation is fitted to the foundation of the crown and the two are fastened together by the application of a hot iron, the hatmaker's most important tool. Then the entire body receives another coat of varnish and, after drying, it is ready to be covered with silk plush.

The covering is in two pieces, a circle and a rhomboid. The illustration shows a girl tracing the outlines with chalk on the back of the plush and another girl cutting out the pieces. A skillful needlewoman then sews the pieces together. This is a very delicate operation, for the seams must not show in the finished hat. The plush is stretched tightly and the nap is brushed over the seams.

In the operation of covering the hat, cashmere is glued on the lower side of the brim and silk plush on the upper side. Then the wooden block already used, which is composed of five sections, is wrapped with cotton wadding and forced into the hat body in order to stretch it as much as possible. The plush cover is next forced over the body and smoothed and made to adhere by the application of a wire brush, a damp sponge, and a hot iron. Then comes the most difficult and delicate task of all, the joining of the side to the brim by an invisible seam. The entire surface is again dampened and ironed and the hat is placed on a lathe and polished with a strip of velvet, which cleans the plush perfectly and gives it a brilliant gloss.

The inequalities in the crown caused by the five-parted form on which it was forced are removed by placing it and turning it on a gallows-shaped heated iron tool, an operation which requires great strength as well as skill and taste. The crown is now covered with paper to protect the surface and the flat brim is molded to the desired form and slightly curled. The edge of the brim is then sharpened with knife and plane, covered with silk braid and finally shaped to suit the particular style desired or the taste of the wearer, if it has been made to order. The final operation, performed by girls, is the insertion of the leather sweat band and the silk lining.

The silk hat of the twentieth century can defy the elements. It is less ornate than its ancient prototype of soft felt garnished with plumes, but it is far lighter and more durable.

The Finishing Touches.

Final Shaping of the Brim.

THE STORY OF A SILK HAT.

The man who buys a 1907 model will get something bigger and better in the shape of a car than he ever dreamed of a few years back, but the item of depreciation appears to remain stationary despite the vast improvement that has been brought about. And in this connection depreciation must be considered in two senses—actual and financial. The former is the reduction in value that the car has actually suffered through wear and tear on its mechanism, accidental injuries, and the like, and the latter is the slump in its market value that has come about merely through the fact that it has been used and regardless of how little it may really have lost. That it has been run an entire season or only a month appears to make little difference. The blight of being second-hand is upon it. And even though it may actually fulfill every representation of the owner anxious to part with it regarding the short distance it has been run and its perfect condition, it is extremely difficult to realize more than 60 per cent of its original selling price. This does not represent an extreme in either direction. In occasional instances more may be realized, but in the majority it is less and the item of depreciation is correspondingly heavier. The car that sold for $2,000 when new will seldom bring much more than half that price when a year old, and at the end of its second year this will practically be halved again, despite the fact that as a well-built piece of machinery it may have several years of efficient life before it.—Motor World.

A New Use for Concrete.

Repairing breaks in the hull of a sunken steamer with concrete is a new departure, but one likely to prove frequently useful. The scheme was successfully tried upon the steamer "George W. Elder," which was sunk in the Columbia River over two years ago, and remained under water many months. The boat struck on a jagged rock, which stove several holes in her iron hull; the principal one, about 80 feet from the bow, measured about 35 feet in each direction. Through this enormous gap the rock projected into the hold for nearly 11 feet. A bulkhead was built by divers forward of the break, and another aft, and two more aft of the engine room. Heavy canvas was then placed over the rock which projected up into the ship, and concrete was placed over the canvas until a heavy covering had been obtained. This was supported against the outside water pressure by a concrete beam athwart the hold, measuring 18 x 48 inches and 38 feet long. The concrete was mixed and placed under water by divers, the cement being sent down a chute in sacks and the stone in a box.

Other smaller breaks having been similarly treated, the water was pumped out of the hold, and the vessel floated and towed forty miles to a drydock. One of the problems connected with concluding the operations involved the relation between the capacity of the pumps, which were discharging the water from the hold, and the flow through leaks developing around the huge cement cone, and at other points in the hull which had been severely strained by the action of the current during the sixteen months of submersion. By the terms of the contract under which the salvage operations were undertaken the successful wreckers received $30,000, as against nothing in case of failure. The original owners had sold the wreck for $10,400, and, as the cost of repairs was about $20,000, the outlay of the buyer amounted to about $60,000. After the ship was ready again for service an offer of $160,000 was made for her.—Iron Age.

An Interesting Use of the Telephone.

