FRENCH CANDLE MAKING.

BY JACQUES BOYER.

The tallows, oils and other fatty substances from which common candles are made are mixtures of a solid fat, stearine, with a liquid fat, or oil, oleine. Most of the defects of the old-fashioned tallow candle are due to the latter ingredient, the elimination of which results in the production of a stearine candle, which does not run and "gutter" in burning or grease everything that it touches. The problem of producing stearine candles, first broached by Braconnot, was solved theoretically by the celebrated Chevreul and practically by Milly and Dr. Motard, who succeeded in overcoming the technical difficulties and laying the foundation of the new industry. In particular, they substituted lime for soda in the process of saponification and employed boric acid in the preparation of the wicks, a treatment which is essential to satisfactory combustion. Since their time the various operations of the manufacture have been little changed except by the introduction of some mechanical improvements.

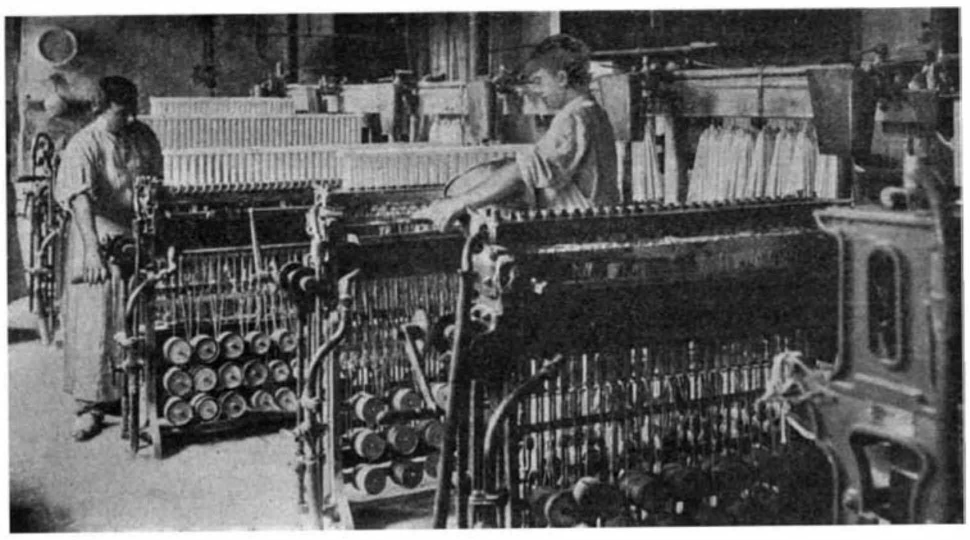


Fig. 1.—Molding Stearine Candles.

Fig. 2.—Mixing Colors with Stearine.

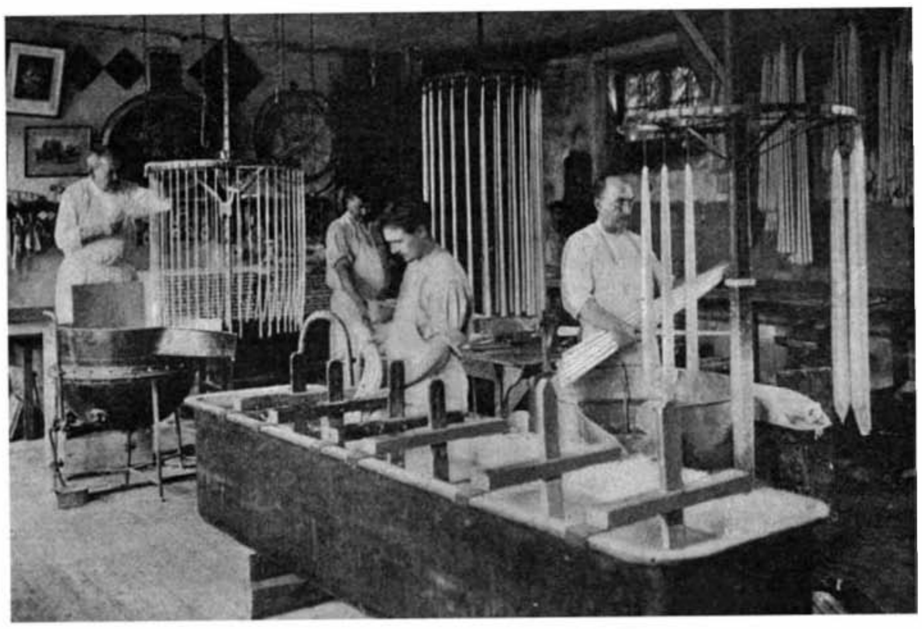


Fig. 3.—The Wax Candle Room.

