

A MULTIPLE MOLDING MACHINE.

BY JAMES COOKE MILLS.

A new invention covering certain useful improvements in methods of forming sand molds has recently been introduced in the iron and steel world, and is acknowledged to be an important factor in foundry practice.

In the present state of the art it is almost universal practice in the formation of sand molds to fill the loose sand into the flask upon an up-facing pattern and then to compact the sand either by tamping or by pressure. The advantage of this method is that the interstices of the pattern are filled with sand by gravity, while the impact of the sand against the pattern face causes a certain degree of compression. As a consequence a perfect imprint of the pattern is thus initially formed and the subsequent tamping or pressure will impart the proper degree of hardness to all portions of the molding-face.

In multiple molding, where it is necessary to form molding-faces upon opposite sides of the flask, the lower face only can be formed by this method. It has therefore been found impracticable to form a good imprint of the pattern upon the upper face of the sand for the reason that the movement of the pattern into the sand will cause the projecting portions to carry the sand away from the face of the depressions or interstices of the pattern, leaving soft spots in the molding-face, which will not retain the proper shape. Thus gravity, which assists in the formation of the molding-face against the up-turned pattern, has precisely the opposite effect in the formation of the face by the down-turned pattern.

With the present invention difficulty of forming an imprint of the down-turned pattern is overcome by increasing the velocity of movement of the pattern relative to the body of loose sand to such an extent as to practically eliminate gravity as a factor and to compact the sand against the pattern-face by inertia. This may be accomplished either by moving the sand-

holder upward relatively to the stationary pattern or by moving the pattern downward relatively to a stationary sand-holder; but in either case the essential factor is the requisite velocity of the moving part. In carrying out the improved method the inventor, John A. Rathbone, employs a molding machine such as shown in the accompanying illustrations.

With all its complexity, the machine is simple in operation and its action is positive. The operator sets an iron flask on the flask frame so as to engage the pins with the holes in the lower lugs of the flask.

having been turned, the electro-magnets hold the sand frame while the mold frame is carefully drawn away from the drag pattern by the reverse action of the ram. The drawing of the lower or cope pattern is done in precisely the same way. The flask frame is raised from the mold head containing the cope pattern, by small pneumatic rams, leaving the completed mold free for stacking. The yoke is swung back and the mold lifted off. The patterns are cleaned by a jet of air through pressure hose.

The next mold is made in the same manner, except

that the sprue for the mold now formed between the first and second flasks is cut through it automatically by the machine. So mold after mold is made until, determined mainly by convenience in pouring, the topmost one is in position, when a larger pouring basin is shaped upon it and, if thought best, a pouring weight is added. Except for the top mold, no weight is needed, as the lower molds' joints are made good by the weight of the upper molds upon them.

It is generally supposed that the lower molds must be strained by the head of the liquid metal above, but, by a judicious ap-

portioning of the section of the gate to the massiveness of the casting, it may be caused to just feed it without straining and, for most of the work for which multiple molding is suitable, it is sufficient that the gate should be thinned down so that it has set by the time the second mold above is filled and the head is on the point of being increased by the filling of the sprue above.

A NEW BRITISH LOCOMOTIVE.

BY F. C. COLEMAN.

The competition between rival railroads on long-distance runs, and the changes in urban local travel due to the opening of new suburbs and the competition of street railways, have led to a live forward movement in British locomotive engine construction. The latest of these giant locomotives built for long-

