941,023.

H. P. MACDONALD.
SAND RAMMING MACHINE.
APPLICATION FILED MAR. 25, 1908.

Patented Nov. 23, 1909.

3 SHEETS—SHEET 1.

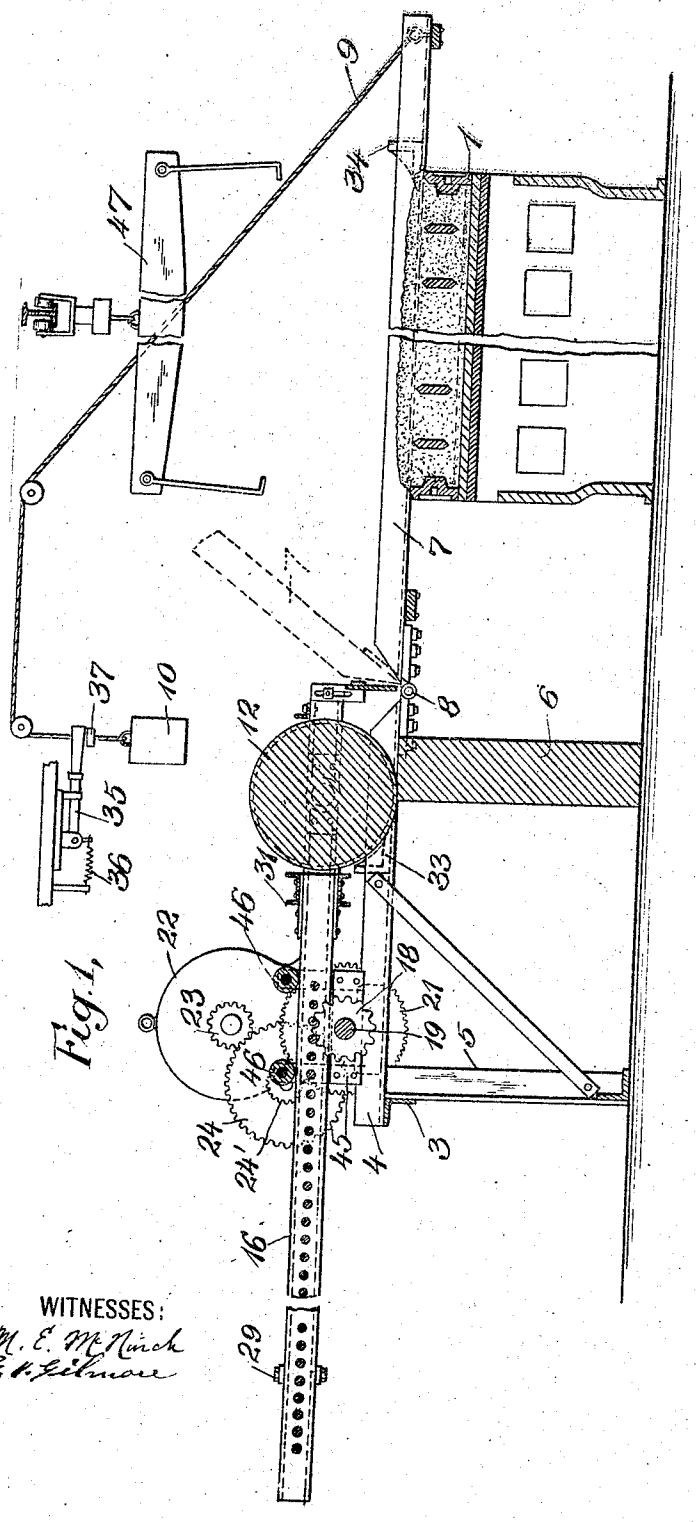

Fig. 1.

