FROM THE TOBACCO LEAF TO THE CIGAR.

ALTHOUGH we are a nation of smokers, many will learn with a shock of surprise that the annual estimated expenditure in this country for cigars alone reaches the stupendous figure of $300,000,000. It must be admitted that an industry whose total revenue is written in nine figures possesses an interest which demands for every question affecting it the most thoughtful consideration.

The present article deals with the technical side of the cigar industry; and it will be shown that in the manufacture of this, as of many another familiar luxury of our modern life, there is involved a variety of delicate processes and a range of technical skill, far greater than the average citizen would suppose. Ask the man on the street if he knows how cigars are made, and he will probably tell you that he does, having frequently watched the process in some one or other of those shop-window exhibitions, which form a favorite method of advertising the stock of goods within. Yet it is a fact that if the cigar is being carefully and properly made, the man who rolls it is merely performing the last operation in a succession of carefully-considered and carried-out processes which, as in the case of the American Cigar Company, whose plant and methods are described in the present article, will extend over a period which must be measured by months and, in the case of some brands of cigars, even years of time. We have often pointed out in the columns of the SCIENTIFIC AMERICAN that, as far as the merely technical side of any industry is concerned, there are undoubted advantages to be gained from the combination of a large number of factories and industrial plants under a common management. We have often shown that not only does it become possible to introduce economies both in management and labor, but that the shop traditions and special methods of manufacture peculiar to each of the factories thus brought together enable the consolidated concern to produce an article embodying all the points of excellence, or as many as it may wish to incorporate, of these hitherto separated and opposed interests. As an immediate result, the consolidated interests are in a position not only to turn out a superior product, but to produce it at lower cost.

Although the methods by which the cigar leaves are rolled up into the cigar and covered with the wrapper are, except for the introduction of cigar-making machinery, the same to-day as they have been from time immemorial, there has been great progress made in the art of preparing the leaf for the cigar roller, and this is particularly true of the company whose plant forms the subject of the accompanying illustration. In fact, if they were asked to indicate where they had been enabled to make the greatest advance in the art of cigar manufacture, they would undoubtedly point to their large stemmeries, located chiefly in the moist southern climate, where new and elaborate methods have been introduced for subjecting the tobacco leaf to a thorough curing and blending process, intermediate between the curing at the leaf houses and the working up into the finished cigar. Broadly speaking, all cigars may be divided under three heads, according as they are imported cigars, domestic cigars, and little cigars. The term imported cigars is universally recognized as applying only to those which are made in Havana. As the strictest laws are enforced against the importation of tobacco to Cuba, it follows that all genuine Havana cigars are made of Cuban tobacco. For the birthplace of the cigar, we must go to Havana, Cuba, and for centuries the word Havana has stood for the highest quality. The Havana Tobacco Company controls 260,000 acres of the best tobacco lands in the Vuelta Abajo district, and they have twenty-five factories in Havana. Here Havana cigars are made in all grades, from the cigar which may be purchased on any stand at two for 25 cents up to the most expensive brands which, if bought at retail, would cost about $2 apiece. The high quality of the most expensive Havana cigar is due to the very careful selection of the tobacco—tobacco which is grown in limited quantities in specially-favored districts; secondly, to the perfect curing and blending of the leaf and to the high wages which are paid to the best cigar makers; and lastly, to the fact that in making the most expensive grades, these men are allowed to take all the time they consider necessary.

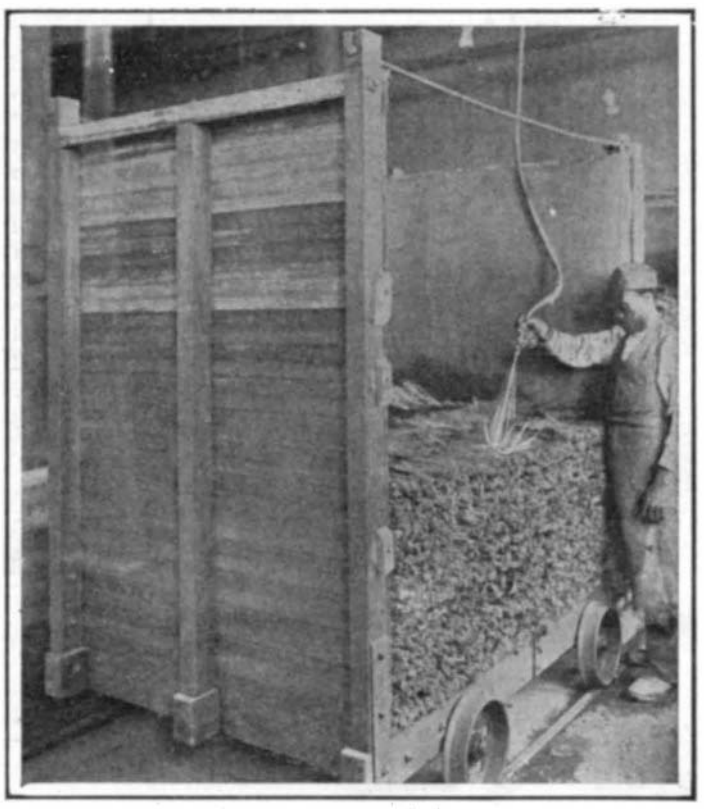


Fig. 1.—Tobacco is Unloaded from Cases in Which It Comes from the Leaf Houses, Placed on Trucks and Sprayed with Water Preparatory to Sweating.