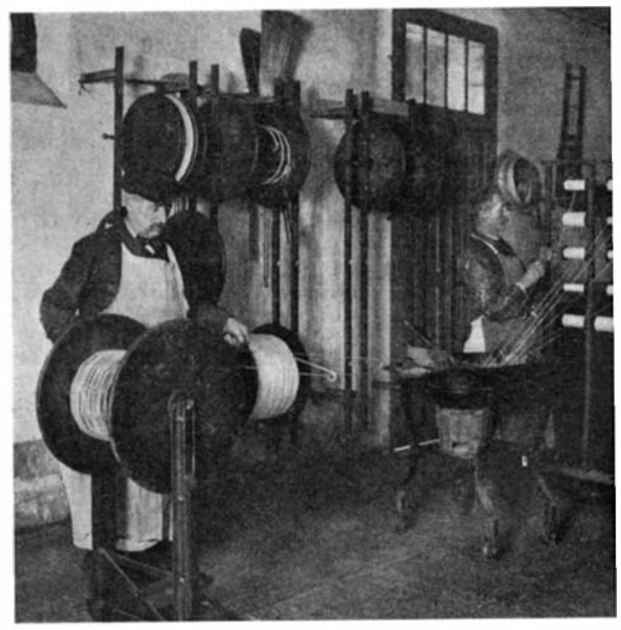


Fig. 4.—Making "Cellar Rats" or Long Wax Tapers.

The first process is the saponification of the fats, which is effected in closed vessels, under pressure, a condition which reduces the proportion of lime required for precipitation to two or three per cent. A cylindrical copper boiler is filled with about 4,000 kilogrammes (4 tons) of tallow or oil and 2,000 liters (550 gallons) of water in which 120 kilogrammes (264 pounds) of lime have been slaked. Steam at a pressure of eight atmospheres is then introduced and the digestion is continued for four hours. When the contents of the vessel have cooled to 130 deg. C. (266 deg. F.) they are drawn off in two successive portions, one consisting of the fatty acids resulting from the action of the steam on the fats, and the other of glycerine and water, holding in suspension the lime soap which, when decomposed by sulphuric acid, yields an additional quantity of fatty acids. The mixture of fatty acids, when freed from glycerine, consists of solid stearic and palmitic acids and liquid oleic acid. (The "stearine" of commerce is a mixture of stearic and palmitic acids.) The mixture of the three fatty acids is treated with sulphuric acid, washed with steam, distilled and run into iron pans where it solidifies in thin cakes. These cakes, wrapped in haircloth, are first pressed cold and then pressed again between cast-iron plates heated by steam to 35 or 40 deg. C. (95 to 104 deg. F.). In these operations the oleic acid is forced out through the filtering cloth leaving the "stearine" behind as a white, solid, and brittle mass.

Fig. 5.—Rolling Wax Candles.

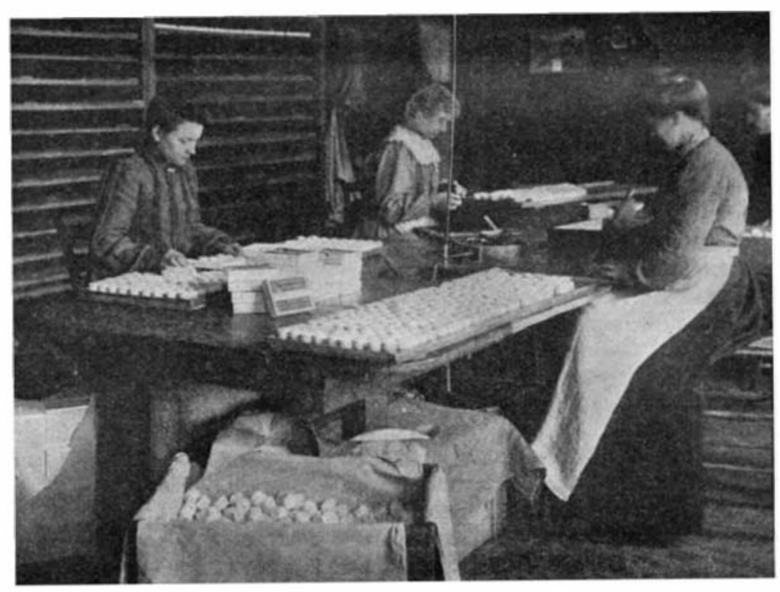


Fig. 7.—Cupping, Labeling and Packing Night Lights.

