A ONE-HUNDRED-TON DERRICK CRANE FOR FITTING OUT VESSELS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting electric crane of the derrick type is now in operation at the Greenock dockyards of the Scott Shipbuilding and Engineering Company, on the River Clyde, for facilitating and expediting fitting-out operations on large vessels. The crane has been designed and constructed by Messrs. George Russell & Co., of Motherwell near Glasgow, to whose courtesy we are indebted for the accompanying illustration. The crane is erected on the west bank of a new fitting-out basin that has recently been completed. Owing to the design of the crane, it has been possible to place its center extremely close to the edge of the quay wall.

As will be observed from the illustration, the crane itself is carried on three masonry pedestals or piers, the advantage accruing from which is that it is possible to get clearance for the sides of vessels. The piers supporting the center mast and diagonal legs are continued to a height of twenty-five feet above the level of the quay. The piers are built upon concrete foundations of a great depth. In the case of the pedestal carrying the vertical mast of the crane, the center of the pier is only seven feet from the edge of the quay. This enables the crane to deal with its maximum load of one hundred tons at an effective reach of sixty-three feet from the edge of the quay.

The mast of the crane is built up of steel plates and angles well braced together, and connected at the bottom by a massive steel box girder, which transmits the vertical pressure to the center pin. This vertical pressure is distributed over the surface of the concrete by a large base, which insures the imposition of a small pressure on each square foot of concrete. At the top of the mast is a heavy forged steel post, in which the upper end of the mast terminates, and to which also the diagonal legs are fixed by means of trunnion rings. To overcome the liability of bending stresses upon the diagonal stays, the connecting arrangement at this upper end is such that the center line of each diagonal intersects the center line of the mast. To the concrete base is bolted a heavy steel plate, which carries the cast-steel slewing rim of the crane, and also a cast-steel socket in which the center pin is fitted.

The tapered diagonal legs are connected at their bases with the central pier by horizontal stays built of steel plate and angles. In order to resist any compressive strains to which they might be subjected, they are stiffened by a lattice construction. The diagonal legs rise at an angle of forty-five degrees, while the base horizontal girders similarly form an angle of forty-five degrees with the edge of the wharf in the ground plan, thereby leaving ample space on either side of the crane for the accommodation of material. The railroad tracks are laid parallel with the edge of the wharf.

The electrical equipment comprises four motors and gearing. For derricking the jib, there is one motor of fifty horse-power running at 290 revolutions per minute; one of similar horse-power for the main purchase hoisting, and two of thirty-five brake horse-power for light purchase hoisting and slewing respectively, representing an aggregate of 170 brake horse-power. Each motor and its attendant gearing are independent, and all are controlled from a cabin carried on the side of the mast at a height of fifty-six feet above the level of the quay, so that the operator has a clear and uninterrupted view of the whole field of operations. The equipment in the cabin comprises the main switchboard and four controllers, as well as the hand wheels for applying the auxiliary braking arrangements. Each motion is fitted with automatic electric brakes, and for the hoisting and derricking gears powerful hand brakes are provided. All the main spur wheels are of cast steel, while the smaller wheels and pinions have machine-cut teeth. In the cases of the slewing and derricking gearing the worm-wheels are of gun metal, with the worms of forged steel. The main barrels for hoisting and derricking are of seven foot diameter, right and left screw grooved in the lathe. The design of these barrels constitutes an importa feature, since the spur gears are placed in the center of the barrels, with the two sections of the barrel on either side grooved right and left hand, so that the ropes can coil on both ends simultaneously, thereby dividing the stresses equally between the two sides of the mast. Four hundred feet of cable can be wound on each section.

In order to clear the gunwales of a vessel when the crane is working at its maximum radius of seventy feet, there is allowed a clear height of thirty-five feet between the edge of the wharf and the under side of the jib. The main hoisting block has a vertical range of one hundred feet, and the load is carried on eight parts of rope, thereby giving a duplicate quadruple purchase. The load-carrying device is ingenious. There is a cylinder containing oil on which the load is carried, and the latter is able to revolve with very little resistance by means of a lifting ring with a piston at its upper end. In order to overcome oil leaking from the cylinder, which is made of steel, there is a gun-metal liner three-eighths inch in thickness.