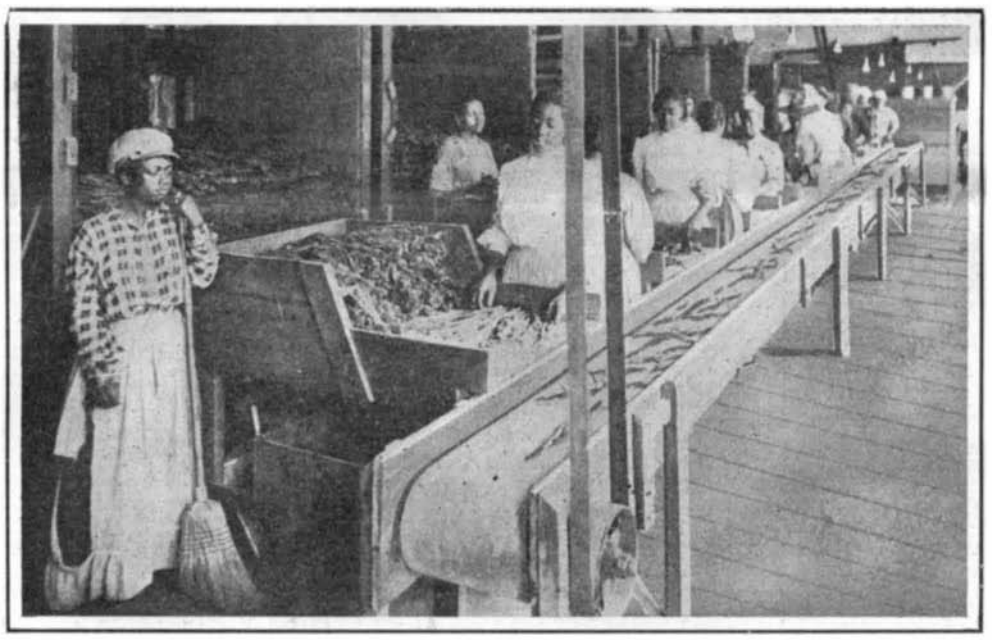


Fig. 2.—Selecting and Blending the Fillers. Poor Tobacco is Thrown Out; That of Good Quality is Placed on the Belt Conveyor.

Domestic cigars are made either from imported Havana tobacco, or from tobacco grown in this country, or from a combination of both. The domestic cigars, from the five-cent cigar upward, are made by hand in various factories of the American Cigar Company, to the number of twenty-five or more, which are scattered among the various cities of the United States. Quite a few cigars, below five cents in value, and all little cigars, cheroots, and most of the stogies manufactured by this company, are machine-made.

In the manufacture of all cigars, whether they are made by hand or by machine, whether they are made to sell for five cents or two dollars apiece, perfect sanitary cleanliness is maintained, because a better product is thereby obtained, and the factory conditions are rendered pleasanter for the operatives.

THE LEAF HOUSES.—As soon as the tobacco crop has been gathered and stored in the barns, which is done in the fall of the year just before the coming of the frost, the company's agents select from their own farms, or purchase from the tobacco farmers, leaf tobacco suitable for various brands of cigars that are to be made. The tobacco for small cigars, cheroots, and all the cheaper brands is grown in the States of Wisconsin, Connecticut, New York, Pennsylvania, Ohio, and Florida. That for the more expensive brands is grown, as we have already noted, in Cuba, and the wrappers in Sumatra. The leaf tobacco as thus selected and purchased is delivered to the various leaf houses of the company. Here it is classified according to the brand for which it is to be used; is packed in cases, and shipped to large storage houses, where it is kept for twenty-four months and subjected to natural fermentation or sweating, the object of which is to sweeten and mellow the leaf, which otherwise would be strong and rank, and also to give it a uniform color.

At the time of purchase, the tobacco is classified according as it is to be used for wrappers, binders, or fillers. Contrary to the popular belief the wrapper has practically nothing whatever to do with the quality of the cigar, which is determined almost entirely by the filler. As a matter of fact, the filler constitutes about 94 per cent of the weight of the cigar, and it is questionable whether the average wrapper constitutes more than 2 per cent of its weight. Consequently, the color of the wrapper can have but little effect upon the strength of the cigar; for the mildest cigar may be covered by a dark wrapper, and *vice versa*.

THE STEMMERIES.—In the ordinary process of cigar manufacture, it is customary for the buyers to ship the leaf tobacco to the various factories, where two or three grades will be placed on the cigar-maker's bench; and in making up the filler he will select a certain number of leaves from each grade, and roll them together in the cigar, thus making what is called a blended cigar. The American Cigar Company, however, consider that it is only possible to get a perfect blending of several different grades of tobacco if, after they have been mixed together, they are subjected to a second and artificial sweating or fermentation, and it is largely due to the thoroughness with which this process is carried out in their stemmeries that they attribute the excellence of their output. The accompanying illustrations are taken at the company's large stemmery in Richmond, and the process as here illustrated and described may be taken as representative of their system.

CASING ROOM.—The tobacco is shipped from the leaf houses to the stemmeries in large cases, which are received in the casing room, opened, and inspected by the superintendent. The tobacco as it arrives is very dry and crisp, and if handled in this form is liable to break up and make a large amount of scrap. It is, therefore, opened out, bundle by bundle, and placed on large trucks where it is sprayed with water (Fig. 1) to make it pliable for handling. As the tobacco comes from the leaf houses, it will be of various qualities, and in loading it upon the trucks, the various qualities are taken, say from as many as eight different cases, so that each truck-load represents a blend of many varying grades. After being sprinkled on the trucks, it is taken to the sweat room, where it is kept at a temperature of 94 degrees and in a humidity of 95 per cent for a period of from two to four weeks. The trucks are then brought back to the casing department, where they are drawn up, six at a time, in front of what are known as the picking tables (Fig. 2). Here one man distributes the leaves from the trucks to the tables, where women untie the bundles, spread them out before them, pick out the inferior tobacco, which is used for a cheaper

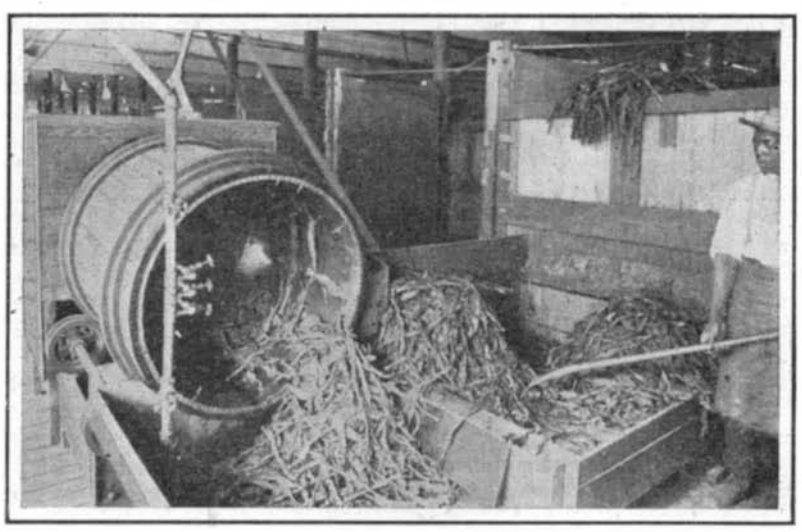


Fig. 3.—Spraying and Blending the Tobacco in the Mixing Cylinder.