Two novel uses of the telephone are given in the American Telephone Journal. During the past summer public entertainments have been given in Riverview Park, Chicago, which is one of the largest of its kind in the United States. One of the novel features of these entertainments was the placing of telephone receivers attached to horns in several of the trees in different parts of the park. During the entertainment, music produced on a piano, a cornet, or songs was reproduced by these telephones, much to the mystification of the audience. This effect was made possible by means of the powerful transmitter devised by the International Telephone Manufacturing Company, of Chicago, known as the "Transmitophone." The soloist who gave the selection was located out of sight and was able to keep in time with the accompaniment of the orchestra by means of a special receiving circuit.

The other interesting use of the telephone was in reporting the Michigan-Ohio State football game. Two bare wires were stretched across the field, and a small trolley arranged to run on them. To this trolley was attached a portable telephone set, which was used by the reporter, who followed the progress of the ball along the field. This circuit was connected with the Ann Arbor (Mich.) exchange, and through it to the University of Michigan. In this way the progress of the game was followed at Ann Arbor almost as closely as it was on the field where it was played.

Preparation of Pure Helium.

A new method for the preparation of helium in a pure state is the subject of a paper presented to the Académie des Sciences by Messrs. Jacquerod and Perrot. In a preceding note, the authors called attention to the great facility with which helium is diffused through a quartz bulb which is brought to a high temperature. Their researches upon the expansion of gases showed on the other hand that silica is quite impermeable to other gases, with the exception of hydrogen, and perhaps carbon monoxide, up to the temperature of 1,952 deg. F. These observations led them to a method of purifying helium which may present a certain interest, owing to the difficulty found in the chemical or other processes used up to the present time.

A quartz bulb, which ends in a capillary tube of the same substance, is placed inside a cylindrical platinum tube of somewhat larger diameter, stopped by a metal plate which allows the capillary tube to pass. Sealing wax is used to make a tight joint. Side tubes allow of making a vacuum in the annular space between the platinum and the quartz, as well as inside the quartz bulb, and gas can be also introduced. The apparatus is heated to about 2,010 deg. F. in an electric furnace having platinum resistance coils, with the exception of the sealing wax joint, which is cooled by a jacket having a cold water circulation. The quartz bulb can be put also in connection with a mercury gas tank by means of a stop cock. A vacuum is first made in an almost complete manner in the two envelopes by using the mercury pump, then ordinary unrefined helium coming from the calcination of cleveite is introduced into the platinum tube at somewhat higher than atmospheric pressure, so as to hasten the diffusion. By adding to this impure helium from five to ten per cent of oxygen we can fix under the form of water vapor or carbonic acid, the hydrogen or carbon monoxide which may be present there. After a few minutes the pressure gage connected to the quartz bulb shows that the gas is commencing to diffuse. The pressure rises in a very regular way and after two or three hours a portion of pure helium can be introduced into the gas-holder. In these conditions the output of gas, with the quartz bulb containing 42 cubic centimeters is somewhat slow. It corresponds with about 1 cubic centimeter of pure helium per hour. On the contrary, the method, when once the apparatus is mounted, is easy to operate and the purification seems to be perfect. In fact, spectroscopic examination of the gas shows none but the characteristic rays of helium, which are very brilliant, and the nitrogen bands, although easy to see, are quite absent. Only the red ray (H) of hydrogen can be perceived, but it is very faint. It comes very likely from traces of hydrogen retained by the electrodes of aluminium of the Plücker tube, and it is known in fact how difficult it is to have the spectrum of this gas completely absent in a spectroscopic vacuum tube. Thus it is seen that the diffusion of helium through quartz at a high heat gives a good method of obtaining the gas in a pure state.

The Assay of Silver Bullion.

At the Institution of Mining and Metallurgy a paper was read recently by Mr. E. A. Smith on "The Assay of Silver Bullion by Volhard's Ammonium Thiocyanate Method." It has recently been the practice to modify slightly the method of finishing the assay by adding sufficient ammonium thiocyanate to the check assay to intensify the red color of the ferric thiocyanate, and to use this color as a standard of comparison. Experiments described by the author proved that, by finishing the assay in this way, a limit of accuracy of less than 0.1 per 1,000 of silver can be obtained by Volhard's method. Working in the ordinary way the limit of accuracy is 0.2 to 0.3 per 1,000.

The consumption of pig iron in Germany during 1906 amounted to 12,396,088 tons, against 10,739,871, an increase of 1,656,217 tons, or 15½ per cent. This makes a consumption per head of the population of 444.4 pounds, against 391.6 pounds in 1905 and 356.4 pounds in 1900—the previous boom year.