Dec. 22, 1931. G. FURMAN 1,837,320

MOLD FOR FOUNDING

Filed Sept. 20, 1929 5 Sheets-Sheet 1

Fig. 1

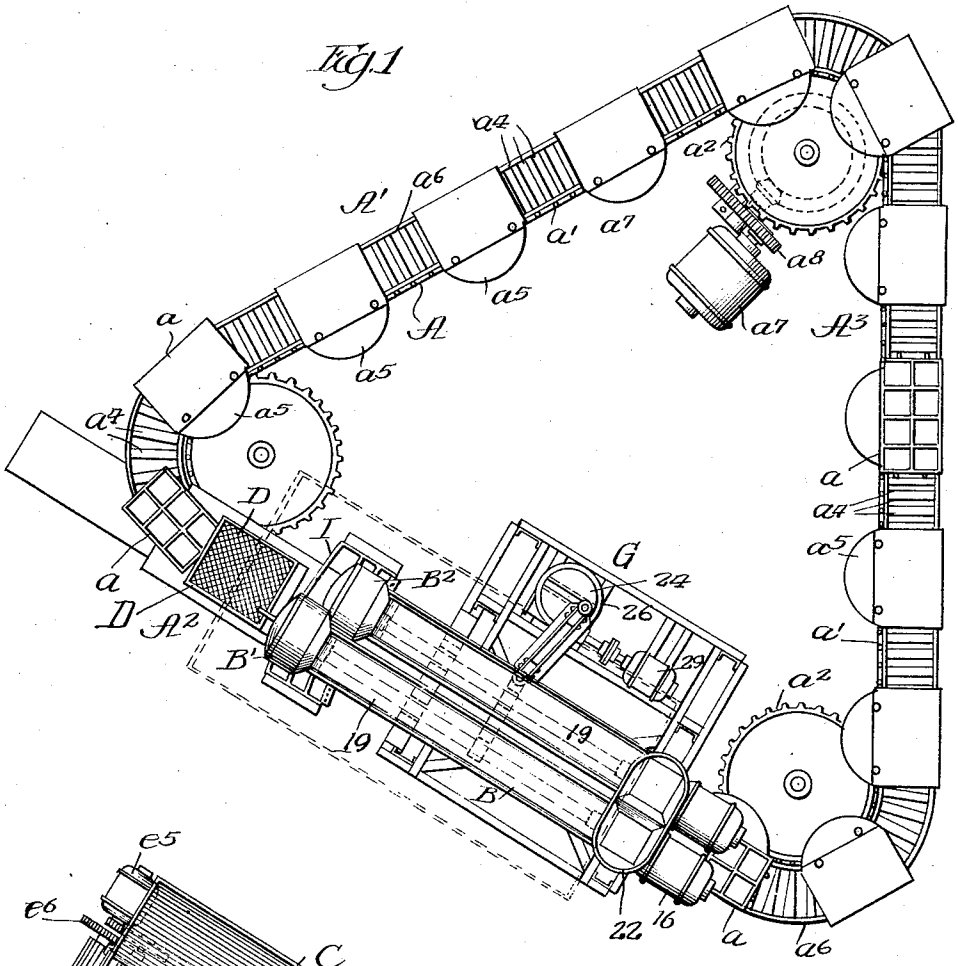
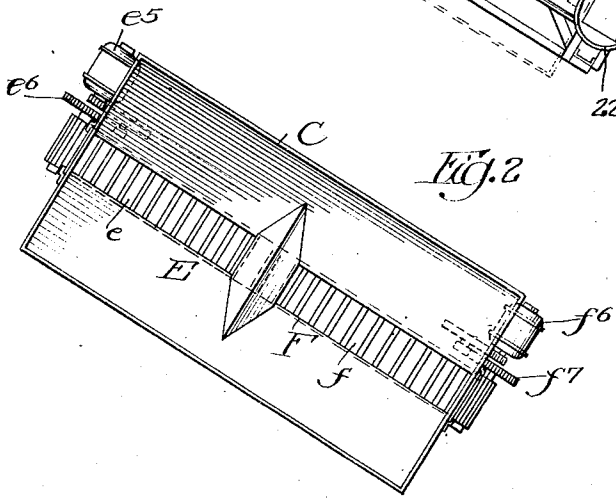