The crane has been tested to one hundred and twenty tons with complete success, though the maximum working load is one hundred tons at any radius between a maximum of seventy feet and twenty-five feet, at a lifting speed of five feet per minute. Ninety tons can be raised at seventy-five-foot, eighty tons at eighty-foot, seventy tons at eighty-five-foot, and sixty tons at ninety-foot radii. With loads from ten to fifty tons the lifting speed is ten feet per minute, and for loads less than ten tons, forty feet per minute. With the independent light purchase gear a weight of ten tons can be lifted at any radius up to one hundred feet. The slewing speed with the full load of one hundred tons is one hundred feet per minute.

With this appliance the operations of fitting out a vessel can be expeditiously carried out. The radius of the crane enables the whole beam of the ship to be commanded; and for lifting and lowering into position the heavier sections of the vessel's machinery installations, it has proved to be especially advantageous.

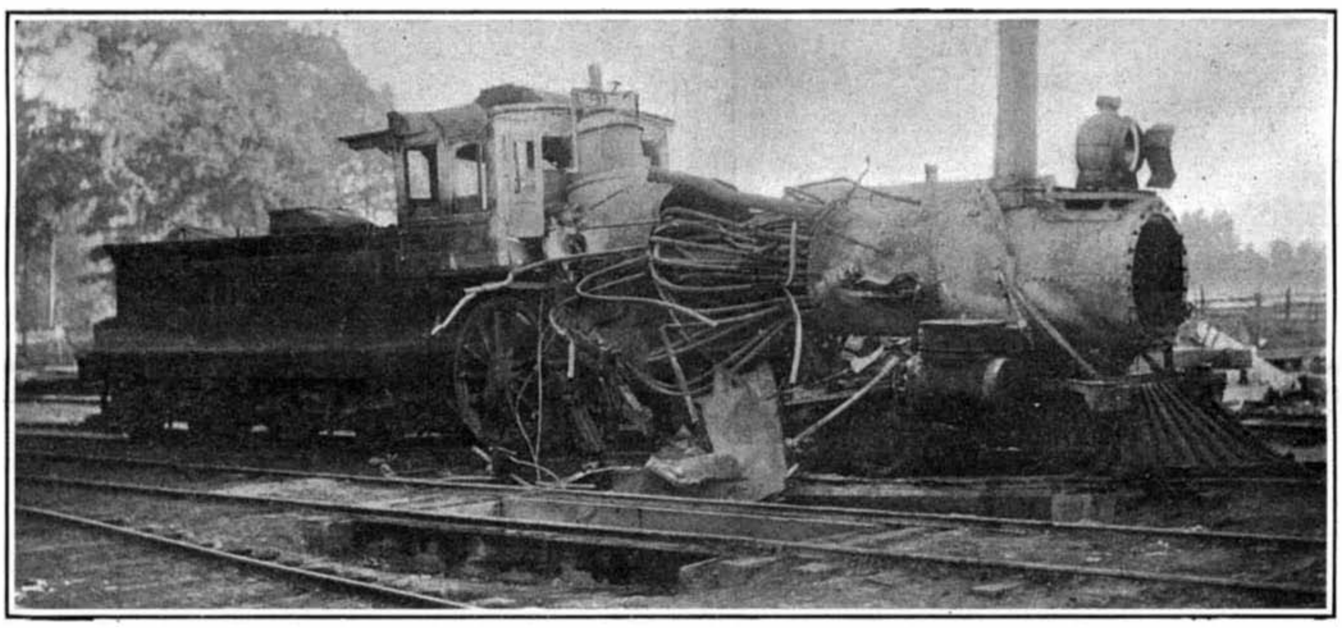
The Current Supplement.

The current SUPPLEMENT, No. 1590, is opened with an illustrated article on the rotary converter sub-stations of the Long Island Railroad. A very practical article is that on Tinning. Mr. J. E. Thornycroft concludes his articles on gas-engines for ship propulsion. The second installment on "Canals, Ancient and Modern," is published. Mr. Nelson P. Hulst concludes his treatise on the Metals in Human Progress. Some statistics are published on the foreign commerce of the United States. Mr. Robert Grimshaw writes instructively on Gypsum, a much-misunderstood material. Some devices for determining the energy losses in sheets of iron are described by Dr. Alfred Gradenwitz. Perhaps the most important paper in the current SUPPLEMENT is that by Marconi on the control of the direction of electric waves. The paper relates to results observed when, for the usual vertical antenna employed as receiver or absorber in a wireless telegraph station, there is substituted a straight, horizontal conductor placed at a comparatively small distance above the surface of the ground or water. Major Ormond M. Lissak's paper on Primers and Fuzes for Cannon is concluded. The preliminary report of the State Earthquake Investigation Commission is presented.