Fig. 4.—Stemming the Leaf by Hand.

Fig. 5.—Stripping by Machinery. Operator Withdrawing Stripped and Booked Leaves.

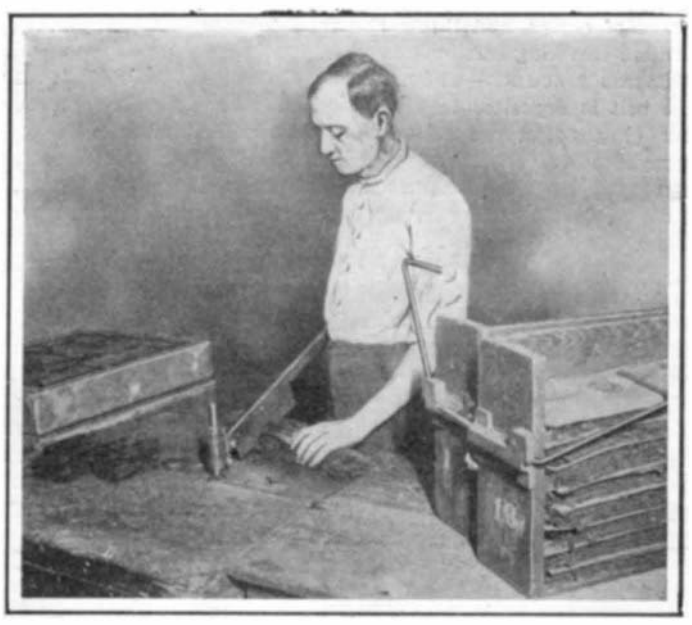


Fig. 6.—Cutting Binders into Lengths to Suit Different-Sized Cigars.

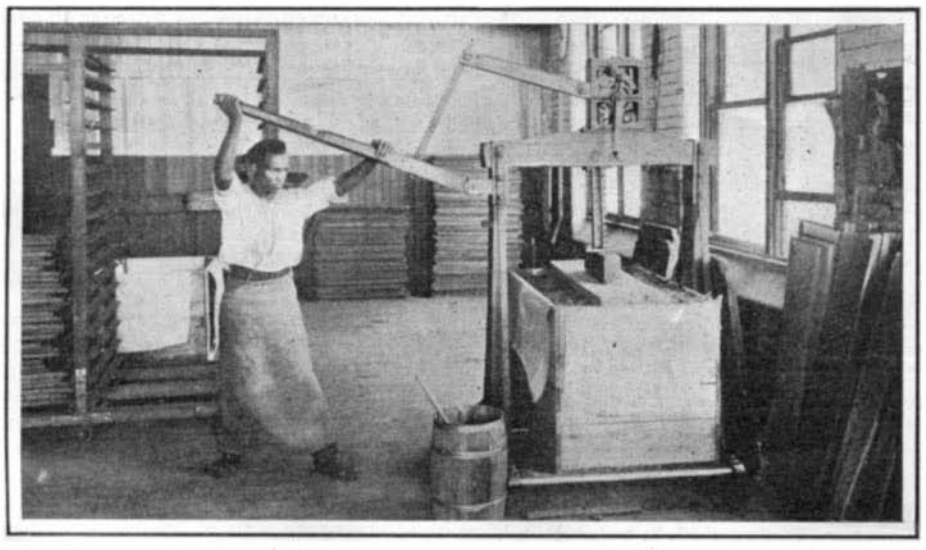


Fig. 7.—Packing Tobacco in Cases at the Stemmery for Shipment to Cigar Factories.

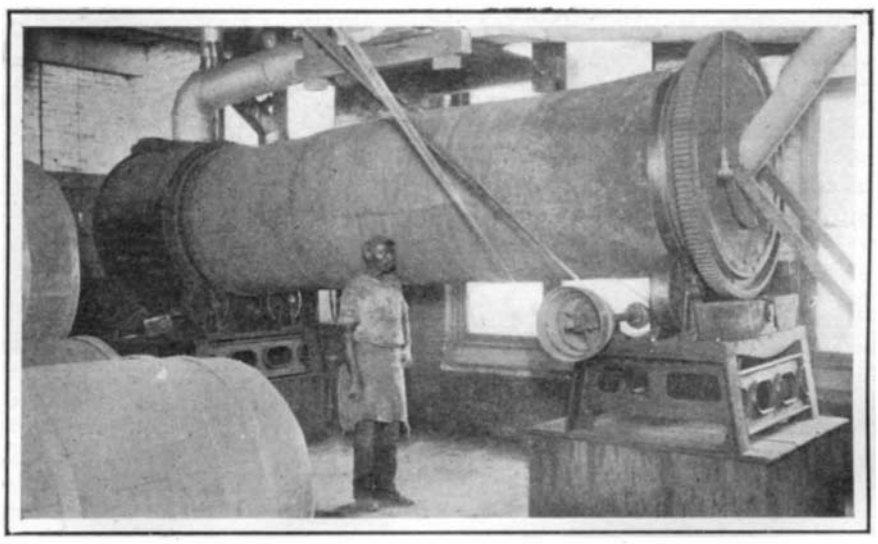


Fig. 8.—Rotating Cylinder in Which the Scrap Is Dried After It Has Been Cut to Suit Size of Little Cigar or Cheroot.

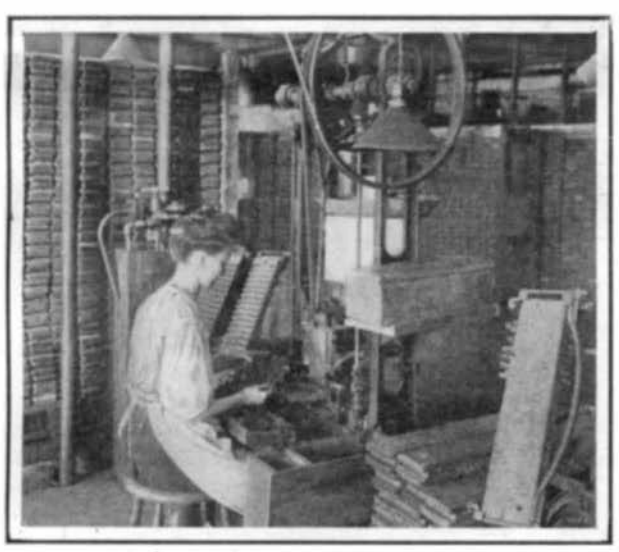


Fig. 9. Cheroot Bunch-Making. Girl Lays Binder on Rolling Apron, Filler Drops from Hopper Above.