Fig. 2



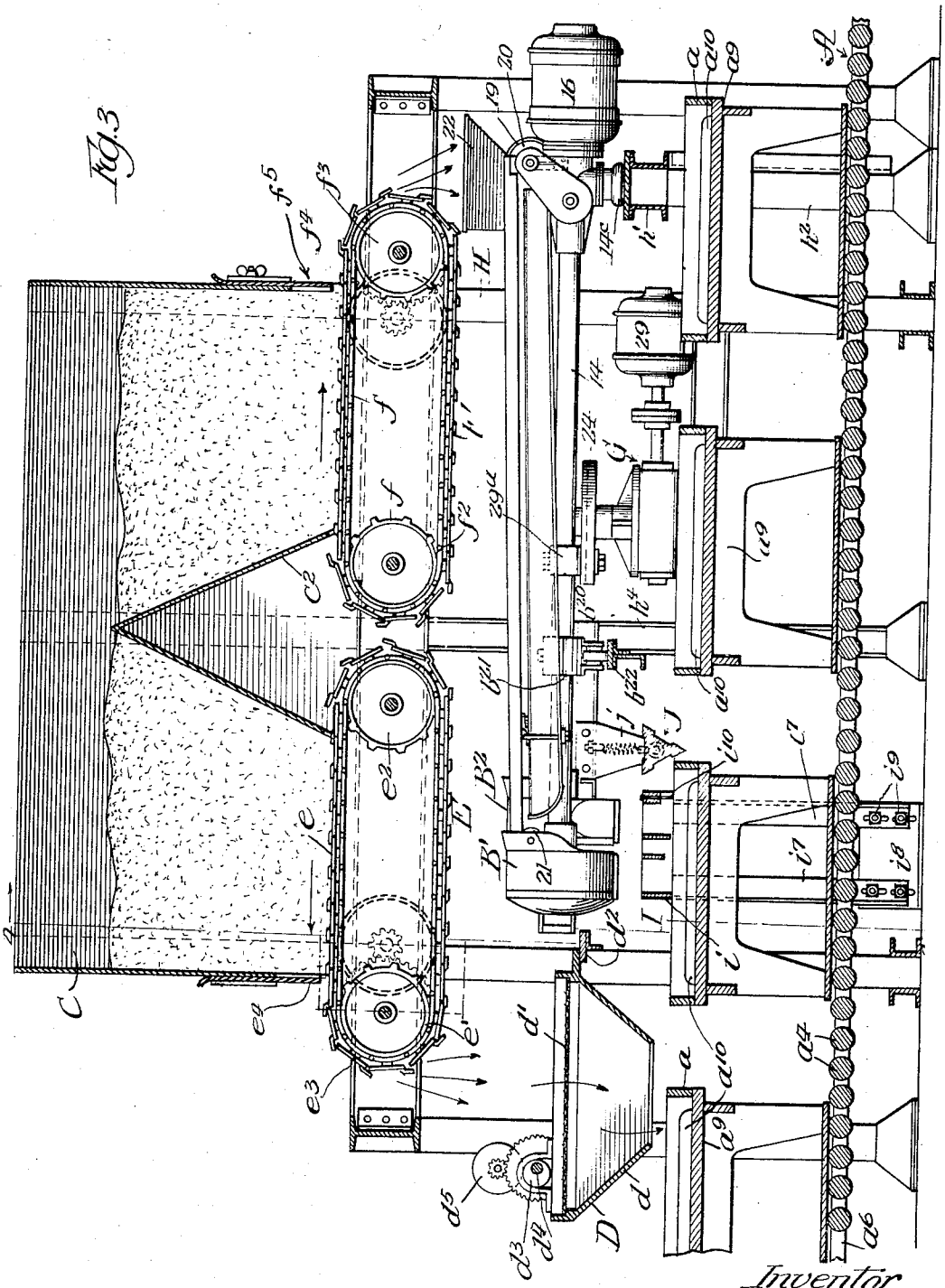
Inventor:
George Furman
By Fred Gulack
his Atty.

Dec. 22, 1931. G. FURMAN 1,837,320

MOLD FOR FOUNDING

Filed Sept. 20, 1929 5 Sheets-Sheet 2

Fig. 3



Inventor
George Furman
By Fred Gerlach Atty.

Dec. 22, 1931. G. FURMAN 1,837,320

MOLD FOR FOUNDING

Filed Sept. 20, 1929 5 Sheets-Sheet 3

Fig. 4.