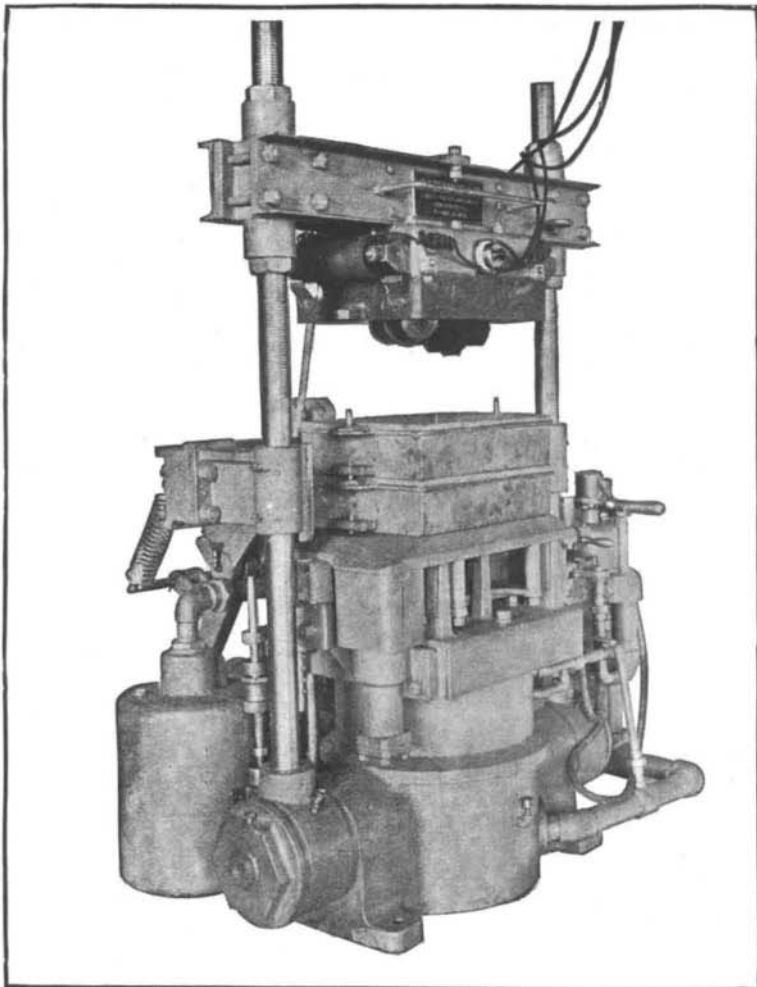


Fig. 1.—View Showing Yoke Swung Forward, the Drag Pattern, and Sand Frame Held by Magnets.