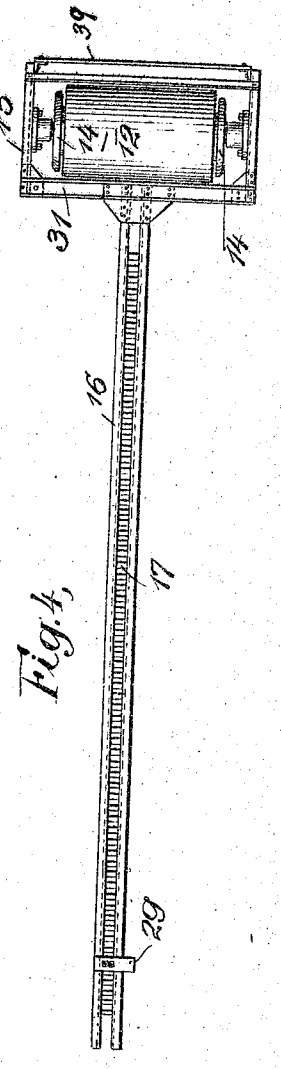

Fig. 4.

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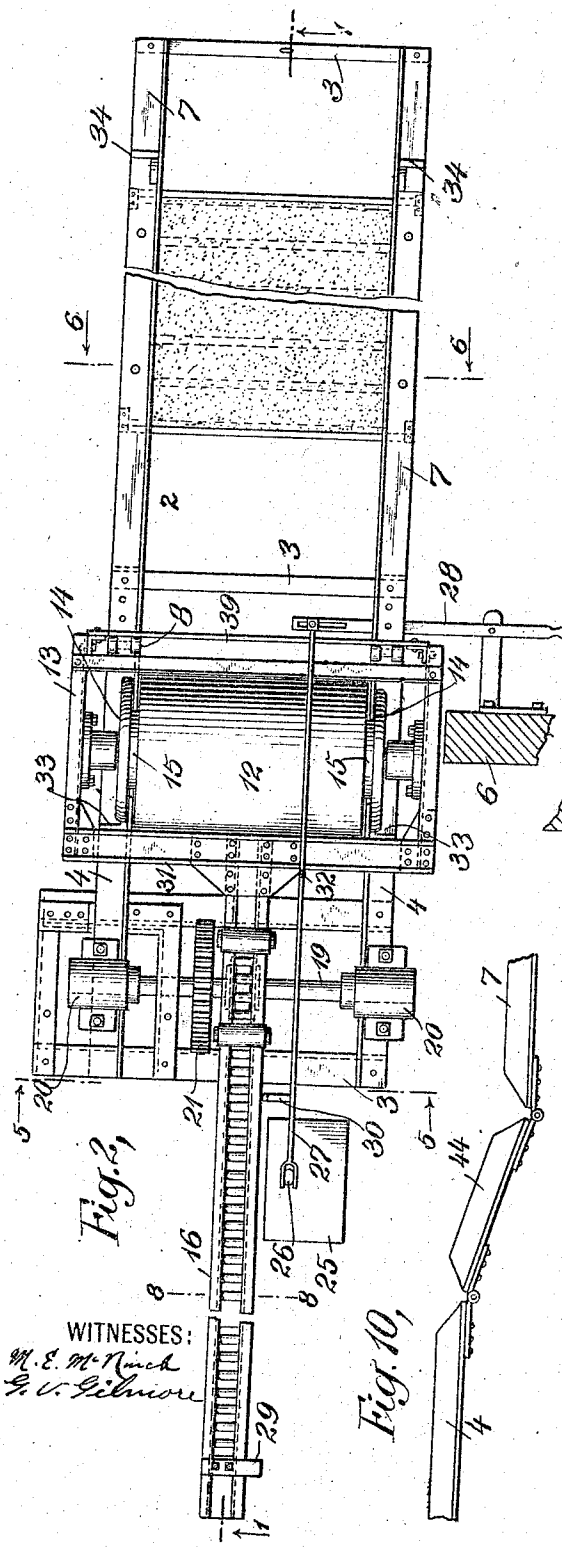

Fig. 2.

Fig. 10.