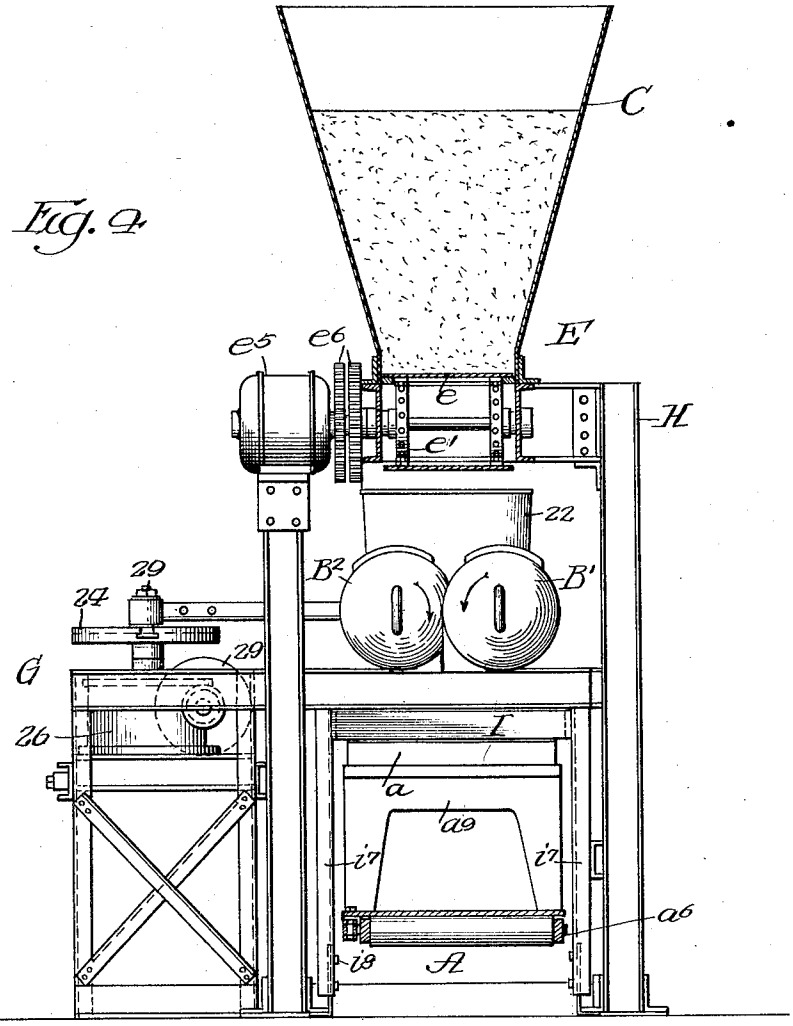


Fig. 6

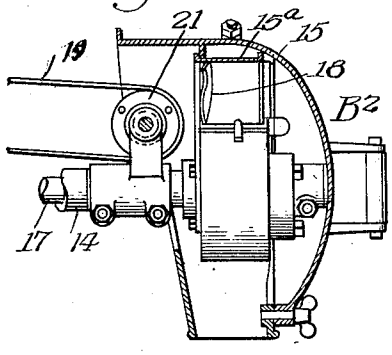
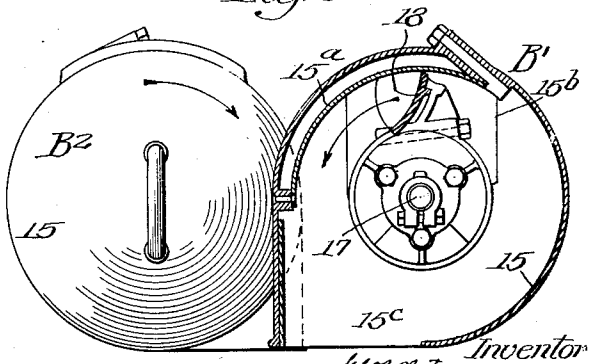