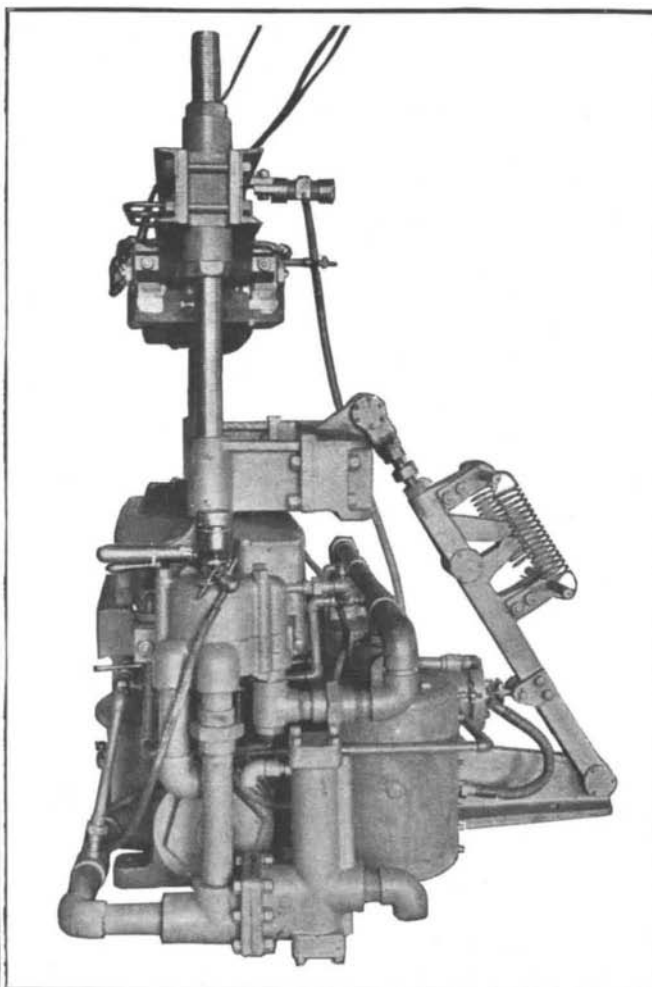
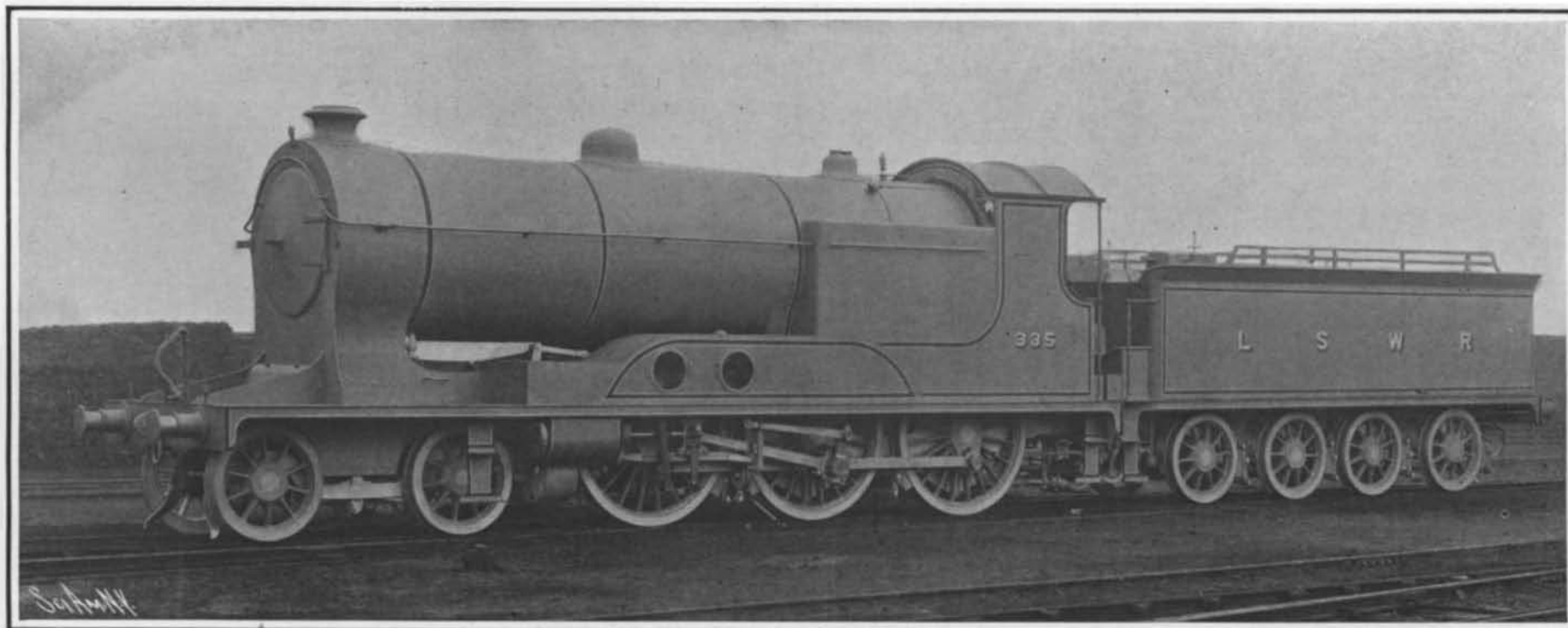


Fig. 2.—Side View of the Machine With Flasks Removed and Cope Pattern Ready for Operations.

A MULTIPLE MOLDING MACHINE.

Within the frame and secured to the mold head is the cope pattern. He riddles the facing sand over the pattern until it is entirely covered, and places the narrow sand frame over the flask with the pins engaged. The molding sand is then shoveled in, completely filling it, and leveled off smooth flush with the edge. By turning the smaller valve to the right, the yoke mechanism is brought forward by the action of a pneumatic ram and made secure in its position by a toggle joint behind. The drag pattern is now in place ready for ramming. The operator turns the air valve to the right, and the mold frame under the pressure of ten tons exerted by the ramming head makes a tremendous thrust upward, thus effectually ramming both cope and drag molds simultaneously by the same motion. The vibrator to jolt the drag pattern is automatically set in action. The switch



Cylinders, four, 10 1/2 inches by 30 inches. Driving wheels, 6 feet diameter. Heating surface, 2,737 square feet. Boiler pressure, 175 pounds.