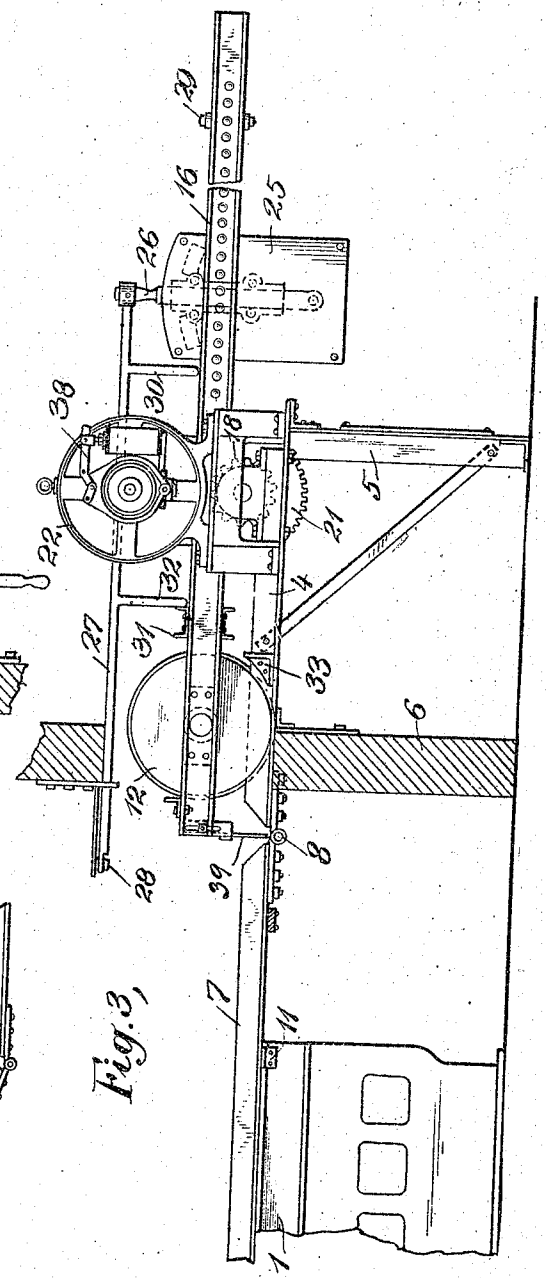

Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 6.

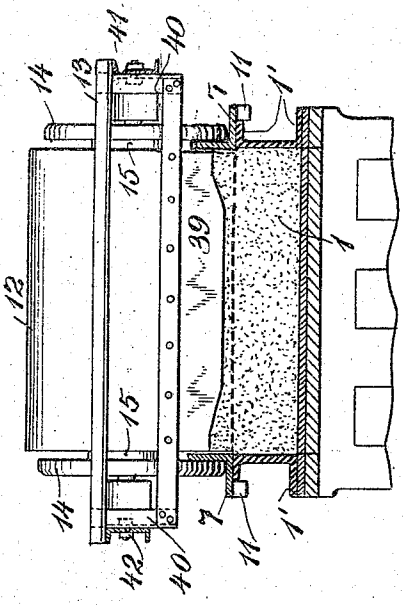
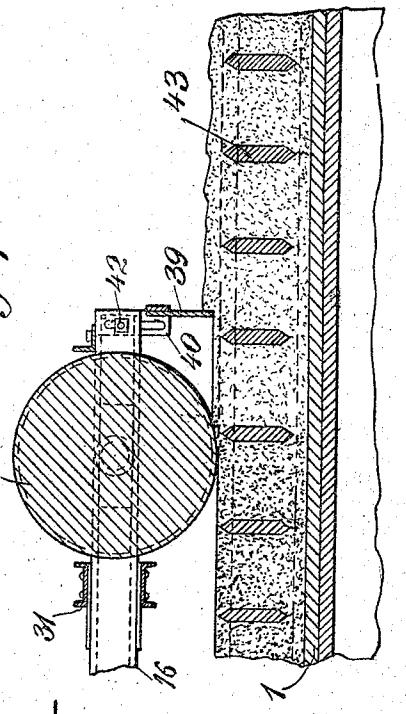


Fig. 7.