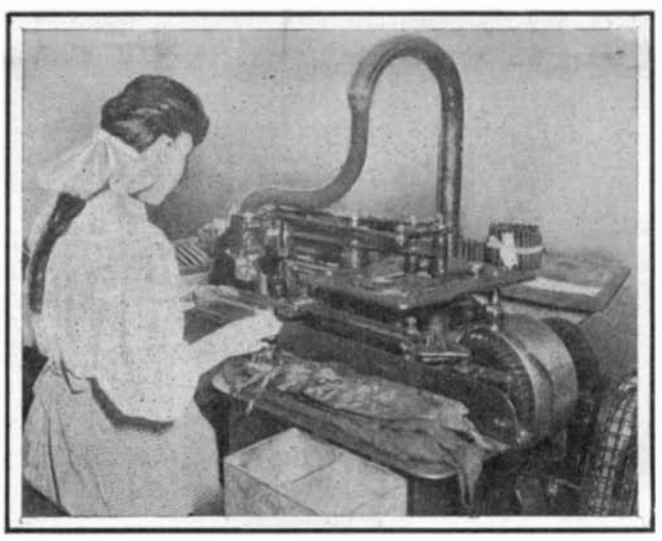


Fig. 10.—Making Cheroots. Wrapper Being Transferred by Suction from the Die to the Cigar.

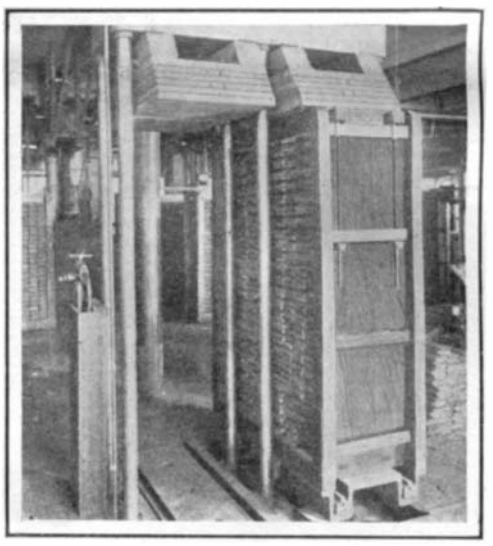


Fig. 11.—Pressing 5,000 Bunches for Cheroots in Molds at One Time in 30 Seconds.

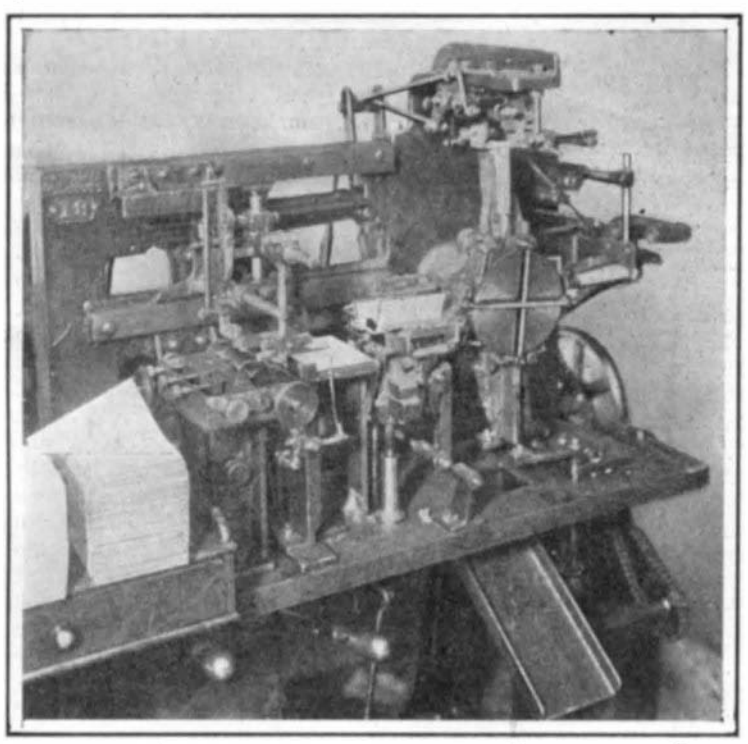


Fig. 12.—Automatic Machine for Making Cups in Which Cheroots Are Packed. Capacity, 75,000 per Day.