A NEW BRITISH EXPRESS LOCOMOTIVE.

distance express traffic has just been completed at the London works of the London and South-Western Railway from the designs of Mr. Dugald Drummond, chief mechanical engineer of the company. The engine will run over the London-Plymouth route, a distance of 230¾ miles. Plymouth is connected with London by two competing lines, and as it is a port of call for Atlantic liners there is keen competition for the American as well as the local trade.

It is in accordance with the traditions of British rivalry that the officials of the London and South-Western Railway Company prefer not to make known full details of their new engine.

The engine is four-cylinder, six coupled, the cylinders being 16½ inches diameter, with a 26-inch stroke. The driving wheels are 6 feet in diameter, and the bogie wheels 3 feet 7 inches. The total heating surface is 2,727 square feet, made up of 340 boiler tubes equaling 2,210 square feet, 112 firebox tubes equaling 357 square feet, and the firebox, 160 square feet. The grate area is 31½ square feet, and the working pressure of boiler 175 pounds per square inch.

Four tons of coal and 4,000 gallons of water are carried in the tender; the heating surface of the tubes in the tender well is 382 square feet. The total length, engine and tender, over buffer, is 63 feet and the tractive force on rails is 30,968 pounds.

A SELENIUM PHOTOMETER.

The inaccuracies of the photometric methods now in common use are well known. In many cases differences amounting to as much as ten per cent will exist between the estimates made by different observers with the best available scientific means of comparison. Furthermore, the colors of the lights to be compared are of great importance. The colors differ in the intensity of the effect produced upon the eye of an individual, and there is marked variation between different persons in this respect; so that by some observers two lights of the same color may be compared with considerable accuracy, but a change in the color of the standard will render the determination worthless. In addition, the practical impossibility of maintaining a standard light which will not vary from time to time with the pressure of the atmosphere and its specific composition at the place of test, and with the purity of materials used to produce the flame (a flame being usually employed for this purpose), affects the precision of comparison to a greater or less degree.

The common standard of comparison is the now well known "Pentane" lamp; the color of this standard is toward the red end of the spectrum, and to most eyes it shows decidedly pink. Hence, when an attempt is made to compare a yellow incandescent lamp, for example, with the standard, the results obtained from different observers are often so discordant as to make them of little use; it has therefore become a practice to have a single observer compare a number of incandescent lamps with the selected standard with great care, so as to make them secondary standards, which when burned at proper voltage will give for a considerable period a substantially unvarying light. Obviously, however, this introduces still further inaccuracies, since the lamps will, in spite of all possible care, differ among themselves, and comparisons made with them will necessarily differ by the personal equations of the different observers. In addition these equations vary in different ways with different persons, being dependent as already pointed out upon physiological factors such as the ocular perception of the individual, varying with fatigue and with physical condition, as is well understood.

To obviate all these difficulties Mr. William J. Hammer, a well-known New York electrical engineer, has devised and patented a very simple and ingenious photometer in which sensitivity of selenium to light is practically applied.

In an electric circuit a selenium cell of approved construction is arranged through which a current is passed, the changes in the current, due to the action upon the cell of the light selected for test, being indicated. The specific electric resistance of selenium varies over wide limits under the influence of light. In circuit with the cell and the source of current is included any desirable form of electrical measuring instrument. Preferably an instrument which will show variation in only one electrical quantity, since in any investigation it is best to employ only one variable at a time; but under some conditions other forms of measuring devices may be used.

In Fig. 1, *A* is the battery or other source of current which is to be measured and variations in which are taken as indicative of light intensities. The battery is arranged in circuit with a selenium cell *B*, which is preferably of that form in which the selenium, after being coated upon a suitable conducting support, such as a coil of nickel wire, is sealed in a tube of preferably as nearly perfect a vacuum as can be obtained, the ends of the conducting wire being passed through the glass by means of platinum tips or otherwise; since the current is small, and no great heat is evolved, platinum is not necessarily used.