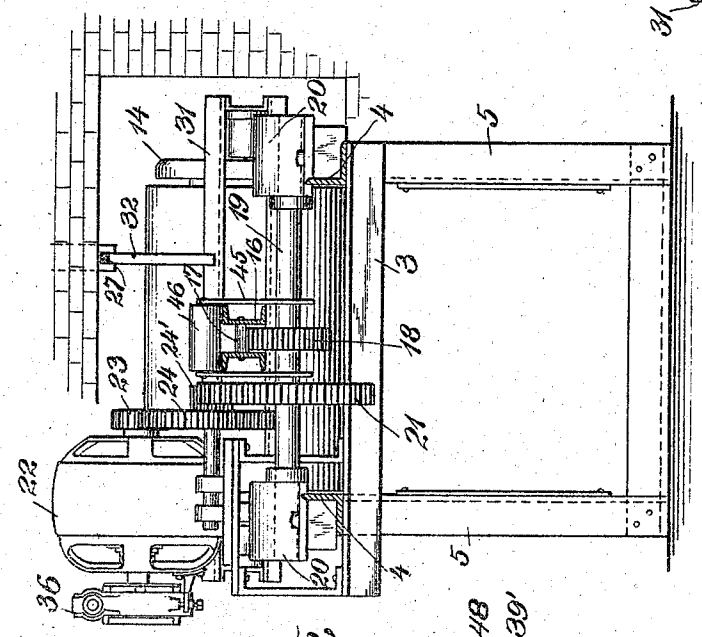


Fig. 8.

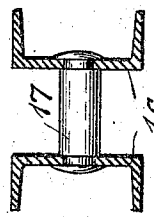
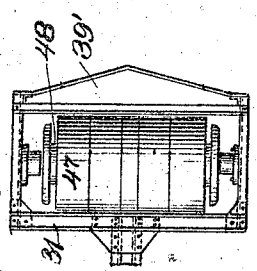


Fig. 5.

Fig. 9.



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UNITED STATES PATENT OFFICE.

HARRY P. MACDONALD, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO SNEAD & COMPANY IRON WORKS, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

SAND-RAMMING MACHINE.

941,023. Specification of Letters Patent. Patented Nov. 23, 1909.

Application filed March 25, 1908. Serial No. 423,167.

To all whom it may concern:

Be it known that I, HARRY P. MACDONALD, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Sand-Ramming Machines, of which the following is a specification.

Present methods of ramming the sand in flasks to form green sand molds are open to many objections. The generally practiced method of hand ramming is costly and often requires highly skilled labor, and many molds made by it are defective because of the sand being rammed too hard or too soft causing blow holes, straining, etc. Power squeezers are expensive and of limited application, and molds made by them are often lost owing to the air in the sand being compressed and then suddenly released causing "drops" and torn edges. Jarring machines are also expensive and costly to maintain, and often destroy molds on neighboring floors through the excessive vibrations they set up.

To overcome the objections incident to the methods of ramming above referred to, I have devised a mechanism comprising a roller by means of which the mass of sand is subjected to pressure progressively applied from one end of the flask to the other, such pressure being uniform throughout and with no possibility of injury to the mold or to the pattern. Combined with the roller is a strike-off placed in advance of the roller and which may be of varying contour to level the sand in such manner that by leaving more or less sand at certain points it may be rammed hard or soft by the roller as may be required. I have also provided means for the automatic control of the roller in its travel back and forth, and other features to facilitate the rapidity of making molds in a manner not heretofore possible, all of which will be understood from the following description taken in connection with the accompanying drawings in which—

Figure 1 is a longitudinal vertical section on the plane of the line 1—1 of Fig. 2; Fig. 2 a top view with the motor and some of the gears removed; Fig. 3 a side elevation; Fig. 4 a top detail view of the ramming roller and its connected rack; Fig. 5 a transverse section on the plane of the line 5—5 of Fig. 2; Fig. 6 a transverse section on the plane of the line 6—6 of Fig. 2; Fig. 7 a longitudinal vertical section on an enlarged scale through the flask showing the roller in operation; Fig. 8 a detail sectional view of the rack for moving the roller; Fig. 9 a top view of a modified roller and strike-off; and Fig. 10 a detail view of a portion of a modified track frame.