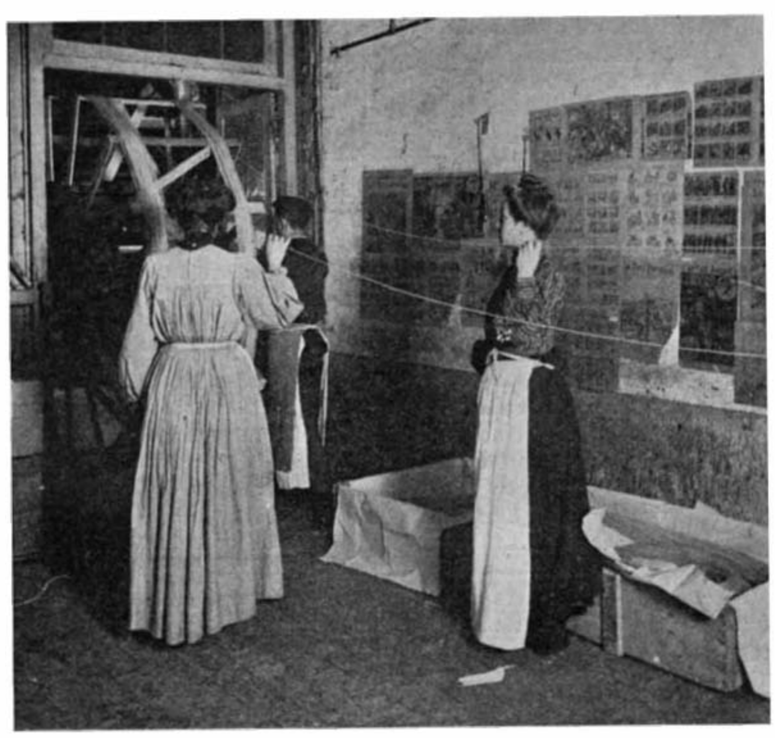


Fig. 8.—Reeling Wax Tapers.

THE MANUFACTURE OF CANDLES IN FRANCE.

The wick of the stearine candle is composed of three cotton strands braided together. One of the strands is twisted more tightly than the others, the result being that the end of the wick, as it burns, bends to one side and reaches the outer or oxidizing part of the flame. This bending is increased by the weight of the little glassy beads of fusible borates which, formed by combination of the ash with the boric acid in which the wick has been soaked, appear successively on the end of the wick and drop into the pool of melted stearine. By these devices both ash and carbon are disposed of and the candle needs little snuffing.

The stearine is melted in basins heated by steam from which it is dipped with spouted pails and poured into the molding machine. This consists of a double row of slightly-tapering tubes, in the axis of each of which a wick is kept taut by a pin above and a reel below. When the stearine has hardened the attendant opens the top of the machine, raises the row of molds with the aid of a train of wheelwork, passes a knife under it to cut the wicks, and removes the candles from the molds. The candles are then trimmed to uniform length by a small and swiftly-moving circular saw and carried by an endless chain to rotating brushes which clean and polish them. After receiving the mark of the factory from a moderately-heated silver die they go to the packing room, where girls wrap them in paper and put them into boxes. Colored candles are made by the same process except that the desired color is mixed with the melted stearine, in steam-heated vessels, before molding.

Most French candlemakers manufacture, in addition to stearine candles, wax candles, night-lights and paraffined paper.

Wax, like tallow, has been used for illumination for centuries, but nowadays the high price of wax has almost abolished the use of wax candles in France, except in the ceremonies of the Roman Catholic Church.

In the manufacture of wax candles the wax is first bleached by spreading it in a thin layer on canvas and exposing it to the sun for several days. By repeating this process a second time a sufficient degree of whiteness is obtained. As no satisfactory method of preventing the adherence of wax to the mold has yet been devised, wax candles are still made in the old way, by pouring the melted wax on the wicks. The wicks are attached to a horizontal hoop suspended from the ceiling over a steam-heated basin of melted wax. The candle maker, with a dipper, pours a little wax over each wick in succession, repeating the operation until the candles have attained the desired thickness and testing their diameters, from time to time, by passing an iron or copper ring over them. When all the candles exactly fit the ring they are taken down, softened by plunging into warm water and rolled under a board on a table in order to make them truly cylindrical. In the bottom of each candle a little hole is made, with a wooden point, to facilitate its attachment to the chandelier.