C is a measuring instrument, in the case illustrated a voltmeter, responsive to small variations of pressure.

Upon a suitable table, *D*, is arranged the lamp *E* to be tested. At *F* is a screen having a hole *f* which may be closed by a slide *F'*; in practice it is preferable to place the selenium cell in a light-tight box *M* (shown partly broken away) having free ventilation, so that the indications may not be affected by exterior light; and inasmuch as the effect to be observed is not detectable by examination of the cell, it is necessary to open the box only at long intervals.

The method of operating the arrangement thus described is substantially as follows: A standard lamp of any desired construction, such as the Pentane lamp referred to in the previous description, is placed in proper position adjacent to the apparatus and lighted, being screened completely from the cell; a small current, preferably a small fraction of an ampere, is then caused to flow in the circuit including the cell, and after it has attained a steady value, the fall of potential around the cell is measured by the volt-meter. After this the light of the standard lamp is allowed to fall upon the cell, and the change in the resistance of the circuit (as indicated by the change in the drop) caused by the action of the light upon the selenium is measured and recorded; this then becomes a "constant" of the particular cell employed. After this, the light which is to be compared with the standard may have its specific effect upon the cell determined in the same way. Obviously the indications of the cell for the first specimens constructed must be calibrated by comparison with the results obtained by photometers, since the measurements of light now in use are purely arbitrary and have no relation to any definite physical quantity; but this relation having been once established in the manner indicated may be in-

Fig. 1

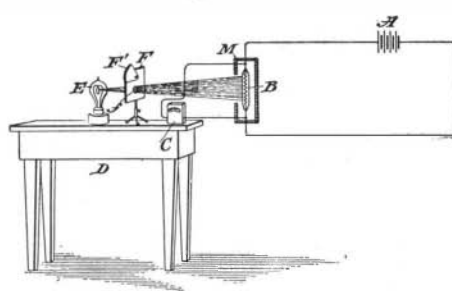


Fig. 2

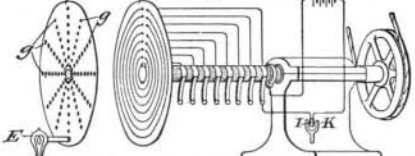
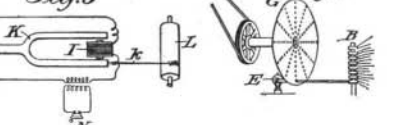


Fig. 3



A SELENIUM PHOTOMETER.

definitely perpetuated by periodic comparisons of different cells to guard against change.

In Figs. 2 and 3, are shown a second means of practicing the method. This consists of a siren-disk *G* of well known construction in which the rows of holes *g g* bear to each other certain definite relations, such as the notes of the scale. Opposite to, and rotating with this disk (the perforated disk being shown detached for clearness of illustration) is a disk *H* bearing upon its surface conductors coated with selenium, one for each of the rows of holes *g*. The ends of the conductor go to collector rings rotated with the shaft, the whole being driven at constant speed. In the circuit with the collector rings and source of current supply is a coil *I*, disposed so as to affect a tuning-fork *K* provided with a pointer *k*, the amplitude of vibration of which is recorded upon the revolving cylinder *L*, in the manner of a chronograph. The rows of holes in the siren-disk may conveniently be in the relation to the notes of the octave of a tempered scale, and may each be provided with a similar tuning-fork, which at the normal rate of rotation will respond to its appropriate tone; these, being all substantially like the fork *K* and arranged in a similar way, are not illustrated. Such an organization will enable the observer to conduct a number of tests at the same time, when desired.

The apparatus thus described being brought up to normal speed, which should be maintained as nearly constant as possible, the tuning-fork *K* will begin to vibrate as soon as the standard lamp is turned on, and the amplitude of its vibrations will be recorded upon the cylinder *L*; upon turning off the standard and turning on the lamp to be tested the amplitude of the fork's vibration will indicate the intensity of the lamp to be tested, relative to the standard.