Fig. 5

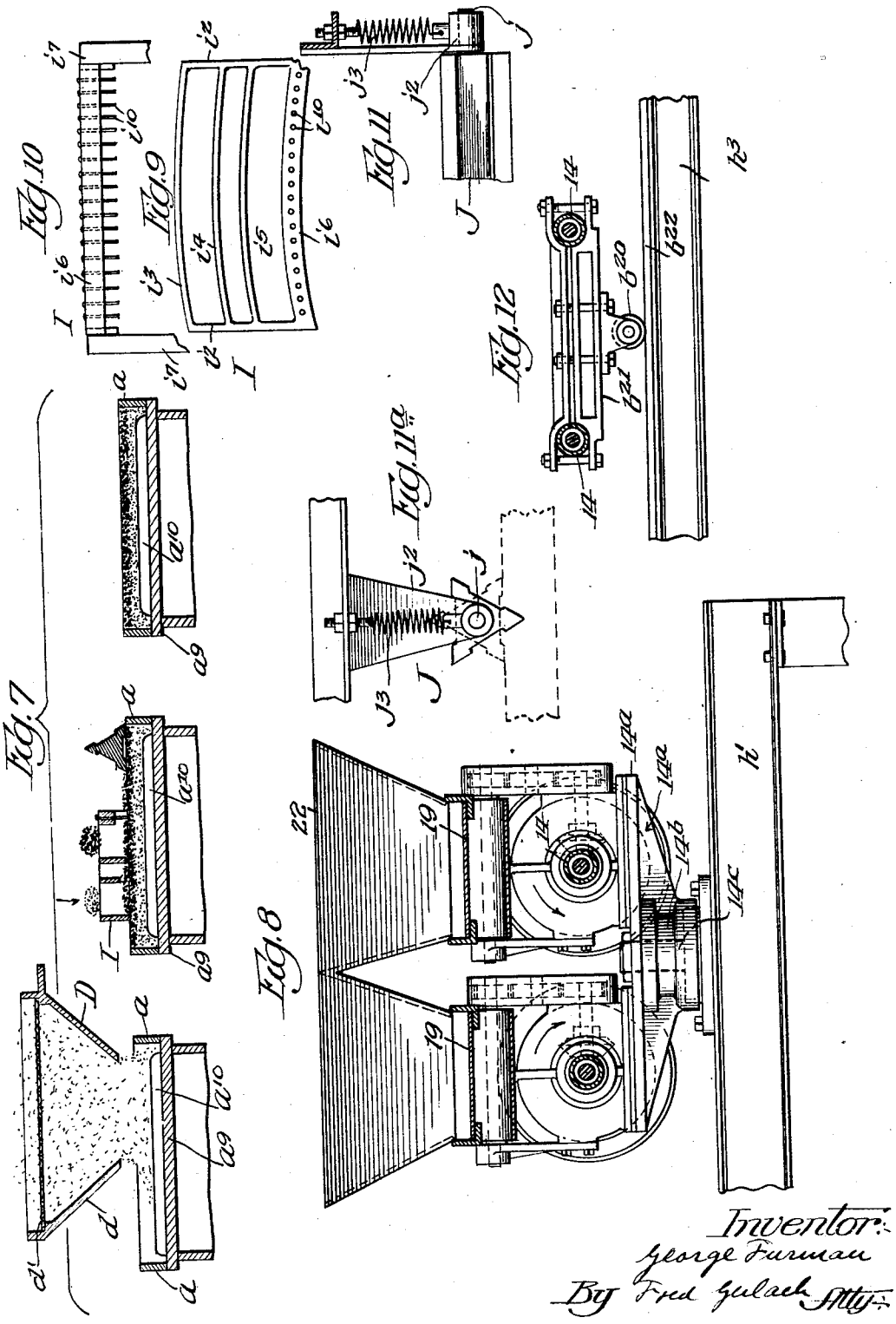


Inventor
George Furman
By Fred Gulack Atty

Dec. 22, 1931. G. FURMAN 1,837,320

MOLD FOR FOUNDING

Filed Sept. 20, 1929 5 Sheets-Sheet 4



Dec. 22, 1931. G. FURMAN 1,837,320

MOLD FOR FOUNDING

Filed Sept. 20, 1929 5 Sheets-Sheet 5

Fig. 13

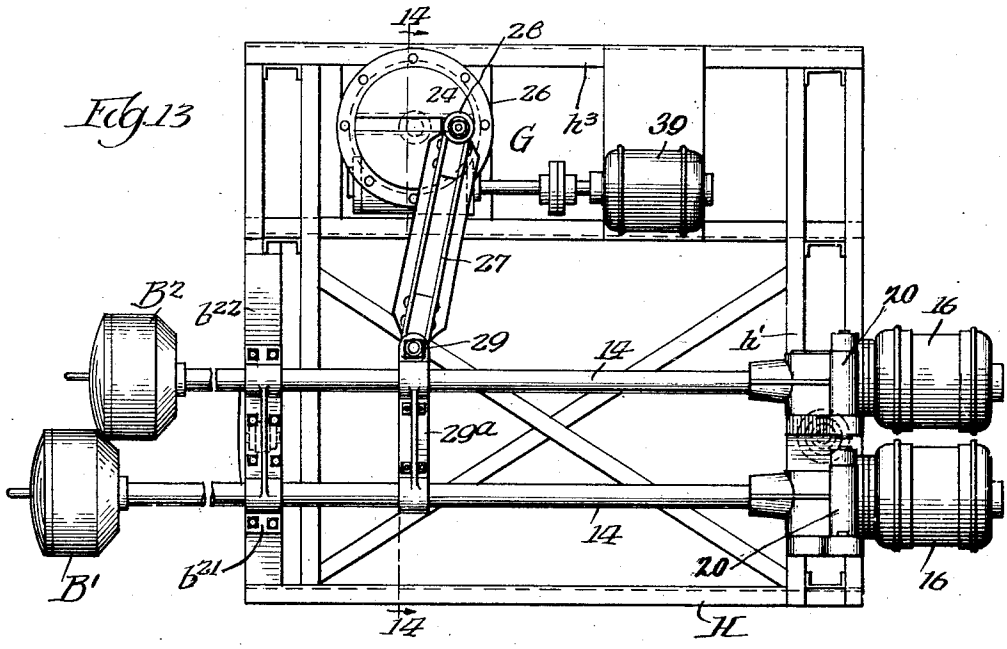


Fig. 14

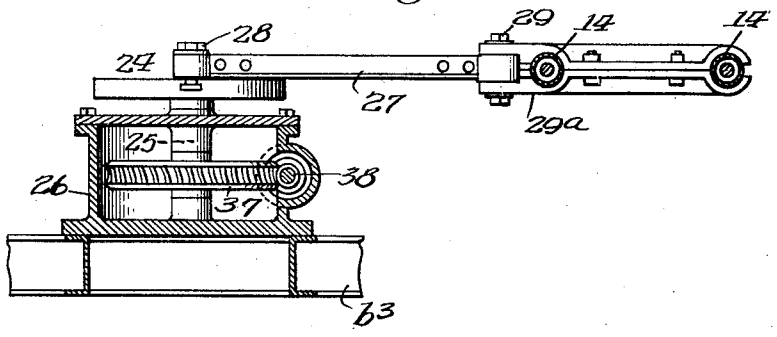
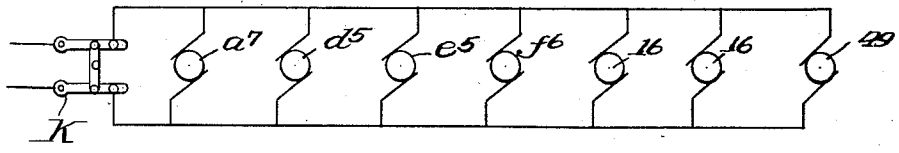


Fig. 15



Inventor
George Furman
By Fred Gerlach Atty.

Patented Dec. 22, 1931 1,837,320

UNITED STATES PATENT OFFICE

GEORGE FURMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE BEARDSLEY & PIPER COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

MOLD FOR FOUNDING

Application filed September 20, 1929. Serial No. 393,869.

The invention relates to making molds for founding.

The principal objects of the invention are to provide: a method and mechanism for slinging wads of sand into flasks, so the sand immediately adjacent the patterns will be packed with less density to permit expansion of the metal, and the sand at the outside of the flask will be more densely packed to prevent disintegration in handling the filled flasks; mechanism for slinging sand, by means of rotary high-speed projectors, into flasks so different zones will be packed in different densities; an improved method and machine for expediting the filling of the flasks and preventing wear on the patterns, by depositing loose sand on the patterns and then slinging wads of sand at a sufficiently high speed on top of the loose sand to pack the sand densely around the patterns; an improved automatically operating machine of the rotary projector type, performing all operations necessary in filling the flasks; and an improved machine with a plurality of rotary projectors for expediting the filling of molds on a travelling conveyor. Other objects of the invention will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by the appended claims.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views: Fig. 1 is a plan of a machine embodying the invention, the sand-feeding mechanism above the projectors being omitted. Fig. 2 is a plan of the mechanism for feeding sand to the rotary projectors of the machine. Fig. 3 is a side elevation, parts being shown in section. Fig. 4 is a section taken on the line 4—4 of Fig. 3. Figs. 5 and 6 are transverse and longitudinal sections, respectively, of one of the projectors. Fig. 7 is a diagram showing the method of packing sand in a flask. Fig. 8 is a section showing the pivotal mount for the projector-arms. Fig. 9 is a plan of the guide through which the wads of sand are projected. Fig. 10 is an end elevation of said guide. Figs. 11 and 11ª are details of the strike for levelling the sand on the top of the rammed flask. Fig. 12 is a detail of the support for the outer ends of the projector-arms. Fig. 13 is a plan of the mechanism for swinging the projectors horizontally. Fig. 14 is a section on line 14—14 of Fig. 13. Fig. 15 is a diagram of the electric-connections for controlling all of the various motors.