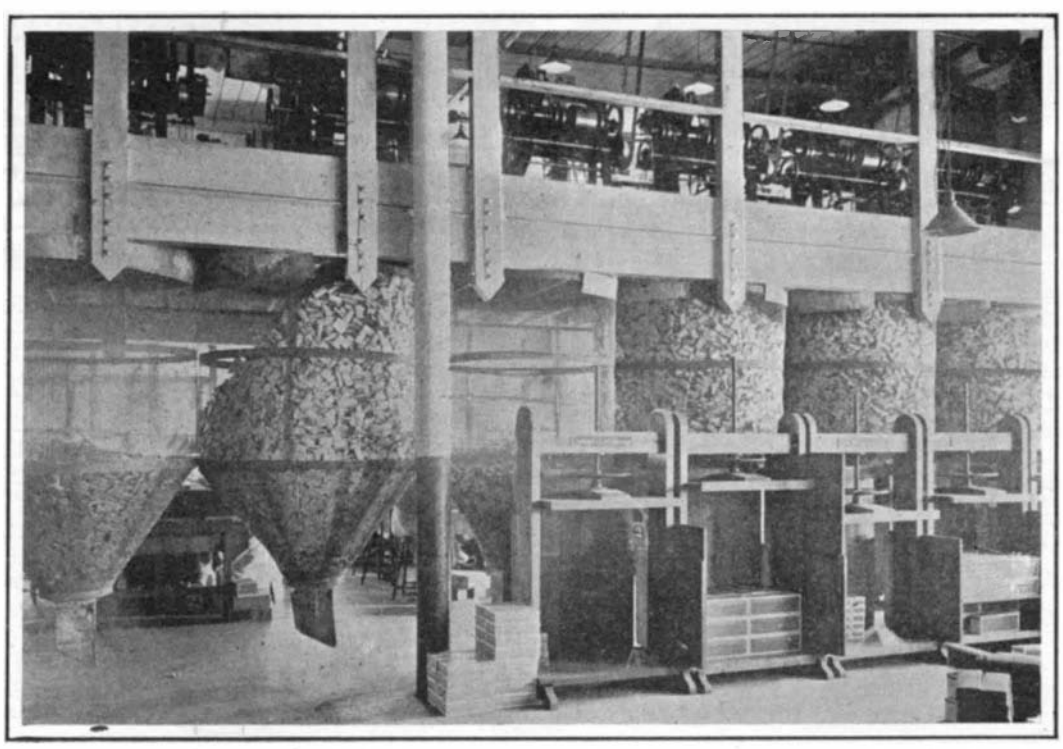


Fig. 13.—Wire Bins into Which the Cups Fall by Gravity from the Cup-Making Machines. Capacity, 75,000 Each.

FROM THE TOBACCO LEAF TO THE CIGAR.

grade of cigars, and throw the good tobacco onto an endless traveling belt or conveyor.

Casing Machine.—The selected tobacco thrown on the belt is deposited in a copper-lined rotating cylinder (Fig. 3), where it is rolled over and over and sprayed with fine jets of water, to give it the proper amount of moisture for fermentation. It is then pitchforked into a truck, where it is packed down tightly, and taken to the sweat room, where it undergoes fermentation until it has thrown off all the sap and rankness, and has reached the best smoking condition. It remains here for a period of from three to four weeks. When this process is complete the leaf tobacco, still on the truck, is brought up to the third floor again and undergoes another process of blending, sometimes as many as five different grades being mixed together. This blending takes place in a revolving screen cylinder where, in addition to the blending, sand, soil, and any other substance from the farm are removed, and the tobacco is thoroughly cleaned. It is then loaded onto the trucks again, where it stays packed for two or three days, the purpose being to secure a thorough exchange of aroma between the different grades of leaf, and to draw the leaves to a uniform condition for stemming.

It should be understood that the process of artificial fermentation has a double result, each of which is vitally important to the quality of the tobacco. In the first place, as seen above, it serves to sweat out the rankness, removing the sap and gummy substances; and secondly it serves to secure a thorough exchange of flavor of aroma from leaf to leaf, various leaves giving and taking from one another, and securing, so the experts of the company claim, a blend greatly superior to that which can be obtained when a cigar is made up of leaves that come direct from the leaf houses and have not been subjected to artificial fermentation.

Stemming Department.—The blended tobacco leaves are now wheeled on trucks to the stemming department, where the stems are removed. In stemming by hand, as shown in our illustration Fig. 4, the stem is torn from the leaf by the operator, who commences stripping from the tip, and by a deft movement strips it clear, leaving the leaf in two parts. In the illustration the stem is shown half torn away, the leaf being separated into two halves or strips, as they are called. The strips are neatly arranged, one above the other, in two piles, or "books," of fifty leaves each. The books of strips are taken from the stripping benches and placed on wire trays, 14 inches wide by 3 feet long. There are eight piles to the tray. The trays are loaded into the shelves of large trucks, ninety-six trays to the truck, and brought down to the drying department.

Drying Department.—In the drying department the strips are allowed to dry out naturally for a period of twenty-four hours. They are then placed in the dry room, where a current of warm air, at a temperature of 95 deg. to 100 deg. Fah., is driven through them until it has taken off all the surplus moisture, the process of drying occupying from four to five hours, according to the grade of tobacco. The trucks are then drawn out, and the tobacco allowed to cool out for twenty-four hours.

Ordering Room.—The process of drying out is liable to have left the outside leaves of the tobacco a little too dry for packing, and, therefore, the trucks with their load are taken out and placed in what is known as the ordering room, as shown in Fig. 15. Here the tobacco strips are subjected to a current of humid air at a temperature of from 92 to 95 degrees, for a period of from fifteen minutes to half an hour. The trucks are then wheeled out and the contents removed and packed in paper-lined cases (Fig. 7), after which the cases of tobacco are placed in storage for from three to five months, in order to allow the tobacco to make a further exchange of aroma. The product is then ready for shipment to the various cigar factories.

A most notable feature in this stemmery is its absolute cleanliness, the free circulation of fresh air, the absence of dust, and the clean personal appearance of the people who are employed. Another feature that will be appreciated by smokers is the fact that the tobacco leaf in the stemmeries rarely comes in contact with the hands of the workmen. Machinery takes the place of human hands wherever possible, and this of course aids in keeping the finished product free from anything objectionable.

The Old Virginia Branch.—One great advantage of the widely-extended operations of the American Cigar Company is that, making such a great variety of cigars, and of such widely different grades, it becomes possible not only to secure great economy by using up all of the tobacco in some one grade or other, but it also becomes possible to use these various grades of tobacco in the particular quality of cigar to which they legitimately belong. Moreover, the company claims that by virtue of this variety and these economies, it is able to put a higher quality of tobacco into a given grade than could be put in that grade by a manufacturer whose operations were carried out on a less extensive scale. Interesting proof of this is shown in what is known as the Old Virginia Branch, which is devoted to the manufacture of what are known as "scrap filler" cigars; that is, little cigars, the fillers of which are made of high-grade, short-length tobacco from the factories which make the higher grades of cigars by hand. This branch handles all by-products, such as wrapper and binder cuttings, and short pieces of tobacco too short for long-filler cigars. The material is brought to this factory from the various factories of the company in America, Cuba, and Porto Rico; and here it is cut up, hand-picked, thoroughly cleaned, sweated, and put through curing and blending processes analogous to those already described in the treatment of the stemmery.