A telephone *N* may be connected in circuit if desired,

either directly or inductively, and the note of the fork will then sound in the ear of the observer; an operator with a good musical ear may reach a very close approximation to a correct comparison by the relative intensities of the sounds produced by the two lights; this is, however, open (though in a less degree) to the objections pointed out with respect to visual photometers.

In Fig. 4 is indicated a construction which is cheaper and yet substantially effective. In this figure the cells *B* are arranged upon a stationary support and the siren-disk alone rotates, cutting off and admitting the light by its rotation.

An Earthquake Warning Service.

It is generally known that for the last few years the great earthquakes which have occurred in distant parts of the globe, San Francisco, Chile, Mexico, and the West Indies, have been first announced to Europe, not by telegraph, but by the indications of the various seismological observatories of Germany and Italy. In fact, important tremors of the earth announce themselves in every part of the globe very soon after their occurrence by the vibrations which they impress upon the crust and the entire mass of the earth. There has been organized in Germany an earthquake warning service, operated without the aid of the telegraph, but simply by means of the diagrams traced by recording seismographs for the purpose of indicating promptly to great shipping firms the approximate location of the epicenter, or center of disturbance. After the earthquakes of San Francisco and Valparaiso the Chamber of Commerce of Hamburg asked the director of the local earthquake station for a daily service of seismograph records of the central station of Strassburg and determinations of the probable epicenters deduced therefrom. In consequence of this request a complete service was inaugurated on the following lines:

In order to determine without any ambiguity the approximate position of the center of a distant and powerful earthquake it is necessary to combine the data furnished by three stations; that is to say, by three seismographs. For these stations Hamburg, Strassburg, and Graz were selected. Immediately after a tracing of a distant violent shock is recorded determinations are made at each station of the durations of the two preliminary phases, from which the distance of the epicenter can be calculated by well-known methods. The stations of Graz and Hamburg telegraph their data to Strassburg, which, quickly combining the three results, telegraphs to Hamburg the probable situation of the epicenter. All this is a matter of three telegrams and a few hours of time. On December 4, 1906, this method was applied to data furnished by Strassburg and Hamburg alone and consequently the result was less certain. Hamburg sent to Strassburg the following telegram: "Yesterday 231016, 1849, 2723"; and Strassburg replied: "230954, 1815, 2524. Lesser Antilles."

This meant that at Hamburg the first shock began at 23 h. 10 min. 16 sec., the second at 23 h. 18 min. 49 sec., and the principal shock at 23 h. 27 min. 23 sec. The length of the phases being known it was found that the epicenter was distant 7,550 kilometers (4,660 miles) from Hamburg and 7,400 kilometers (4,598 miles) from Strassburg. Two circles drawn on a terrestrial globe around these two cities as centers, with the radii indicated above, were found to intersect each other in two points, of which one was in the Lesser Antilles, a region particularly subject to earthquakes and hence obviously the place of the disaster. By making use of three stations even this slight ambiguity is removed. It was not until the 7th of December, three days later, that a telegram from New York announced that an earthquake had occurred at Kingston, Jamaica, on the 5th, and it was not until the 26th of December that it was known that the shock really occurred on the 3d. The importance of these earthquake warnings for great shipping firms is quite evident despite the approximate character of the location of the centers derived from the seismograph records.

"Wanted to Buy" Column.

The continued success of our "Wanted to Buy" items which are incorporated with our "Classified Advertisement" column, is most gratifying, and has proven a real help to the manufacturer. One firm writes us as follows: "We thank you for the names furnished us in your last letter, and beg to advise you that with your kindness we are already in possession of an order. This is, without exception, the greatest stunt that was ever inaugurated, and it is an item for which the SCIENTIFIC AMERICAN deserves an endless chain of praise."

The Canadian railways had a total length of 22,452 miles on June 30, 1907, or 27,611 miles including double tracks, sidings, and spurs. The greatest mileage in any province was 7,637 miles in Ontario, and the least was 96 miles in Yukon.