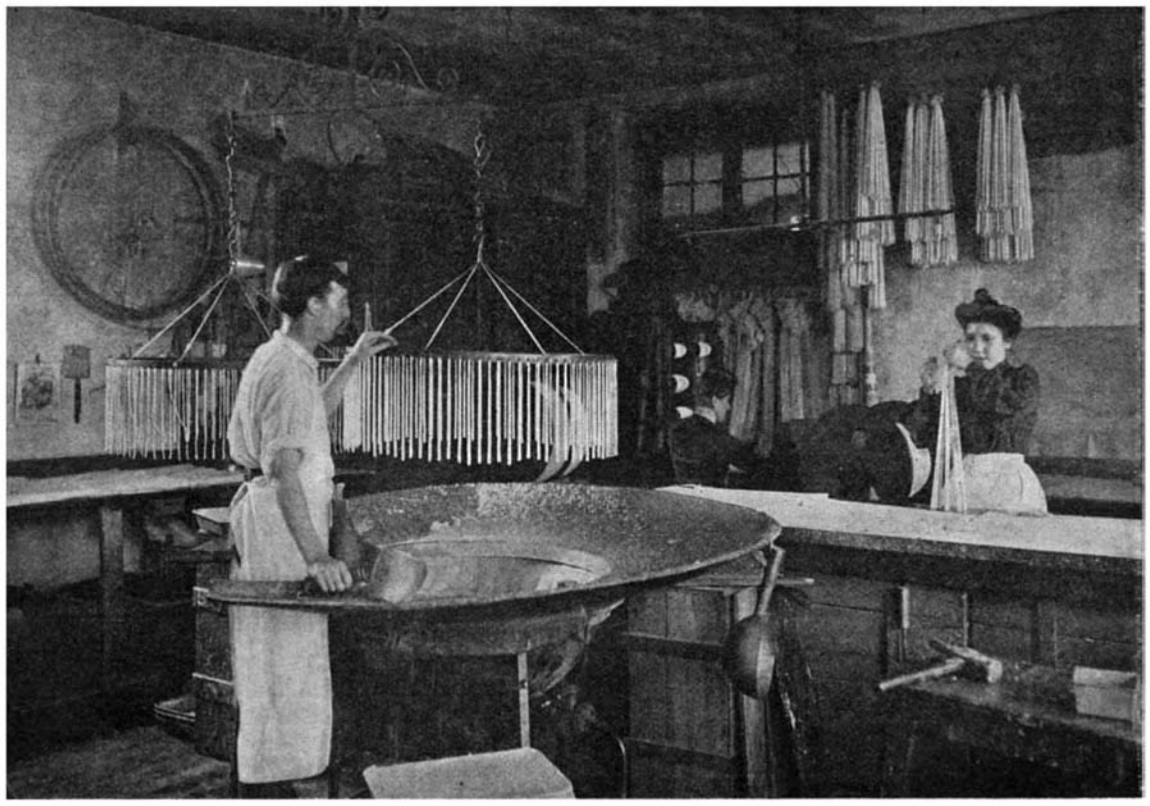


Fig. 9.—Making Small Wax Candles by Pouring.

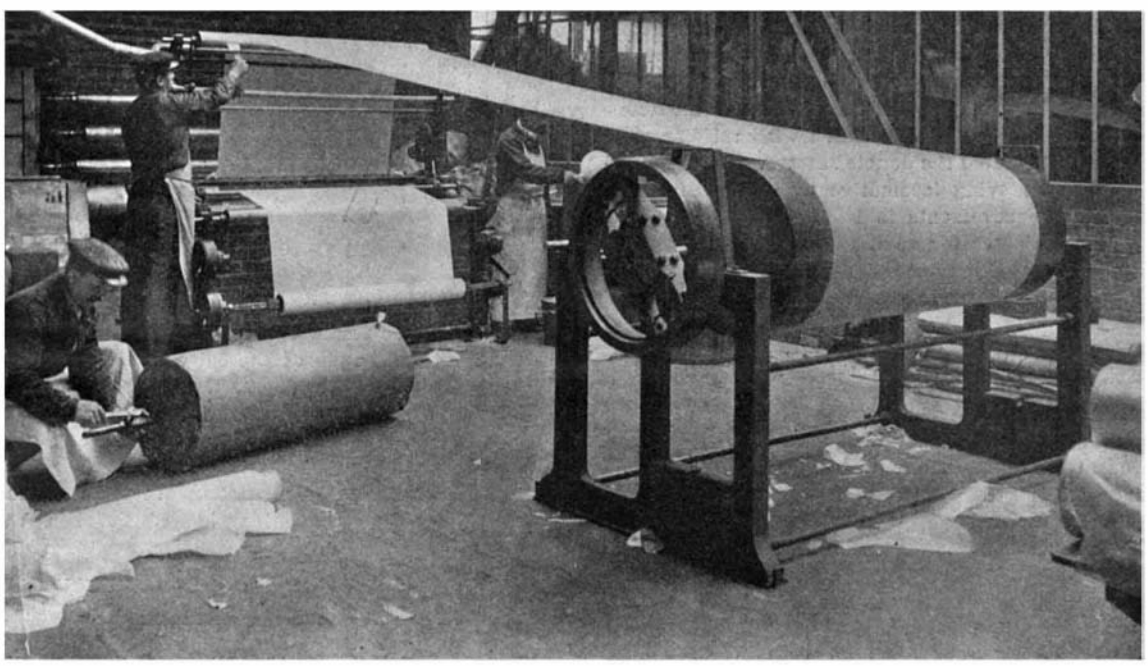


Fig. 10.—Preparation of Paraffined Paper.