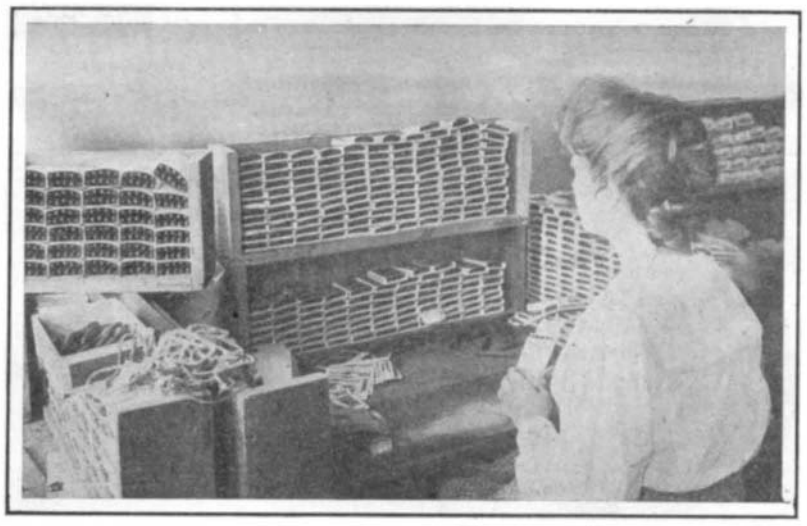


Fig. 14.—Sorting for Color and Packing Little Cigars.

The cases are opened, inspected, and graded. The tobacco is then sprinkled, allowed to stand for twenty-four hours, and then carefully picked over on tables to remove any foreign matter. It is then bulked in bins, and allowed to stand for twenty-four hours to draw it to a uniform condition. It next passes through a machine, where it is subjected to a further process of cleaning by means of an air blast, where all fine substances are blown away. Next it passes through a sieve, in which it is still further cleaned and graded as to size. It next passes down to a steam drier (Fig. 8), a large rotating cylinder in which the tobacco is thoroughly dried out. From the drier it falls down through chutes to another floor, and direct into hogsheads, in which it is pressed down and snugly packed under a 750-pound press, ready for shipment to the little-cigar factories.

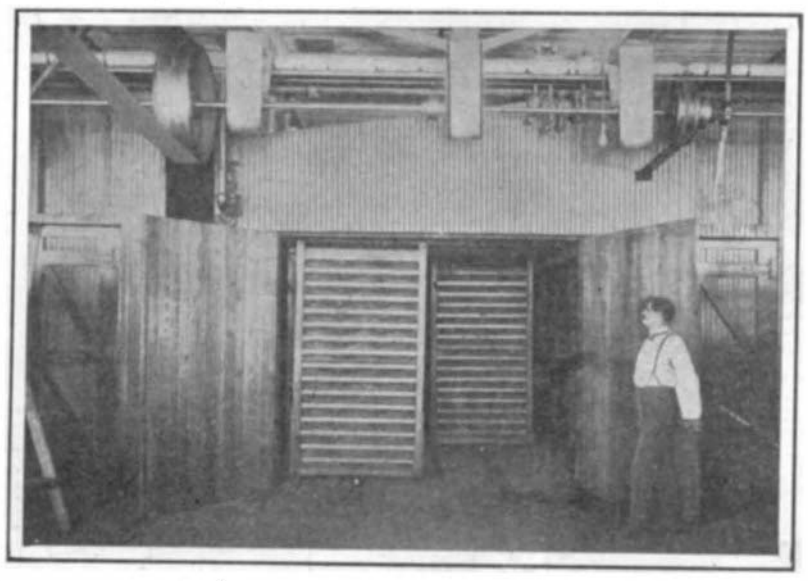


Fig. 15.—Ordering Room in Which Fillers After Being Stripped, Booked and Dried Are Again Put in Condition for Shipment to Factories.

FROM THE TOBACCO LEAF TO THE CIGAR.

Cigar-Making Machinery.—The illustrations of the manufacture of little cigars by machinery were taken at the Whitlock branch, which employs 1,750 hands, and is the largest single cigar factory in the world. It is chiefly occupied in the manufacture of Old Virginia cheroots and the Royal Bengals little cigar. As in the hand-made cigar the whole operation is performed by hand, so here it is done entirely by machines, which handle the tobacco and go through the operations of bunch-making and wrapping with more than human dexterity and accuracy. The total annual output of this one factory reaches the figure of 250,000,000 cigars and cheroots.

The raw material which is brought to this factory from the various farms and stemmeries, etc., of the company, consists of long fillers and short fillers (the latter consisting of the cut-up leaf as prepared in the Old Virginia plant) and of binders and wrappers which have already been sweated and blended in the stemmery. As the tobacco reaches the factory in a comparatively dry condition, it is taken from the cases, dipped in water, and set upon a casing board to drain. It is left in this condition over night to insure distribution of the mosture, and is then shaken out and taken to the stemming department, where nearly 200 stemming machines are employed, one of which is illustrated in Fig. 5. In this machine the stems are stripped from the leaf. It consists of a pair of rotating cylinders, of the same diameter and carried on the same shaft, which are so placed that their abutting inner ends leave just sufficient space for the stem of the tobacco leaf to pass through. Engaging and projecting through the abutting edges is a circular rotary knife, which, as the tobacco leaf is drawn over the cylinders, neatly cuts out the stem, the two halves of the leaf or "strips" being wound on the cylinder. The process is repeated until fifty leaves have been passed through the machine and neatly laid one above the other in two piles or "books," as they are called, of fifty leaves each. The stems drop into a box below, and are ultimately sold as fertilizer. Both the binders and wrappers are stripped by this method. The books of fifty binders are now cut up into suitable lengths for the particular size of cigar that is to be made.

Automatic Bunch Machine.—In making the "bunch" (the rough cigar, before the wrapper is rolled on) in the ingenious machine shown in our illustration (Fig. 9), the binders are carried in a box in front of the operator, and the filler (in this photograph consisting of the product of the Old Virginia branch) is loaded into the large circular hopper seen at the back of the machine. The girl spreads two pieces of binder on a horizontal rubber rolling belt, and the requisite amount of filler falls from the hopper and is pushed down into the binder by means of a rectangular plunger. Then the belt, by a swift movement, rolls the bunch, which is picked up by the girl and placed in a wooden mold, which is provided with pockets for twenty bunches.

The bunches are then loaded in their molds onto trucks, each of which carries 250 molds, or 5,000 bunches. The trucks are wheeled to a hydraulic press and subjected to a pressure of 1,500 pounds to the square inch, the whole time occupied in pressing this number being half a minute. The capacity of the bunching machine may be understood from the fact that these 5,000 cigars represent about one day's output of a single bunch-maker. The molds are now taken to a machine, which cuts off the long ends of the bunches, after which they are carried, still in the mold, to the automatic rolling floor.