Similar numerals of reference indicate similar parts in the several views.

Referring to the drawings, the numeral 1 designates a flask consisting of a frame of wood or iron to contain the sand and patterns, the term being employed by me to include either the cope or drag of a two-part flask. For the purpose of ramming the sand I have adopted a roller, described more fully hereafter, which is caused to travel back and forth over the flask on an open-ended track frame 2. This frame, in the adaptation of the invention shown, comprises fixed and movable sections, the side members of which are in alinement and in effect constitute rails on which the roller is adapted to run, these side members being secured together by cross-bars 3. The side members or rails 4 of the fixed section may be supported in any suitable manner as by uprights 5 and the wall 6, the latter having an opening therein through which the roller may pass. The movable section of the frame is adapted to rest upon the flask and in order to prevent the sand from being pushed or swept over the side of the flask, the members or rails 7 are in the form of angle irons, and the distance between them is equal to that between the side walls of the flask so that the upright legs of the rails shall be in the same vertical planes as the side walls of the flask, as indicated in Fig. 6. The sides of the flask are flanged as at 1', the upper flanges serving as a bed to receive and support the movable section of the frame 2. In practice it is preferred that the filling and ramming of the flasks shall be done at a designated part of the foundry, the flasks being successively brought into position. To provide, therefore, for the removal of the forward section of the track frame 2 after a flask has been rammed and for lowering it for a fresh flask, I pivotally connect the two parts of the frame through the adjoining rail sections at 8 so that the forward or movable section may be swung upward. This may be conveniently effected by attaching to the free

end of the movable section a rope or cable 9 which runs over suitable sheaves to a counterweight 10.

It is to be understood that it is not of the essence of my invention that the movable section of the track frame shall be pivoted to the fixed section. These two sections may be wholly independent of each other in which case the forward section may be moved into and out of position by a suitable crane, provision being made for holding the sections of the frame in fixed relation to each other during the ramming operation. In either case the base or horizontal leg of the rails 7 will be provided with pins or lugs 11 to guide the frame as it is lowered and to hold it in proper relation to the flask, and also to prevent the frame being moved laterally when once placed in position.

The ramming is effected by means of a roller 12 of such width as to fit snugly within the side walls of the frame 2 to prevent the sand working its way up between the ends of the roller and the frame. The roller 12 is cast with trunnions which have bearings in the side members of a carriage 13. Cast integral with the roller, or separate therefrom and keyed to the roller trunnions are wheels 14 of such diameter that as they rest upon the track frame the roller 12 will not fall below the top of the flask; in other words, the relation between the wheels 14, roller 12, and the base 7 of the side members of the track frame should be such that the roller will ram the sand flush with the top of the flask in order to avoid striking off the flask before clamping on a bottom board or laying the flask on a level sand bed. This is accomplished by making the difference between the radii of the wheels 14 and roller 12 equal to the thickness of the horizontal leg of the angle rail 7. However the wheels 14 may be formed they are separated from the roller by hubs 15 on the ends of the roller, the width of said hubs being substantially that of the thickness of the vertical leg of the side members of the track frame. Such construction is of particular advantage in that it prevents any lateral movement of the roller which would tend to throw it off the frame. The parts should, however, be so disposed as to provide sufficient clearance for the roller and wheels to travel without binding against the track frame.