The invention is exemplified in a machine comprising an endless power-driven table-conveyor A for moving flasks a and pattern-frames a^9 at a uniform predetermined speed in a substantially horizontal plane; a tank C for holding a supply of sand for filling the flasks; a riddle D for delivering loose sand into the flasks; an endless power-driven apron-conveyor E for feeding sand in a regulated stream from tank C to riddle D; a pair of rotary projectors B′, B² mounted to oscillate transversely over the moving flasks; an endless power-driven apron-conveyor F for feeding sand in a regulated stream to a hopper 22 which is mounted to swing with the projectors and directs sand onto feed belts 19 for the projectors; power-driven mechanism G for swinging the projectors horizontally; and suitable frame-work H for supporting the several mechanisms of the machine.

Conveyor A comprises a sprocket-chain a', which travels around three sprocket-wheels a^2; plates a^5 secured to said chain and adapted to support frames a^9 on the top of which the flasks a are laid and patterns a^{10} are suitably mounted for withdrawal from the molds, rollers a^4 mounted in stationary frame-work a^6 and serving to support plates a^5; an electric motor a^7, and reduction gearing a^8 for driving one of the sprockets a^2 to operate continuously the conveyor. These sprockets and rollers are arranged to convey the plates a^5 in a trilateral course to provide a loading station A′, a filling station A², and an unloading station A³ for the flasks.

The flasks on the conveyor A pass under riddle D so they will be filled with loose

sand. This riddle is positioned over the conveyor A, and consists of a hopper d with a screen d' and an opening in its bottom so the sand will gravitate into the moving flasks on conveyor A. One end of this hopper is slidable on a bar d^2, and its other end is connected to an eccentric d^3 on a shaft d^4. An electric motor d^5, mounted on framework H, is connected to drive shaft d^4 and vibrate the riddle to cause the sand to pass through the screen d'.

Conveyor E, which feeds sand to riddle D, comprises an apron e of slats trained around pulleys e', e^2. The upper reach of this apron passes under an opening in the bottom of tank C and carries the sand through an end opening e^3 in the tank, and discharges it in a continuous stream into riddle D. A gate e^4 is slidably mounted on tank C to vary the effective area of the discharge opening e^3 and regulate the rate of flow of the sand to the riddle. An electric motor e^5, mounted on framework H, drives the conveyor E through suitable reduction gearing e^6, to supply the sand continuously to the riddle.

After the flasks have been filled with loose riddled sand, they successively pass under the projector B′ which slings wads of sand onto the loose sand to pack the latter around the patterns a^{10} in such a manner as to permit of expansion of the metal, and then under projector B^2 which is operated at a higher speed to sling wads of sand with sufficient force to pack more densely the top portion of the mold and form a relatively hard backing for the zone of sand around the pattern. Conveyor F, which feeds a stream of sand to the projectors, comprises an apron f of slats trained around an idler f^2 and a drive pulley f^3. The upper reach of apron f passes under an opening in the bottom of tank C and operates to carry a stream of sand through an end-opening f^4 in the tank and to discharge the sand into hopper 22 which directs the sand to the feed-belts 19 on the projector-arms. A gate f^5 is slidably mounted on the tank and serves to adjust the effective area of the discharge opening and regulate the rate of flow of sand to the projectors. An electric motor f^6, mounted on the framework H, drives apron f through reducing gearing f^7, to supply the sand continuously to the projectors. A deflector c^2, with downwardly divergent sides, distributes the sand in tank C to conveyors E and F.

Each projector comprises a casing 15, secured to the distal end of a tubular arm 14; a shaft 17, extending through the arm and into the casing; and a tangential blade 18 fixed to the shaft and coacting with an arcuate liner 15^a to pack sand entering the casing through an opening 15^b into wads and to project the wads downwardly through an opening 15^c. An electric motor 16, secured to the other end of arm 14, has its rotor secured to drive shaft 17. An endless belt 19 is mounted on each arm, extends around an idler 21 and a driven pulley 20 on the arm, and feeds a stream of sand from hopper 22 to the projector. Pulley 20 is driven from shaft 17 by enclosed gearing, as exemplified in Patent No. 1,408,493. The blades 18 of the two projectors B and B′ are disposed longitudinally of each other and driven in opposite direction, and openings 15^c are formed at the inner sides of the casings, so the wads from both projectors will be projected longitudinally of and in close proximity to each other and lodge on successively formed portions of the molds.

The motor for the projector B′ drives its projector-blade at a sufficient speed so the loose sand in the flask will be packed with the desired density around the pattern by the projected wads. A speed of 1200 revolutions per minute, with a blade having a radius of 8 inches, has been found suitable for this purpose. The motor for projector B^2 drives its blade at a higher speed to project wads with sufficient force to pack the top zone of sand with sufficient density to provide a relatively hard packing on the top of the packed sand previously packed around the pattern. In practice a speed of 1800 revolutions per minute with a blade having an 8 inch radius has been found to produce this result. This higher speed causes the wads to be densified to a greater degree by centrifugal force while in the projector casing, and causes them to be projected with greater force.