Automatic Rolling Floor.—The most ingenious invention in this establishment is the machine for rolling the wrappers on the cigars, which is shown in Fig. 10. The wrapper is spread over a die and held down upon it by suction, acting through a large number of holes with which the die is perforated. A knife, formed in the peculiar cucumber-like shape of the wrapper, rises through the die, and a roller passes over the wrapper, pressing it on the knife and cutting out the desired piece. Then another arm or carrier, which is connected by a flexible air hose with the curved suction pipe, which is seen standing at the center of the machine, picks up the wrapper by air suction. As it does so, a loop of wire rises from a little pot of paste, and pastes the end of the wrapper. Meanwhile another arm has brought over a bunch and placed it within a nest of three rotating rollers, which open to receive it. Next a needle comes forward, disengages one end of the wrapper from the carrier, and holds it against the large end of the bunch until the latter has made a turn and a half. Then, as the traveling carrier sweeps across the roller nest with its contained bunch, the wrapper is transferred and rolled on the bunch. Next the arm which brought over the bunch picks up the finished cigar, and places it between two rotary knives which cut it to length. As each cigar is rolled, the bunches, which have been placed on a feeding chain, are moved forward by the space of one bunch; and each bunch is picked up by mechanical fingers, taken over to be wrapped, and returned to the chain, without any human handling whatever. Here again ma-

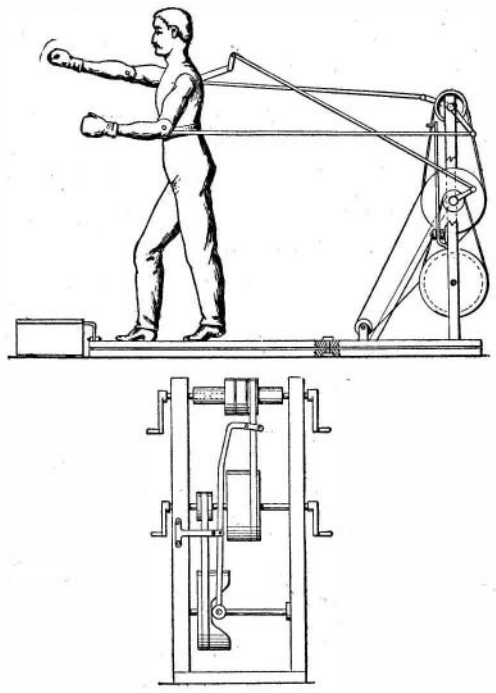
chinery performs even more perfect work than is possible by human hands, and absolute cleanliness of the finished product is insured.

HUMIDORS.—A marked feature in the manufacture of the product of this factory is the care that is taken to keep the cigars in the proper moist condition, which is done by storing them for a certain length of time in humidors. The humidor is a room of special construction, with brick floor and walls, in which the temperature and humidity are maintained at a desired degree. Cigars are liable to become too dry in the process of manufacture, hence, as soon as the wrapping has been done they are taken to the humidor, where they are drawn back to perfect packing conditions. From the humidor they are taken to the cigar packers, where they are carefully sorted according to color and packed in boxes of twenty-five, fifty, and one hundred. The packed boxes are placed in large presses, and left there over night. The next morning they are returned to the humidor, where they remain for a period of from three to six weeks, at the end of which time they are ready for shipment to the dealers.

A MECHANICAL PRIZEFIGHTER.

To accommodate the needs of the professional boxer, as well as to instruct the novice in the "noble art of self-defense," Mr. Charles Lindsey, of 58 Glen Street,

A MECHANICAL PRIZEFIGHTER.



THE MECHANISM OF THE SPARRING MACHINE.

New Britain, Conn., has invented an automatic sparring machine. This machine is really a formidable fighter, and has already gained quite an enviable reputation in the many encounters it has had with local talent. Not only does it deliver straight leads and counters, but it varies these with an occasional uppercut, and its blows are rained with a speed and power that are the envy of the professional boxer. The machine does not "telegraph," that is, it does not give a warning of a coming blow by a preliminary backward jerk, which is so common to all but the best of boxers. Nor can the opponent escape these blows by side-stepping, because the automaton will follow him from one side to the other. At each side of the opponent is a trapdoor, connected with the base of the machine in such a way that when he steps on one or other of these doors, the machine will swing around toward him. The arms of the mechanical boxer are fitted with spring plungers, which are connected with crank handles turned by machinery. Separate crankshafts are used for the right and left arms, and they carry pulleys between which an idle pulley is mounted. These pulleys are connected with the main driving pulley by a belt which is shifted from side to side, bringing first one and then the other of the boxing arms into action. The belt-shifter is operated by an irregular cam at the bottom of the machine, and this gives no inkling as to which fist is about to strike. Aside from this, the body of the boxer is arranged to swing backward or forward under the control of an irregular cam, so that the blows will land in different places on the opponent; for instance, a backward swing of the body will deliver an uppercut. The machine is driven by an electric motor, and can be made to rain blows as rapidly as the best boxer can receive them, or it may be operated slowly for the instruction of the novice. As the machine is fitted with spring arms and gloves, an agile opponent can ward off the blows and thus protect himself.

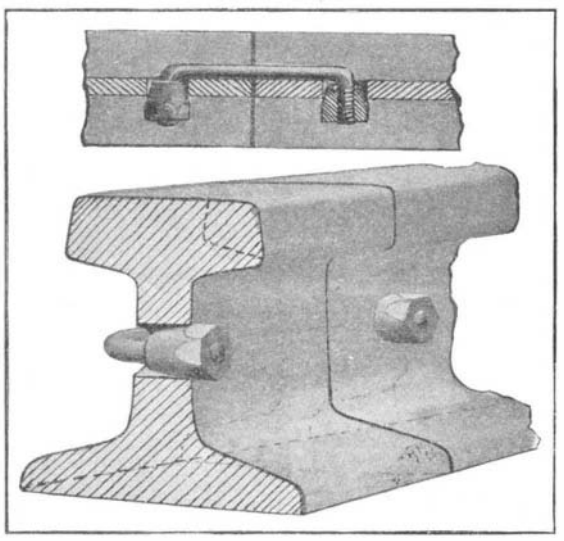
AN IMPROVED TURBINE.