To effect the travel of the roller and its reverse movement automatically I have devised the following. Secured to the center of the carriage 13 and projecting rearwardly therefrom is a rack which may be designated as a ram arm. This rack, a detail of which is shown in Fig. 8, comprises flanged side members 16 connected by studs 17 constituting the teeth of the rack. The rack engages a pinion 18 keyed on a shaft 19 having suitable end bearings 20 supported on the side members 4 of the track frame. On the shaft 19 is also keyed a spur gear 21 which is driven by a suitable source of power, preferably an electric motor 22, through a spur gear 23 on the motor shaft and an intermediate spur gear 24 and pinion 24′. The gears of the train just described are so proportioned as to reduce the speed of rotation of pinion 18 to impart a relatively slow movement to the ram arm. In the employment of an electric motor I provide a suitable controller 25, the arm 26 of which is connected to a rod 27, the latter having a suitable handle 28 extending in proximity to the usual position of the molder near the flask. The controller 25 may be of any known type having provision for different speeds and for reversing the motor. In order that the attention of the molder may not be given to the motor during the ramming operation, I have provided for the automatic reversal and stoppage of the motor. As illustrated in Fig. 3, a movement of the controller arm 26 to the right will give a forward movement to the roller 12 and such movement will continue until a dog 29 near the outer end of the rack 16 contacts with a bent arm 30 depending from rod 27 which will move the controller arm 26 to reverse position. The roller 12 will then travel to its initial position until a dog 31, consisting in this construction of a channel iron forming part of the carriage 13, contacts with an arm 32 depending from the rod 27. The arm 32 is so placed that when impinged against by the dog 31 the controller arm 26 will be moved to stop position. In practice a single travel of the roller forward and back to its initial position will be sufficient for proper ramming. Should it be deemed necessary, however, to again pass the roller over the flask the operator may do so through movement of the handle 28 as above described. The dog 29 is adjustable along the rack so that it may be placed at any desired position to accommodate flasks of varying lengths, and to insure the return of the roller upon the completion of its forward movement or so placed as to stop the roller. I also provide buffers or stops 33 on the fixed section of the track frame, and similar devices 34 on the movable section of the frame to prevent the roller, which is of considerable weight, traveling to an extreme position in either direction which would endanger the safety of the machine, should control of the motor be lost through any unforeseen cause. As a further measure of safety, I place in the motor circuit a knife or other suitable form of switch 35 (see Fig. 1) which is held normally open by a spring 36 and is adapted to be closed by a stop 37 secured to the cable 9. The stop 37 is so placed that when the movable section of the track frame is lowered to operative position it will act to close the

switch and to hold it closed against spring 36. When, however, the said section of the frame is raised, as indicated in dotted lines, to permit of the removal of a flask, the stop 37 will be lowered and spring 36 will then act to open the switch. This feature of a switch is added in order that the motor circuit may be completely closed only when the movable section of the track frame is in position to permit the roller to pass over the flask. It avoids any damage to the mechanism should the controller arm be moved from stop position before the track frame is ready to receive the roller. The motor 22 will be provided with a brake 38 which aids to stop the roller before it is reversed at the end of its forward movement.

Another essential feature of my invention is the strike-off. As shown in Figs. 6 and 7, this consists of a board 39 bolted to a cross-piece secured to hangers 40, the latter depending from channel irons 41 forming part of the carriage 13. The hangers 40 and irons 41 are slotted and the former are adjustable to varying heights by means of bolts and clamp nuts 42. When once adjusted for a given pattern and size of flask, the strike-off will remain fixed for all molds of the same pattern. The function of the strike-off is to level the sand to the desired height in advance of the roller. In practice the sand will be thrown by the operator over the pattern until it fills the flask and track frame as high as the bottom of the strike-off or a trifle higher, the strike-off being so adjusted as to leave just enough sand in the frame to exactly fill the flask after ramming to the required hardness. The strike-off extends below the upper edge of the side members of the track frame and its length is substantially that of the distance between said members, being in this respect the same as roller 12, there being sufficient clearance to prevent binding. The excess sand will, therefore, be pushed forward over the end of the flask, as indicated in Fig. 7, and the roller immediately following will act to compress or ram the sand. Should it be desired to ram the sand harder along a given section of the flask, the bottom of the strike-off may be given the desired profile to leave a greater quantity of sand where necessary. Thus in Fig. 6, the bottom of the strike-off is given such profile that the sand will be higher along the sides of the flask than in the center, the effect being to ram the sand harder along the sides of the flask, inasmuch as the roller in all cases is of such weight as to compress the sand flush with the top of the flask. The provision of a strike-off traveling in advance of the roller is of advantage in that the sand will always be struck off to a fixed height. Instead of having the strike-off in a single vertical plane it may be pointed forward as indicated at 39′ in Fig. 9 so as to act more or less as a plow in pushing the sand.