In the manufacture of wax matches and the long and slender tapers which are known as *"rats de cave"* ("cellar rats") the method introduced into France by Pierre Blesmiare in the middle of the seventeenth century is still in use. One of the accompanying photographs illustrates the method as it is practised to-day in the Carrière factory, at Bourg-la-Reine, near Paris. The cords of which the wick is composed pass into a basin of melted wax heated by a small furnace, from which they are drawn through a perforated plate to a large wooden drum which is turned slowly by hand. The operation is repeated two or three times, the size of the hole through which the cord passes being increased each time. When the waxed cord has attained the required size it is wound on large reels in skeins of 400 or 500 meters (about 1,500 feet) which are boxed and shipped to wholesalers. It is also furnished in lengths of from 3 to 10 meters (10 to 33 feet) folded as often as may be required for convenient packing. These tapers are now used chiefly by wine merchants, and by sextons in lighting church candles.

The very short and thick candles called *veilleuses*, or night candles, are composed of a mixture of wax and stearine. The molding machine, shown in one of the photographs, differs considerably from the apparatus used for ordinary candles, although the principle of the operation is unchanged. After the little candles have cooled the attendant removes them from the molds and conveys them to women who put them into tin cups which prevent the escape of melted wax during combustion, and pass them to other women who label and pack them.

Paraffined paper is made simply by drawing long rolls of paper, by means of a series of cylinders, through a steam-heated trough containing a solution of paraffine and stearic acid, and thence to a large wooden cylinder on which it is rolled.

It is reported that an engineering firm at Pittsburg has patented a new type of universal plate mill. The mill will be driven by an electric motor of 6,000 to 8,000 horse-power capacity, this, it is said, being the first time that a mill of this character and size has been electrically driven.