Turbine engines of the Parsons type, in which the steam passes continuously through the engine in the general direction of the axis, are formed with a series of circumferential enlargements of both the shaft and the casing, in order to provide for the expansion of the steam. This construction offers the objection that each enlargement of the shaft or spindle presents a shoulder or abutment, on which the steam acts to produce a powerful end thrust. In order to balance this thrust, it is customary to provide the spindle with a series of thrust rings, against which the steam presses in the opposite direction. In the accompanying engraving we illustrate an improved form of turbine, in which the steam acts upon the center of the spindle out toward the opposite ends, so that the thrust of one half of the spindle will counterbalance that of the other. Furthermore, to allow for expansion of the steam, the cylinder is formed of two frustro-conical sections with their smaller ends connected. The shaft is of uniform diameter throughout, but beginning at the center the blades of each row are made longer than those of the preceding row, to correspond with the conical casing. Near the ends of the spindle, where the blades would be dangerously long if they extended all the way to the casing, a circular flange is used, which divides the blades into two concentric rings. Instead of feeding the steam from a single point through the entire series of blades, means are provided for admitting steam to each row of blades individually. It will be observed that the turbine is formed with two casings, namely, an outer one, *A*, and an inner one, *B;* reference has already been made to the latter as being formed of two frustro-conical sections. The space between the two casings forms a steam reservoir for a series of stationary inlet tubes, *D*, which project inward between the rows of blades on the spindle, *C*. These tubes are slotted at the forward side, and through these slots the steam is directed against the blades. Each tube is also provided with a wing extending rearwardly, and serving as a stationary blade to direct the steam from one row of movable blades to another. Thus, aside from receiving a fresh supply of steam from its own series of tubes, each row makes use of the steam passing through the preceding rows. The inner rows of blades are designated at *E* in the engraving, while the outer double-decked rows are indicated at *F*. The tubes which supply the rows *F* are short and feed steam mainly to the exterior blades of these rows, being practically cut off from the interior blades by a ring or circular bottom wall. Within the ring are a series of stationary blades, *G*, which serve to conduct the steam from the blades *E* to the interior blades, *F*. A patent on this improved turbine has been secured by Mr. George L. Mundigler, of West Allis, Wis.

A new process of manufacturing hollow tin soldiers so popular a toy with children has been successfully devised by an English firm. Hitherto this product has been practically a German monopoly, the soldiers being cast solid. By means of this new process, however, the toys are cast hollow, and are some sixty per cent lighter than the German article, while owing to the reduction in the amount of metal and the speed with which the work can be carried out, the articles can be produced much below the German figure. As a result of this discovery the German trade with England which has hitherto been of great proportions is rapidly declining, while the toys are of stronger construction owing to the utilization of a more stable metal.

IMPROVED RAIL BOND.

A patent has recently been secured by Edwin W. Robinson, of Punxsutawney, Penn., on an improved rail bond for electric railways. The new bond is arranged to insure an exceedingly firm electrical connection between adjacent rails, and in a very simple and economical manner.

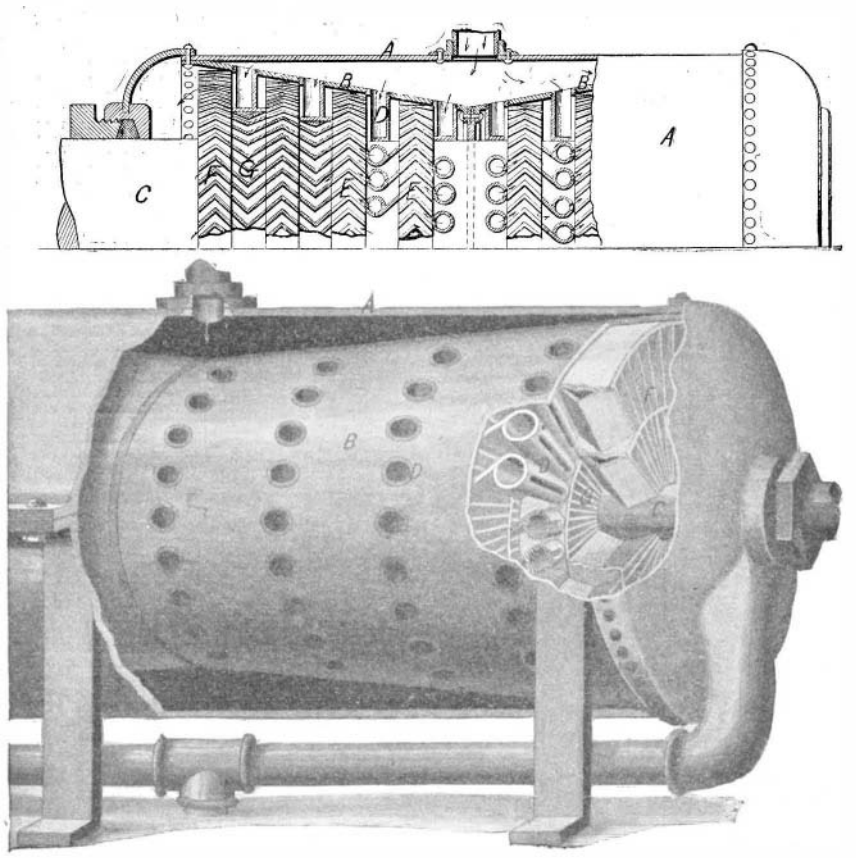


AN IMPROVED RAIL BOND.

The invention will be clearly comprehended by a glance at the accompanying engraving. It comprises a conductor in the form of a rod, which is bent to enter holes in the webs of two adjacent rails. The ends of the rod are threaded to receive a pair of nuts, which enter the holes in the webs. The nuts are formed with frustro-conical ends, and as the nuts are screwed up on the rod, they not only draw the rod into close contact with the webs of the rails, but also wedge their frustro-conical ends tightly into the holes in the webs. This insures an exceedingly good electrical connection between the adjacent rails. It will be evident that the new rail bond can be applied to rails as now constructed.

Wanted: A History of Physics.

There are great histories of mathematics and great histories of astronomy, but no history of physics on a grand scale. Some serviceable manuals there are, as well as monographs on particular topics; what seems to be lacking is some comprehensive and comparative survey of the whole range. The history of any of the natural sciences, like the history of human activity, is not merely an encyclopædic record of past facts; it reveals both the spirit and the wealth which the past has bequeathed to the present, and which, in due course, the present will influence before transmission to the future. Perhaps all our physicists are too busy to spare the labor needed for the production of a comprehensive history; yet such a contribution to the subject would be of great value, not to physicists alone.



AN IMPROVED TURBINE.