Since 1898 there have been completed for the French navy thirteen armored cruisers, which may be divided into five types: Three units of 7,700 tons, three of 9,500 tons, five of 10,000 tons, one of 11,300 tons, and one of 12,500 tons. In addition to these, there are under construction three additional cruisers of 12,500 tons, and three of 13,600 tons.

A LOCOMOTIVE BOILER EXPLOSION.

It is seldom surely that the ubiquitous camera has recorded a more picturesque view of an exploded locomotive boiler than that shown in the accompanying illustration. The accident happened at the town of Daleville, Ark., on a road known as the Ultima Thule, Arkadelphia and Mississippi Railroad. The engine had been in the shop undergoing repairs, which had just been completed. After washing out the boiler, sufficient steam was raised to run the engine out of the shop and over the cinder pit, where the explosion occurred. The injectors on both sides had just been tested and found in good condition, and by the use of the blower the steam had been raised to the desired pressure of about 145 pounds to the square inch, when the boiler gave way. We are indebted for the photograph to Mr. A. A. Peters, master mechanic of the A. S. W. R. R., of Gurdon, Ark., who informs us that it was impossible to determine the age of the boiler, the name and number plate both having been removed. It was built of 3/8-inch iron, and the seam on the bottom of the barrel was reinforced with an additional 3/4-inch sheet, making with the covering strip a total thickness of 1 1/8 inches. The explosion tore the sheet off through the line of the rivet holes, tearing into the connection sheet near the firebox. The barrel was entirely carried away between the firebox and the front rings of the boiler. Twenty of the flues collapsed, and were split open as though they had been cut through with a chisel, for a length of from 10 to 24 inches. The front flue sheet was broken in pieces and the nozzle and front end were blown entirely away. At the time of the accident a man was oiling the driving box of the front right-hand driver. The explosion tore the frame apart at this point, blew this driving wheel off its axle and entirely away from the engine, and, of course, killed the oiler. Subsequently to the accident, Mr. Peters, who was called in to investigate, and, if possible, explain the explosion, took off the pop valve, tested it with water pressure, and found that it went off at 140 pounds. The engine had been carrying 145 to 150 pounds previous to its visit to the shops. One fact to be noted was that some time previously a new firebox had been put in the boiler, and there was a smaller number of flue holes in the fire-box flue sheet than in the front flue sheet. These surplus holes were closed with pocket-flues, nearly all of which blew out of the sheet at the time of the explosion, and crashed into different places in the machine shop. Some idea of the enormous energy of the explosion is given by the fact that these pocket flues had been rolled into the flue sheet and beaded.



Forward Driving Wheel Blown Away; Bar Frame Broken; and One Section of Barrel Entirely Destroyed.

DISRUPTIVE FORCE OF A LOCOMOTIVE BOILER EXPLOSION.

As to the cause of the disaster, we can only suggest that in putting on the reinforcing strip along the bottom seam of the barrel, fresh rivet holes may have been drilled intermediate of those already there, and the available sectional area along the seam so greatly reduced, that it was actually weaker rather than stronger for the third plate. The fact that the sheet parted, in spite of its total thickness of 1 1/8 inches, along the line of the rivet holes, would seem to suggest this as the cause of the disaster.

The Armament of the "Dreadnought."

As a result of prolonged trials and experiments by the British Admiralty, it has been decided that the main armament of the "Dreadnought," which is rapidly approaching completion, is to comprise ten of the new 12-inch Mark X wire-wound, breech-loading, quick-firing guns. The weapon is the most powerful that has yet been designed for naval purposes. It is 45 calibers and weighs 58 tons. The weight of the projectile is still, however, the same as in the former weapon, that is, 850 pounds, but its penetration is much greater, being through 51 inches of wrought iron at the muzzle, while its velocity is 2,900 foot-seconds. The powder charge will be 325 pounds of modified cordite. The firing capacity of this weapon is two rounds per minute. The "Dreadnought" will be ready for steam and gunnery trials in October, by which time construction will have occupied a little more than one year.

FRENCH CANDLE MAKING.

BY JACQUES BOYER.