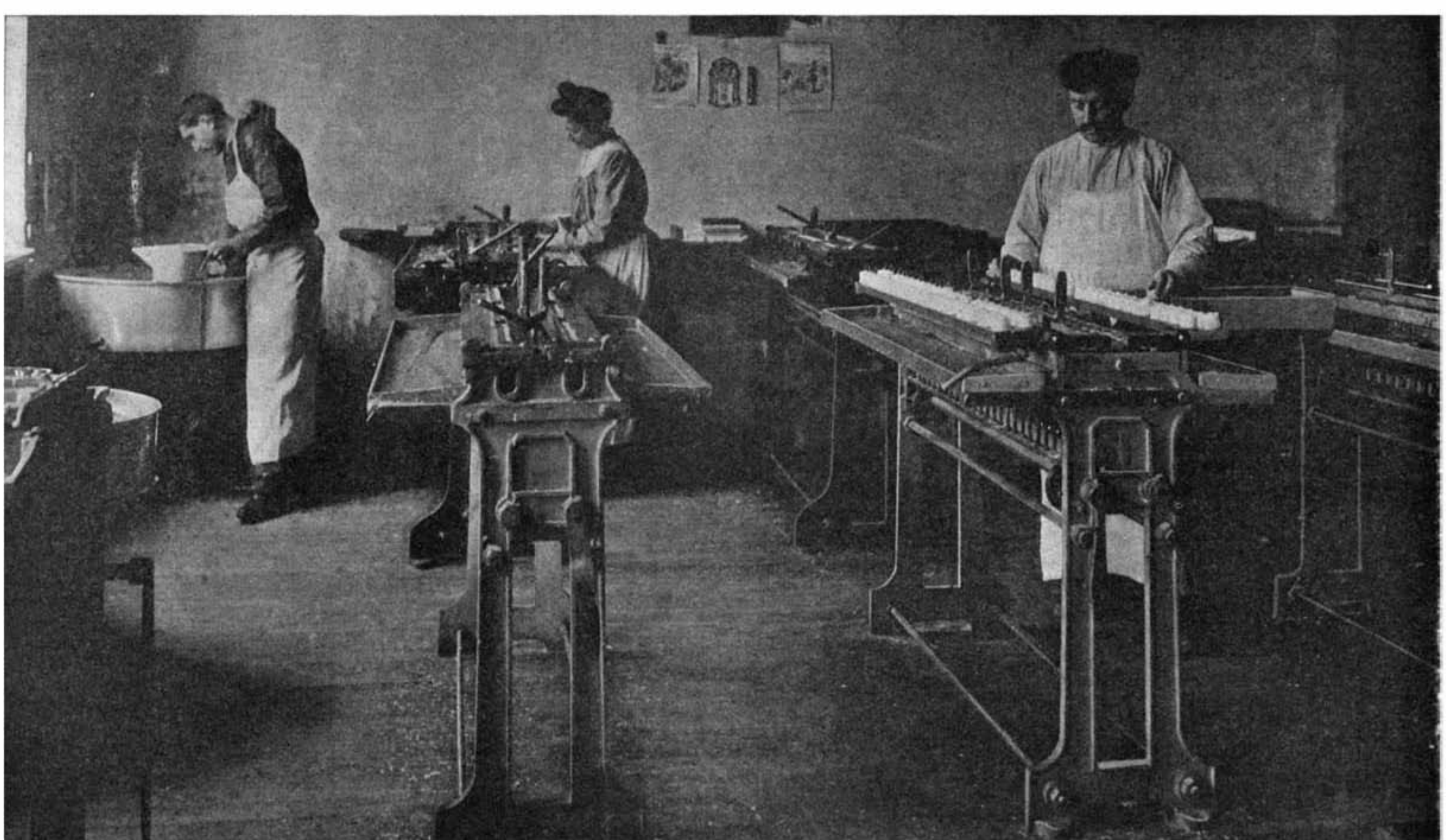


Fig. 6.—Molding "Carriere Veilleuses" or Night Lights.

THE MANUFACTURE OF CANDLES IN FRANCE.

Influence of Invention on Industry.

Sir William Bailey, a prominent English scientific writer, recently delivered a lecture before the Manchester Literary and Philosophical Society on the topographical distribution of men of genius in Great Britain. He stated that the county of Lancashire had produced a large number of inventors, who, during the last hundred years, had exerted a great influence on the prosperity of that country, and, indeed, had done more to change the face of the world by their mechanical contrivances than any other combination of inventors.

Sir William Bailey's statement is doubtless true to a certain extent; and it is to be deplored that, notwithstanding the universal good these Lancashire men wrought, all, with two exceptions, were subjected to ill-treatment at the hands of the communities they directly benefited, and died in poor circumstances.

It is interesting to note that in the first half of the seventeenth century Torricelli invented the barometer for indicating the pressure of the atmosphere, and in a few years the Marquis of Worcester and Savary followed their illustrious leader by introducing their experimental engines. After this nothing of importance took place until 1712, when Newcomen invented his simple vacuum or atmospheric engine, which did useful work for a hundred years before James Watt's double-acting engine, with the conical pendulum or governor balls for controlling it, became popular.

In 1700 England was not superior, nor even equal, to the manufacturers on the Continent. A small trade was done in iron, but all bar iron was imported. About this time the Dutch loom was introduced into Lancashire. Paper making had been introduced by foreigners in the reign of Henry VIII., and a few mills existed in the time of Elizabeth, but the best paper, used in the printing of books, came from France. From Holland came improved windmills and the waterwheel, while Dutch engineers were engaged in erecting pumps and providing water supplies, and the Norfolk Broads and the famous Bedford Level were also finished under Dutch management in the reign of Charles II. The goldsmiths of Bristol, York, and London did some good work; but in metal-work and in textile fabrics England was much inferior to foreign countries, both in design and manufacture. Soon after the commencement of the eighteenth century, Manchester and Liverpool increased rapidly in importance, and Manchester in 1720 obtained a bill for making the river Irwell navigable to the Mersey and to the sea. The increased facilities thus afforded gave a great impetus to the industrial prosperity of England.

A great demand for textile goods for export caused those engaged in the trade to desire means of increasing the production, and the fly shuttle, an invention that doubled or trebled the output of the weaver, came from Kay, of Bury, in 1733. Many other machines were invented by the unfortunate Kay, who was much ill-used by those whom he had benefited, and was obliged to leave Bury to save his life. He died in poverty and obscurity in France, the place of his burial being unknown. This new system of weaving quickly exhausted all the productions of the spinsters, for the new looms could use more weft and warp in a day than the spinsters could produce in a week. Inventors were thus naturally led to consider how to increase the production of the spinning wheel, the result being the invention of the spinning jenny. A careful consideration of the claims of James Hargreaves, of Blackburn, and Thomas Hayes, of Leigh, tends to prove that they invented the jenny simultaneously and independently. Between 1766 and 1769 Hayes produced one with six spindles, and, about the same time, Hargreaves made one with twelve spindles. The next important invention was that of Samuel Crompton, of Bolton. It was still found impossible to meet the demand created by the new loom, and, in the year 1775, Crompton invented the spinning mule. At this time, most of the fine yarns were imported from India, but by the year 1805 England began to export yarns to that country. Crompton was in great fear at one time because of the enmity of workmen, and in 1811 the government made him a grant of $25,000. At the commencement of the nineteenth century, many men were applying themselves to the driving of Kay's loom and Crompton's mule by steam power, but it was reserved to two Stockport manufacturers, Radcliffe and Horrocks, to invent the first practical steam loom, in 1805. This produced a famine in yarn which continued until 1834, when the self-acting mule was invented by Richard Roberts. It is now used extensively all over the world, and it is one of the inventions that have placed Lancashire manufacturers in the front rank. Roberts was one of the greatest mechanical inventors of the nineteenth century. Although he never went to school, he was an accomplished mathematician and draughtsman, and would never permit experimental work to proceed until high-class detailed drawings were prepared. Among his many devices may be mentioned the slide lathe, the metal planing machine, the pentagraph automatic drilling machine, and the Jacquard punching machine. Although the men of Manchester agreed to allow him $5,000 a year if he would come to live in that city, he died in poor circumstances in London, and was buried in Kensal Green Cemetery.