When bars are used in flasks (see Fig. 7) I prefer to round or point their tops to prevent the sand packing on top of the bars under the compression of the roller and so causing an uneven surface.

In the assemblage of the ramming mechanism above described I have shown it in connection with a track frame adapted to flasks of a uniform height, and substantially for flasks of the greatest height to be met in practice. When, however, the work varies so as to necessitate the use of flasks of a different height two main parts of the track frame instead of being directly connected together as before described, are joined by an intermediate section 44 pivotally connected to each part to permit the forward section, or that which rests upon the flask, to be lowered below or raised above the level of the fixed section. In such case in order to hold the rack in mesh with the driving pinion 18 I pivot a yoke 45 (see Figs. 1–2 and 5) on the pinion shaft 19. The vertical legs of said yoke carry rollers 46 which rest upon the upper flanges of the side members 16 of the rack. By reason of this construction the rack may be tilted and still maintained in mesh with pinion 18 as the roller passes over the inclined connection 44 of the track frame, and as it travels over the forward section of said frame. This construction not only prevents disengagement of the rack and pinion but it also prevents cramping of the mechanism as the roller travels over the inclined section.

The operation of the machine will be readily understood from the foregoing description. The flask to be rammed is placed in position over the pattern on a bottom board or on a drop plate molding machine. The forward or movable section of the track frame is then lowered until it rests directly on top of the flask, being guided into position by the lugs 11 and held by the latter so that the inside of the frame is even with the inside of the flask. When the track frame is in position the motor circuit will be closed at the switch 35 and open at the controller 25. The sand is then riddled and thrown in over the pattern until it fills the flask and frame as high as the bottom of the strike-off or a trifle higher. The operator then, by a movement of handle 28, throws the controller arm 26 to forward position. As the roller moves forward the strike-off precedes it and levels the sand to the desired profile. When the dog 29 strikes the depending arm 30 the controller arm 26 will be shifted to reverse position and the roller will travel in a reverse direction until brought to rest in its initial position by the shifting of the controller arm to stop position through dog 31, and arm 32 of the rod

27. It is preferred that the travel of the roller shall be automatically stopped at its initial position rather than to depend upon the molder to shift the controller arm. Upon the completion of the ramming the movable section of the track frame is lifted and the pattern drawn in the usual manner. The flask is then removed and another placed in position. For the purpose of handling the flasks an over-head crane 47 may be employed.

The use of a roller to ram the sand is of advantage in that it enables perfect molds to be made rapidly and cheaply. In the illustrated embodiment of my invention there is no possibility of the roller falling off the flask as it is confined laterally, or of its being set in motion before the frame is ready to receive it. The side members of the track frame also confine the sand laterally and prevent its being pushed over or accumulating on the sides of the flask. In this provision of a track frame for the roller resting upon the flask there is no escape for the sand as it is acted upon by the strike-off except in a forward direction, and no escape laterally after it has been leveled by the strike-out. An unobstructed bed is provided for the wheels 14 so that the roller is caused to pass over the flask at a uniform height and its full weight is utilized to ram the sand flush with the top of the flask. These features are of advantage over the mere running of the roller directly on the sides of the flask as in such case, there being no means to confine the sand laterally, the roller tends to crowd it over the sides of the flask where it accumulates, and by thus making a more or less uneven bed for the roller soft spots result. Additionally there would in such case be nothing to prevent the roller from moving laterally and thus endangering the whole machine. According to my construction, the roller is always under complete control of the operator and, should he be negligent, the roller is prevented from running so far forward as to fall off the end of the frame, or too far back to the damage of the operating mechanism.