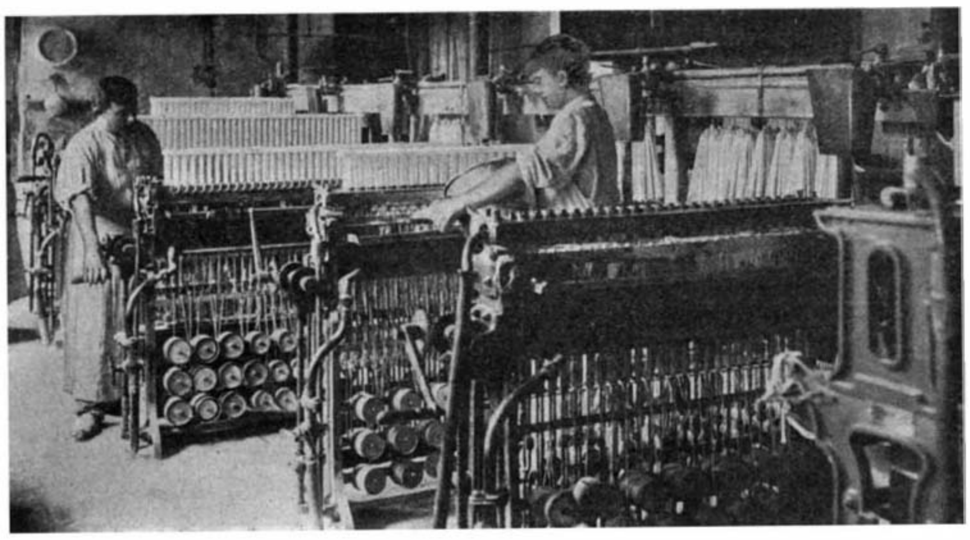


Fig. 1.—Molding Stearine Candles.

Fig. 2.—Mixing Colors with Stearine.

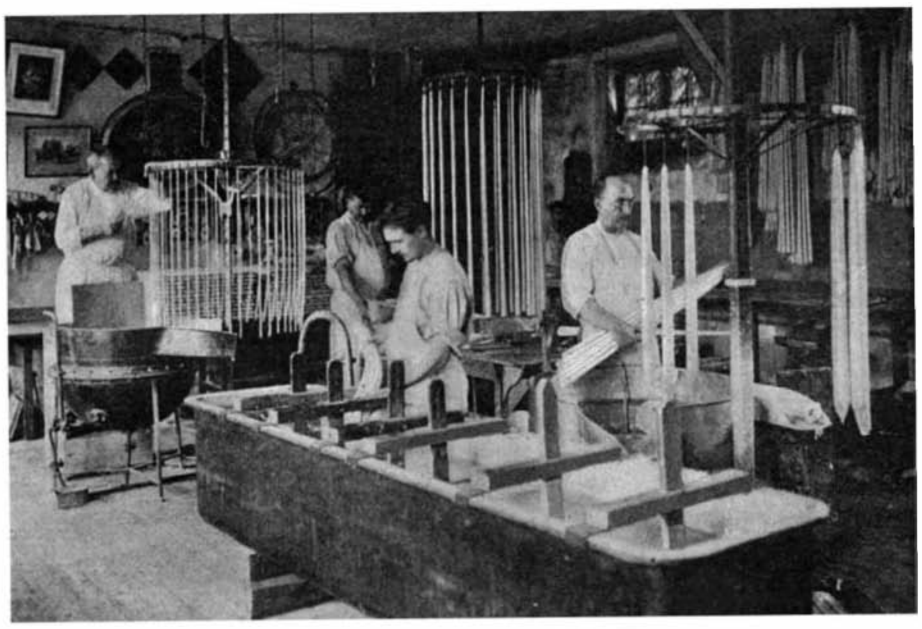


Fig. 3.—The Wax Candle Room.