William Sturgeon, the inventor of the electric magnet, was born near Lancaster. He enlisted in the army, and while undergoing his training he began to study thunderstorms, lightning, and electricity, and in 1825 presented to the Society of Arts his first soft iron electro-magnet, for which he was awarded a premium of $150 and a silver medal. He started the Annals of Electricity, to which all the foremost inventors of the age contributed. His life, however, was one perpetual struggle with adversity, and, in 1850, the Bishop of Manchester and the Literary and Philosophical Society of Manchester petitioned the government on his behalf, obtaining for him a grant of $1,000 and an annuity of $250, which, unfortunately, he only lived to enjoy a few months.

Great improvement in the quality of manufactured iron was effected by the invention of the puddling furnace by Henry Cort, of Lancaster, in 1784. Its object was to remove the impurities of English iron, and its success was immediate and remarkable. Cort also made rolling mills with grooved rollers, and his inventions gave a great impetus to the production of iron, which rose in two years from 90,000 tons to 5,000,000 tons per annum. He died poor and neglected. Among other prominent inventors the name of James Joule, who was born in Salford, may be mentioned. In addition to discovering the mechanical equivalent of heat, he was the first to invent electric welding, and his investigations in electricity generally have been considered of considerable scientific value. The patent lever watch was not invented in France, as has been asserted, but by Litherland, of Warrington, in 1791. The name of John Ramsbottom is well known in connection with railway engineering. He invented the double safety valve, the method of feeding moving locomotive tenders with water, made many improvements in looms, and designed the condenser lubricator for engines. His most important invention was the "weft-fork" for steam looms, which was the means of greatly increasing the productive power of the weaver.

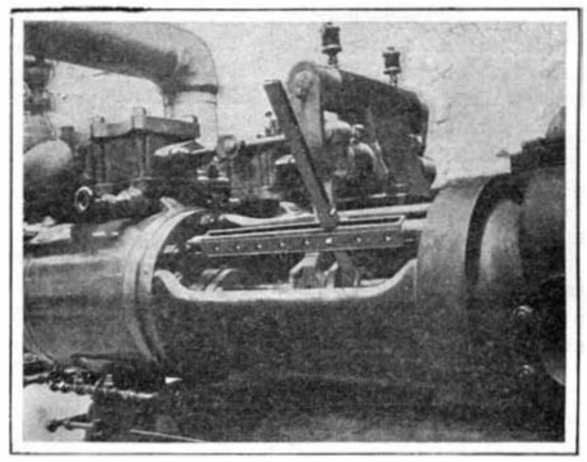
A Fire Shield.

A Southern inventor has made improvements in a fire shield, which if it can be dropped or moved into position at the proper or critical moment will be a decided practical gain in fireproof construction for use as a barrier in proscenium arch openings of theaters. The shield is embraced by and vertically movable in trough-shaped guides, and is provided with any suitable suspension device. It comprises two skeleton frames, each preferably consisting of a number of metal bars or strips, which intersect at right angles, the meeting and crossing portions being rigidly connected by stove bolts. By this construction a large number of panels are formed, each closed by a pane of mica, the panes being clamped between the two curtain frames. On the breaking out of a conflagration, it is only necessary to place the shield into position, when between the stage and the auditorium a transparent mica obstacle is interposed. This permits the firemen and attendants to intelligently direct their work to prevent the spread of flames or to extinguish them. The transmission of light through the mica illuminates the theater in case the usual lights are put out of use, and provides ample means for actors or audience to see their way to safety. The shield is rigid in every part, and where it has been moved into place to close the arch opening, no amount of heat short of that which is sufficient to melt or fuse the steel framework can operate to effect the most minute passageway for the escape of flames, gases, hot air, or any products of combustion. In this particular it is an improvement over asbestos curtains, that are blown away at the sides or edges from the stage opening by the force of heated drafts common to theater fires. At the lower edge of the shield is attached a tubular rib, compactly filled with a packing composed of powdered mica and asbestos. It affords great rigidity to the sheld, and effectually resists the action of the hot air and flame, which seek to gain egress underneath the shield. The shield may be made also in the manner of a pair of sliding doors, which may be arranged to slide from opposite sides of the stage.