A box I with an open top and bottom is fixedly mounted over the flask-path and under the projectors, and comprises side-walls i^2, an end-wall i^3, cross-walls i^4, i^5, and an end-bar i^6. The lower edge of wall i^3 extends to the level of the top of the flask and strikes off all loose sand above that level, so there will be a uniform quantity of sand in the flasks when the wads are projected first into the flasks. The wads from projector B′ pass through the space between walls i^3, i^4, and these walls serve to prevent the scattering of the sand in the flasks by the wads. The wads from projector B^2 pass through the space between wall i^5 and bar i^6 which prevent scattering of the sand by said wads. Box I has legs i^7 which are secured to fixed plates i^8 by bolts and slot connections (not shown) so the box can be adjusted into operative relation with the tops of flasks of different heights. A series of teeth i^{10} in bar i^6 extend downwardly to the top level of the flasks, to loosen the packed excess sand above that level, so it can be removed by a strike J, which consists of a three-edged crossbar which has studs j pivoted in bearings j^2. A spring j^3 is applied to yieldingly hold the strike so its lower margin will be in the path of the front end of the flasks, so they will

rotate the strike until its rear edge will be at the top level of the flask, and remove all sand above said level from the flask. When the flask passes beyond the strike, spring j^3 will swing the strike to its normal position, in readiness for the succeeding flask.

Projectors B′, B^2 are mounted to swing transversely of the flask-path in order to traverse the entire width of the flasks and project wads into all portions of the flasks. For this purpose, the arms 14 of both projectors are fixed on a plate 14^a having a socket 14^b which is journalled on a vertical stud 14^c which is fixed to cross-beams h'. This pivot is adjacent the motors 16. Beams h' are supported above the flask-path by standards h^2, so the flasks and flask-conveyor will travel beneath the projectors. A roller b^{20} in a bracket b^{21}, secured to the projector-arms 14, travels on a track-plate b^{22} to support the outer or distal ends of the projector arms. Said plate b^{22} is fixed on a cross-beam h^3 supported by standards h^4. Mechanism for oscillating the projectors comprises a continuously rotating disk 24 on a shaft 25 which is journalled in a housing 26; a link 27 which is pivoted to a wrist-pin 28 on the disk, and, at 29, to a bracket 29^a which is clamped to both of the projector-arms 14; a worm-gear 37 fixed to shaft 25; a worm 38 meshing with gear 37; and an electric motor 39, to the shaft of which the worm is secured. Housing 26 is supported by a suitable framework h^3 at one side of the flask-conveyor. Wrist-pin 28 is slidably adjustable on disk 24 so the stroke of the projector-arms may be varied to correspond to the width of the flasks.

As shown in Fig. 15, motor a^7 which drives the conveyor A; motor d^5 which vibrates the riddle D, motor e^5 which drives conveyor e, motor f^6 which drives conveyor F, the projector motors 16, and the motor 39 for driving the projector oscillating mechanism are connected in parallel to a single electrical circuit which is controlled by a switch K. By shifting this switch, all of the driven mechanisms of the machine will be simultaneously started or stopped. This insures the necessary synchronization between the several mechanisms for properly filling the flasks.

The operation of the machine is as follows: To start the entire machine, the operator will close switch K, which will cause all the motors to operate. Empty flasks will be placed on the pattern frames a^9 on the conveyor A at the loading station A′ which will continuously convey them until they are removed at the unloading station A^3. The flasks will successively pass under riddle D and be filled with loose sand. This will prevent the wads of sand delivered at high speed by projector B′ from being impacted directly onto the patterns in the flasks to prevent the abrasion and cutting away of the patterns by the initial wads deposited into the flasks, and will also expedite the filling operation. As the flasks successively pass under box I, wall i^3 will strike or level off the loose sand in the flasks to the top level of the flasks, so that the volume of loose sand in the flasks will be uniform when they reach the projector B′. Next, the moving flasks pass under box I, and wads of sand from said projector will be projected onto the loose filling of sand in the flasks, and between walls i^3 and i^4. These wads will pack the loose sand around the patterns with the desired density for casting without being projected directly against the patterns. These walls will prevent the wads from displacing the loose sand. The lateral movement of the projector B′ imparted to it by the motor 39 will cause wads to be projected across the entire width of the moving flasks. Next, the moving flasks pass under the laterally moving projector B^2 which will project wads of sand with greater force between wall i^4 and bar i^5 and onto the packed bed of sand in the flasks, so it will be backed with sand of the density desirable to prevent disintegration of the molds in transporting and handling them to make the copes and drags. Next, the flasks pass under teeth i^{11} which will break up the sand packed above the level of the top of the flasks. Next, the front ends of the flasks will oscillate the strike J into position to scrape the sand above said level. As the flasks pass under said strike, the loose sand will be levelled off. The molds will then be finished with packed sand of one density around the pattern and a backing of greater density. At the unloading station A^3, the flasks with the molds will be lifted off the pattern frames a^9, so that said frames can be loaded again, when they reach the loading station.

The invention has been illustrated in connection with molds for radiator-castings, and is of especial advantage in making shallow molds, which can be produced by coordinating the movements of a laterally movable projector and continuously conveyed flasks, to fill all portions of the flasks.

The invention exemplifies a method of and mechanism for projecting wads of sand into flasks to produce molds with sand packed with different degrees of density; mechanism for successively filling flasks with loose sand and then densifying it around the patterns by projecting wads onto the loose sand to protect the patterns from abrasion by the wads and to expedite the filling of the flasks; an improved machine for continuously and expeditiously and completely forming shallow molds; and an improved machine adapted to produce a large output of molds.

