

E. O. BEARDSLEY AND W. F. PIPER.

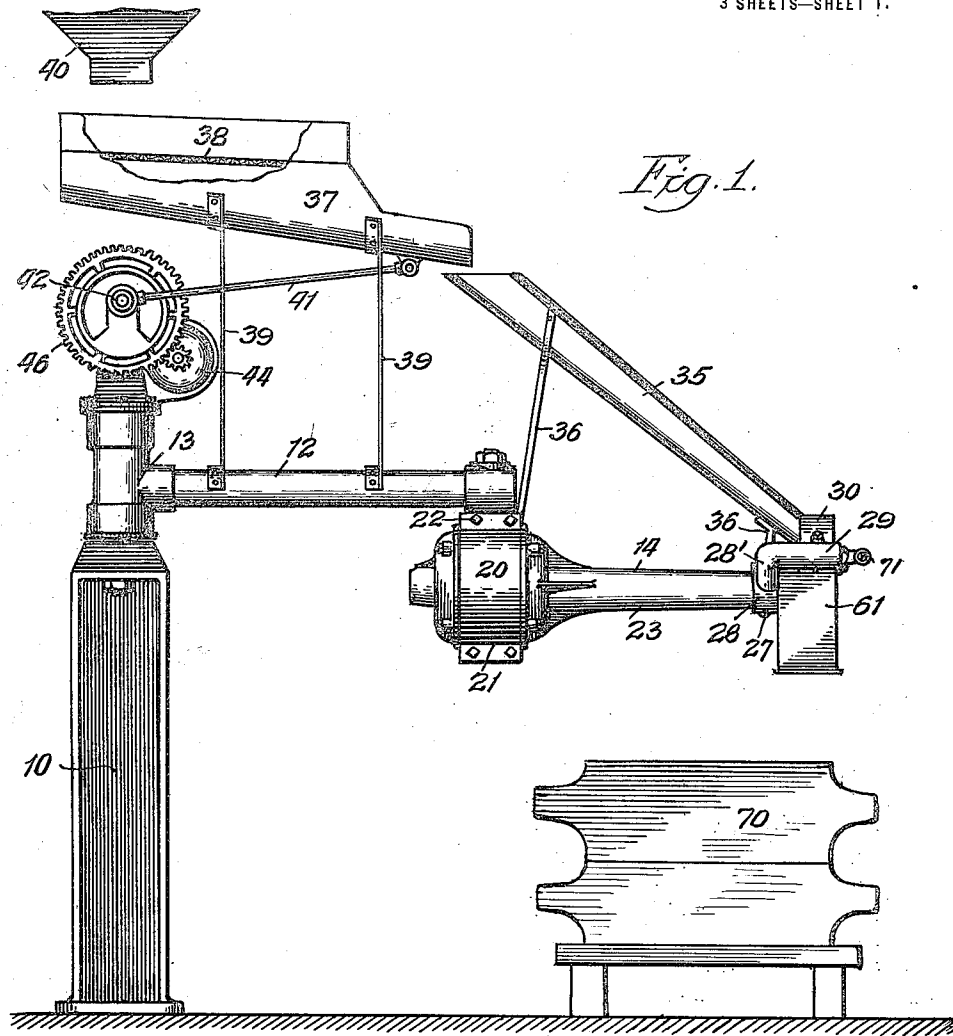
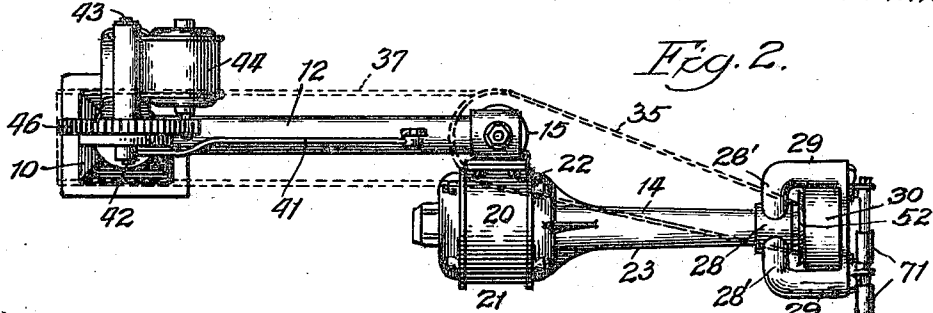
MOLDING APPARATUS.