When the sand is merely heaped up in and over the flask and not struck off evenly to a fixed l ight different portions of the flask, and different flasks in duplicate work, are rammed unequally. Striking off by hand is expensive and slow and of little value unless the sand can be prevented from being pushed sidewise off the flask. According to my invention, however, the sand cannot escape laterally and the strike-off insures the same amount of sand being compressed into each flask and allows it to be rolled down exactly flush with the top of the flask, thus avoiding the necessity of striking off before clamping on a bottom board or laying the flask on a level sand bed.

My invention lessens the time required in making molds and adds much to the safety of the operation in using a roller. The various parts of the machine are few and simple and can be made very strong without interfering with the ready working of the whole.

As before stated, it is desirable in practice to confine the ramming operation at a designated place in the foundry, and to provide for the security of the operating mechanism I have placed the latter in a department separated from the molding department by a wall 6. The rod 27 is extended through an opening in the wall 6 into the molding department so that the motor 22 shall be at all times under control of the molder and he is enabled to start the motor without signaling or without leaving his post. This, however, is a mere detail of foundry practice and has nothing to do with the present invention.

Instead of making the roller in a single piece, or casting the roller and the wheels together I may make the roller of separate disks as indicated at 47 in Fig. 9. Such construction would provide for narrowing the roller to accommodate flasks of varying widths. In such case the wheels 14 will be keyed to the roller shaft and separated from the roller proper by washers 48 serving the same purpose as the hubs 15 before described.

What I claim and desire to secure by Letters Patent is:—

1. A machine of the character described comprising a roller for ramming the sand, a frame along which said roller is adapted to travel, said frame comprising fixed and movable sections pivotally connected together and the latter adapted to rest upon the top of a flask, and means for raising and lowering said movable section out of and into position.

2. A machine of the character described comprising a roller for ramming sand, a motor and mechanism connecting the same with said roller to cause the latter to travel over the flask, and means for automatically reversing the direction of travel of the roller upon the completion of its forward movement or to stop the roller.

3. A machine of the character described comprising a roller for ramming sand, a motor and mechanism connecting the same with said roller to cause the latter to travel over a flask, means for automatically reversing the direction of travel of the roller upon the completion of its forward movement, and means for automatically stopping the roller upon reaching its initial position.

4. A machine of the character described comprising a roller for ramming the sand, a motor and a train of gears connected thereto, a rack connected to said roller and adapted to be actuated by said gears, and means on said rack adapted to effect the re-

versal of said motor or to stop it upon the completion of the forward movement of the roller.

5. A machine of the character described comprising a roller for ramming the sand, a motor and mechanism connecting the same with said roller to cause the latter to travel over a flask, a controller for said motor, means for automatically shifting the controller arm to reverse or stop position when the roller completes its forward movement, and means for automatically shifting the controller arm to stop position when the roller reaches its normal or initial position.

6. A machine of the character described comprising a roller for ramming the sand, an electric motor and mechanism connecting the same with said roller to cause the latter to travel over a flask, a movable track frame to receive the roller, a normally open switch included in the motor circuit, and means for closing said switch when the frame is lowered over a flask.

7. A machine of the character described comprising a frame having fixed and movable sections, and an intermediate movable section, said sections being pivotally connected together to permit of the outer movable section being placed over a flask of any desired height for the purpose described.

8. A machine of the character described comprising a frame having fixed and movable sections, an intermediate movable section, said sections being pivotally connected together, a roller adapted to travel over said frame, means for moving said roller comprising a rack and pinion, and means to prevent the disengagement of said rack and pinion when the movable sections of the frame are not in the same plane as that of the fixed section.

9. A machine of the character described comprising a frame having fixed and movable sections, an intermediate movable section, said sections being pivotally connected together, a roller adapted to travel over said frame, means for moving said roller comprising a rack and pinion, and a yoke pivoted on the pinion shaft and carrying rollers bearing on said rack to prevent the disengagement of the rack pinion when the movable sections of the frame are not in the same plane as that of the fixed section.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HARRY P. MACDONALD.

Witnesses:

CHARLES S. JONES,

FRANK E. RAFFMAN.