The invention is not to be understood as restricted to the details set forth, since these

may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a molding machine, the combination of a rotary projector adapted to sling wads of sand into a flask, a second projector for slinging wads of sand onto the sand packed by the first projector, means for feeding sand to the projectors, means supporting both projectors for conjoint movement over the flask, and mechanism for driving the projectors.

2. In a molding machine, the combination of a rotary projector adapted to sling wads of sand into a flask, a second projector for slinging wads of sand onto the sand packed by the first projector, means for feeding sand to the projectors, means supporting both projectors for conjoint movement over the flask, driven mechanism for moving the projectors over the flask, and mechanism for driving the projectors.

3. In a molding machine, the combination of a rotary projector adapted to sling wads of sand into a flask, a second projector for slinging wads of sand onto the sand packed by the first projector, means for feeding sand to the projectors, and mechanisms for driving the projectors in opposite directions, so the wads from both projectors will be discharged at points close together.

4. In a molding machine, the combination of a rotary projector adapted to sling wads of sand into a flask, a second projector for slinging wads of sand onto the sand packed by the first projector, means for feeding sand to the projectors, pivotal supporting means whereby the projectors may be swung conjointly over the flasks, and mechanism for driving the projectors.

5. In a molding machine, the combination of a conveyor for flasks, a rotary projector adapted to sling wads of sand into flasks on the conveyor, a second rotary projector to which the conveyor successively delivers the flasks, adapted to be driven simultaneously with the first projector and to sling wads of sand onto the sand packed by said first projector, means for feeding sand to the projectors, mechanisms for driving the projectors, means to support the projectors pivotally so that they are free to swing laterally over the flasks on the conveyor, mechanism for automatically swinging the projectors laterally, and mechanism for driving the conveyor to pass the flasks successively under the projectors.

6. In a molding machine, the combination of a rotary projector adapted to sling wads of sand into a flask, a second projector for slinging wads onto the sand packed by the first projectors, means between the projector and the flask to confine sand in the flask against displacement by the wads, means for feeding sand to the projectors, and mechanism for driving the projectors.

7. In a molding machine, the combination of a conveyor for flasks, a rotary projector adapted to sling wads of sand into flasks on the conveyor, a second rotary projector to which the conveyor successively delivers the flasks, adapted to sling wads of sand onto the sand packed by the first projector, means for feeding sand to the projectors, mechanisms for driving the projectors, means to support the projectors for lateral movement over the flasks and transversely to the movement of the conveyor, walls over the flasks and under the projectors, between which the wads are projected, and mechanism for driving the conveyor to successively pass the flasks under the projectors.

8. In a molding machine, the combination of a plurality of projectors adapted to sling wads of sand into a flask to pack the sand in relatively different densities, means for feeding sand to the projectors, and mechanism for driving the projectors.

9. In a molding machine, the combination of a plurality of projectors adapted to sling wads of sand into a flask to pack the sand in relatively different densities, means for feeding sand to the projectors, means to support the projectors for lateral movement over the flask, and mechanism for driving the projectors.

10. In a molding machine, the combination of a plurality of projectors adapted to sling wads of sand into a flask to pack the sand in relatively different densities, means for feeding sand to the projectors, means to support the projectors for lateral movement over the flask, mechanism for automatically shifting the projectors laterally over the flask, and mechanism for driving the projectors.

11. In a molding machine, the combination of a rotary projector for slinging wads of sand into a flask, a second projector for slinging wads onto the sand rammed by the first projector, means for feeding sand to the projectors, and means for driving the projectors at relatively different speeds, to ram the sand in different densities.

12. In a molding machine, the combination of a plurality of projectors adapted to sling wads of sand into a flask to pack the sand in relatively different densities, means for feeding sand to the projectors, and mechanism for driving the projectors, in opposite directions so that wads will be discharged at points close together.

13. In a molding machine, the combination of a conveyor for flasks, a plurality of projectors adapted successively to sling wads of sand into the flasks on the conveyor, and to ram the sand in relatively different densities, means for feeding sand to the projectors, and mechanism for driving the projectors.

14. In a molding machine, the combination of a conveyor for flasks, a plurality of projectors movable laterally over the flasks on the conveyor, and adapted successively to sling wads of sand into the flasks on the conveyor, and to ram the sand in relatively different densities, means for feeding sand to the projectors, and mechanism for driving the projectors.

15. In a molding machine, the combination of a conveyor for flasks, a plurality of projectors movable laterally over the flasks on the conveyor and adapted successively to sling wads of sand into the flasks on the conveyor, and to ram the sand in relatively different densities, mechanism for laterally shifting the projectors, means for feeding sand to the projectors, and mechanism for driving the projectors.

16. In a molding machine, the combination of a conveyor for flasks, a plurality of projectors, adapted successively to sling wads of sand into the flasks on the conveyor, and to ram the sand in relatively different densities, mechanism for driving the conveyor, mechanism for shifting the projector, means for feeding sand to the projectors, and mechanism for driving the projectors.

17. In a molding machine, the combination of a conveyor for flasks, a rotary projector to which the flasks are first conveyed, adapted to sling wads of, and ram, the sand into the flasks, a second projector to which the flasks are thereafter conveyed, adapted to sling wads into the previously rammed sand, and to pack the sand with greater density, means for feeding sand to the projectors, and mechanism for driving the projectors.