James L. Branson, the inventor of the knitting machine which bears his name, was found dead in the stable attached to his residence at Doylestown, Pa., some weeks ago, having been killed in some manner by a horse. His knitting machine was invented during the civil war, and it is said to have yielded him a profit of $60,000 in three months.

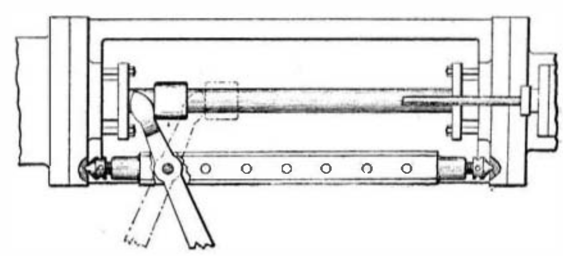
DEVICE FOR MOVING PUMP PISTON RODS.

A very useful device has recently been invented for moving or adjusting a pump piston rod while setting



DEVICE FOR MOVING PUMP PISTON RODS.

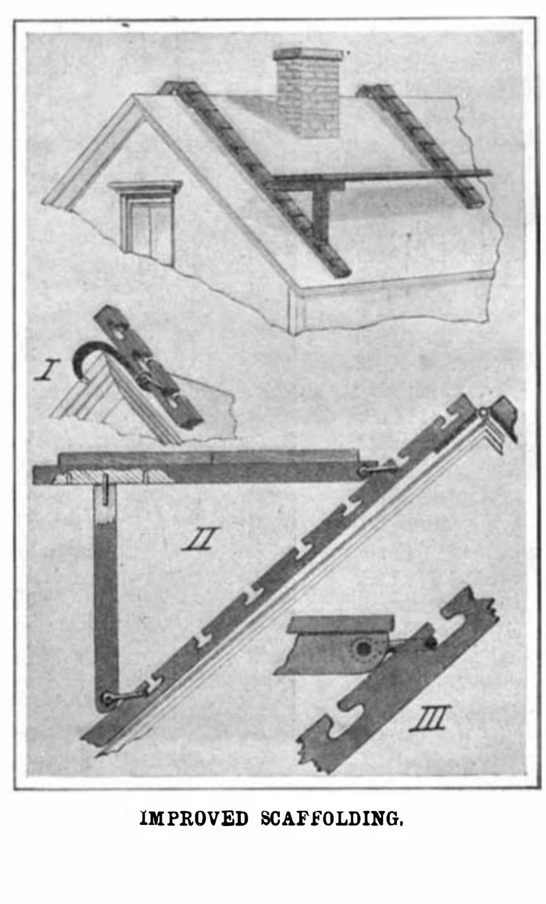
the valve therefor. The device will enable an engineer to place the pump piston rods at any desired position, to facilitate the packing of the stuffing boxes when it is necessary to remove the gland or follower, or in order to set the pump valves when the piston must be moved to a central position. The device comprises a longitudinally slotted fulcrum bar, the opposite members of which are perforated to receive a fulcrum pin on which the operating lever is mounted to swing. This lever is provided with spaced or forked members, adapted to receive the piston rod and engage the driving block thereon. The piston rod, as is usual, connects with the plunger in the piston cylinder, and with the piston in the steam cylinder. Adjusting bolts are threaded into the ends of the fulcrum bar, and their pointed heads engage depressions in the cylinder heads. The position of the lever with relation to the fulcrum bar may be changed by simply removing the fulcrum pin, and passing the latter through another pair of perforations. When not in use the lever may be removed and placed alongside of the bar, thus taking up but very little room. The inventor of this device is Mr. Hans Linke, 312 West 123d Street, New York, N. Y.



DETAILS OF THE PISTON ROD MOVING DEVICE.

IMPROVED SCAFFOLDING.

A novel form of scaffolding has recently been invented, which is particularly adapted for use on roofs of buildings. It will be found very convenient when repairing chimneys or doing other work on a roof, as it may be easily handled or placed in position, and when not in use it can be compactly folded for storage or transportation. The scaffolding comprises a pair of bars, each consisting of two sections which are



IMPROVED SCAFFOLDING.