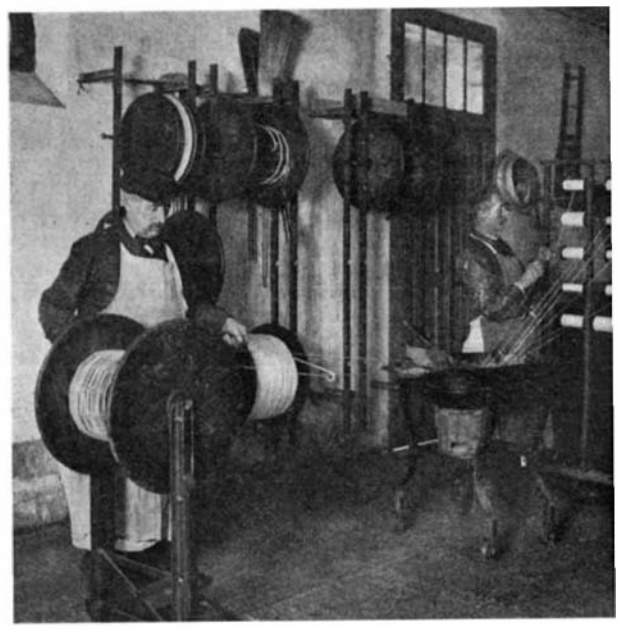


Fig. 4.—Making "Cellar Rats" or Long Wax Tapers.

Fig. 5.—Rolling Wax Candles.

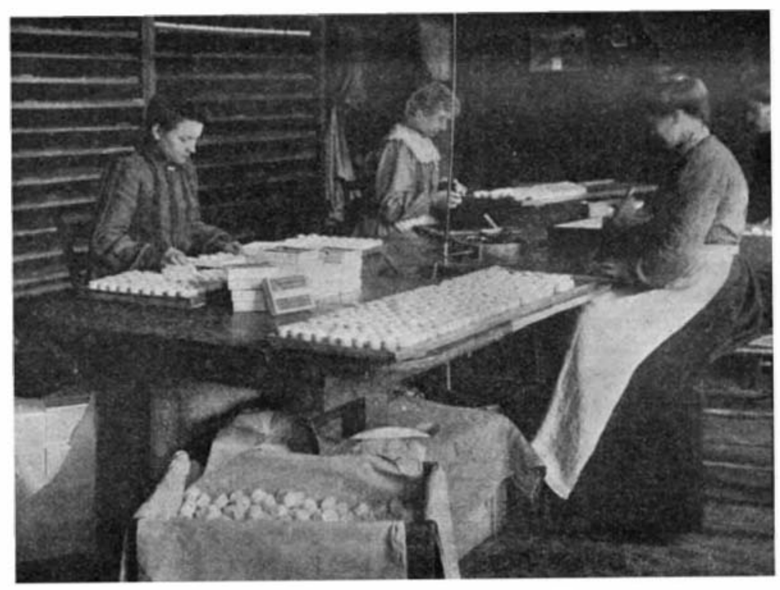


Fig. 7.—Cupping, Labeling and Packing Night Lights.

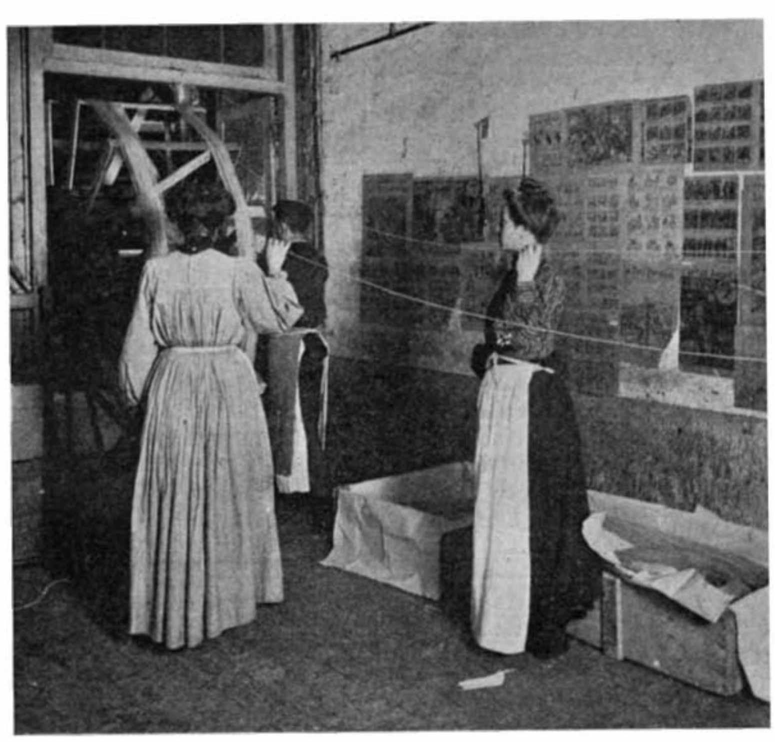


Fig. 8.—Reeling Wax Tapers.

THE MANUFACTURE OF CANDLES IN FRANCE.

The 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.

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.

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