18. In a molding machine, the combination of a conveyor for flasks, a rotary projector to which the flasks are first conveyed, adapted to sling wads of, and ram, the sand into the flasks, a second projector to which the flasks are thereafter conveyed, adapted to sling wads onto the previously rammed sand, and to pack the sand with greater density, means for feeding sand to the projectors, said projectors being laterally movable, mechanism for laterally shifting the projectors, mechanism for driving the conveyor, and mechanism for driving the projectors.

19. In a molding machine, the combination of a conveyor for flasks, a rotary projector to which the flasks are first conveyed, adapted to sling wads of, and ram, the sand into the flasks, a second projector to which the flasks are thereafter conveyed adapted to sling wads onto the previously rammed sand, and to pack the sand with greater density, means for feeding sand to the projectors, and mechanism for driving the projectors in opposite directions and at relatively different speeds.

20. In a molding machine, the combination of a driven conveyor for flasks, a riddle for delivering loose sand onto patterns in the flasks on the conveyor, a rotary projector to which the flasks containing loose sand are conveyed for slinging wads onto the loose sand to ram it around the pattern, a second projector to which the flasks with rammed sand are conveyed for slinging wads onto the rammed sand in the flasks, means for delivering sand to the riddle and the projectors, and mechanism for driving the projectors.

21. In a molding machine, the combination of a driven conveyor for flasks, a riddle for delivering loose sand onto patterns in the flasks on the conveyor, a rotary projector to which the flasks containing loose sand are conveyed for slinging wads onto the loose sand to ram it around the pattern, a second projector to which the flasks with rammed sand are conveyed, for slinging wads onto the rammed sand in the flasks, and ramming the sand on the top of the flask to greater density, means for delivering sand to the riddle and the projectors, and mechanism for driving the projectors.

22. In a molding machine, the combination of a driven conveyor for flasks, a riddle for delivering loose sand onto patterns in the flasks on the conveyor, a rotary projector to which the flasks containing loose sand are conveyed, for slinging wads onto the loose sand to ram it around the pattern, means over the flask to confine the sand in the flask against displacement by the wads, means for delivering sand to the riddle and to the projector, and mechanism for driving the projector.

23. In a molding machine, the combination of a driven conveyor for flasks, a riddle for delivering loose sand onto patterns in the flasks on the conveyor, a rotary projector to which the flasks containing loose sand are conveyed for slinging wads onto the loose sand to ram it around the pattern, a second projector to which the flasks with rammed sand are conveyed, for slinging wads onto the rammed sand in the flasks, means over the flask to confine the sand in the flask against displacement by the wads, means for delivering said to the riddle and the projectors, and mechanism for driving the projectors.

24. That improvement in making molds, which consists in covering the patterns in flasks with loose sand, then projecting wads of sand onto the loose sand, to ram it around the pattern and then projecting wads onto the previously rammed sand to ram the top of the flask with greater density.

25. That improvement in making molds which consists in covering the patterns in flasks with loose sand, then projecting wads of sand at a given velocity onto the loose sand to ram it around the pattern, and then projecting wads at a higher speed onto the previously rammed sand.

26. That improvement in making molds which consists in simultaneously slinging wads of sand at relatively different velocities to ram with different densities in successively formed portions of the mold.

27. That improvement in making molds which consists in slinging wads of sand at one velocity to ram one portion of a mold and simultaneously slinging wads of sand at a greater velocity onto the previously rammed sand.

28. In a molding machine, the combination of a driven conveyor for flasks, a riddle for delivering loose sand onto patterns in the flasks on the conveyor, a rotary projector to which the flasks containing loose sand are conveyed, mounted to move laterally over the flasks on the conveyor, and for slinging wads onto the loose sand to ram it around the pattern, means to level off the loose sand in the flasks while in transit to the projector, means for delivering sand to the riddle and to the projector, and mechanism for driving the projector.

29. In a molding machine, the combination of a conveyor for flasks, a tank for a supply of sand, a riddle for delivering sand into flasks on the conveyor, a driven apron-conveyor for feeding sand from one end of the tank to the riddle, a projector for slinging wads of sand into the flasks, mechanism comprising a driven apron-conveyor for feeding sand from the other end of the tank to the projector, said tank being disposed above the projector and the riddle, and driving mechanisms for the flask-conveyor and the projector.

30. In a molding machine, the combination of a pair of sand projectors, each comprising a projector-blade, a supporting arm, a motor at one end of the arm, and a sand-conveyor on the arm, said arms being secured together, a pivotal support on which both arms can swing laterally, one of said blades being mounted to rotate longitudinally of the other.

31. In a molding machine, the combination of a pair of sand projectors, each comprising a projector-blade, a supporting arm, a motor at one end of the arm, and a sand conveyor on the arm, said arms being secured together, a pivotal support on which both arms can swing laterally, one of said blades being mounted to rotate longitudinally of the other, the motors being adapted to drive the blades in opposite directions.

32. In a molding machine, the combination of a pair of sand projectors, each comprising a projector-blade, a supporting arm, a motor at one end of the arm, and a sand conveyor on the arm, said arms being secured together, a pivotal support on which both arms can swing laterally, one of said blades being mounted to rotate longitudinally of the other, and power-driven mechanism for swinging said arms.

33. In a molding machine, the combination of a pair of sand projectors, each comprising a projector-blade, a supporting arm, a motor at one end of the arm, and a sand conveyor on the arm, said arms being secured together, a pivotal support on which both arms can swing laterally, one of said blades being mounted to rotate longitudinally of the other, and a transverse track on which the arms are supported, adjacent the blades.

Signed at Chicago, Illinois, this 13th day of September, 1929.

GEORGE FURMAN.