APPLICATION FILED JAN. 27, 1919.

1,309,833.

Patented July 15, 1919.

3 SHEETS—SHEET 1.



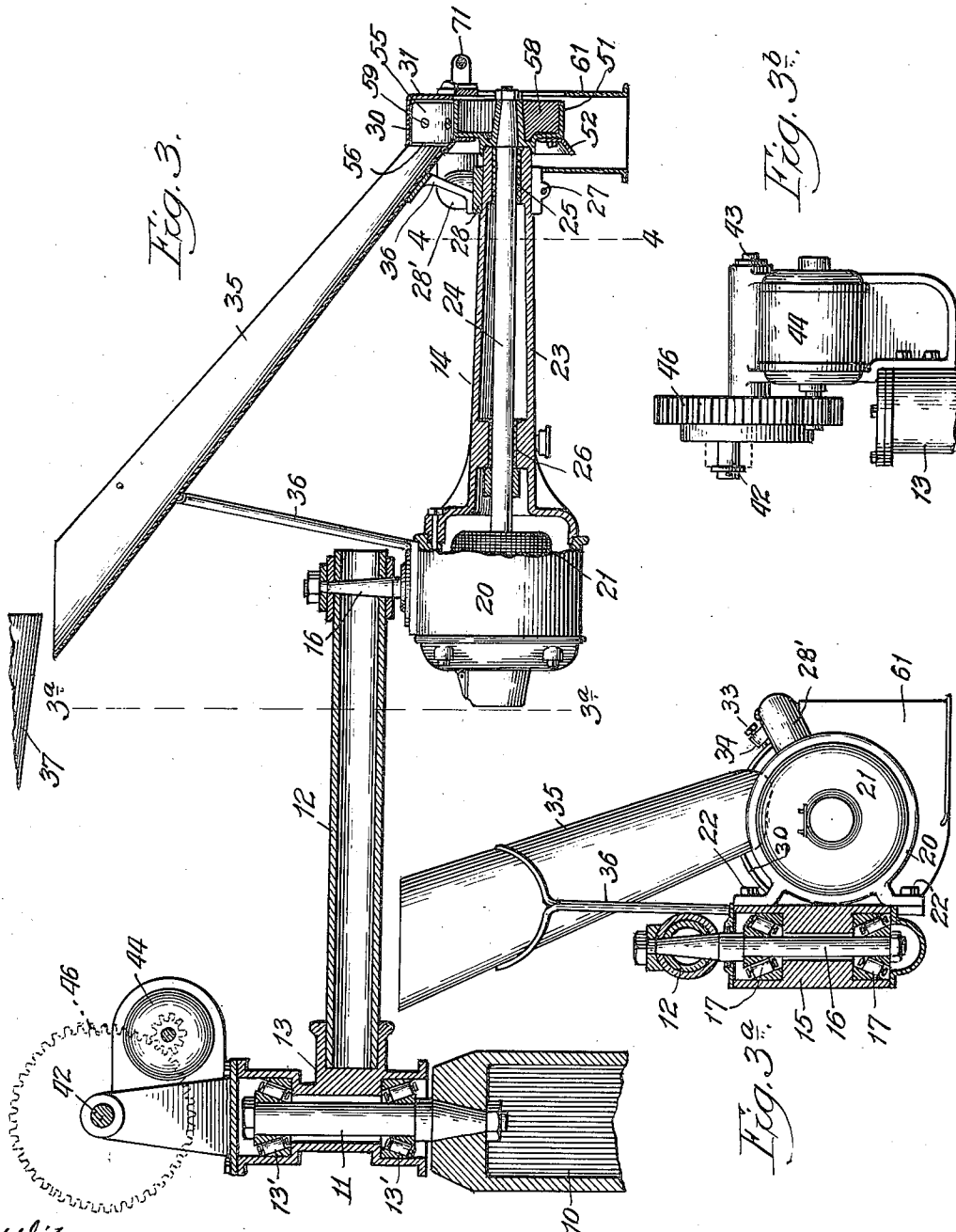
Witness:
John Enders

Inventors:
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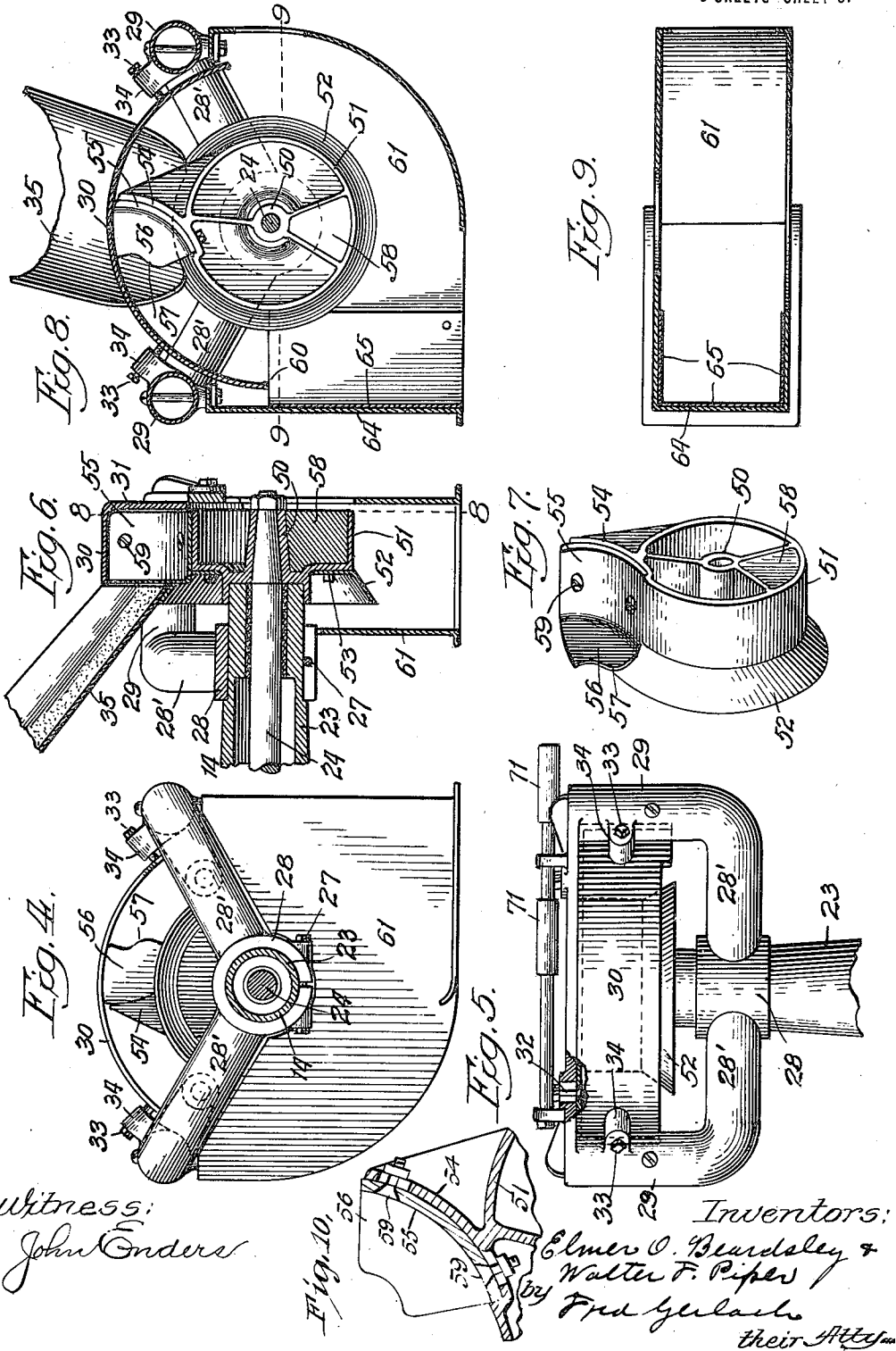
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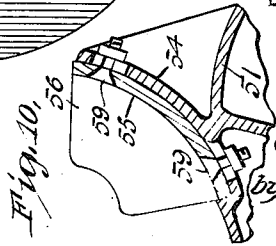
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Witness:
John Anders



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UNITED STATES PATENT OFFICE.

ELMER O. BEARDSLEY, OF CHICAGO, AND WALTER F. PIPER, OF OAK PARK, ILLINOIS.

MOLDING APPARATUS.

1,309,833.

Specification of Letters Patent. Patented July 15, 1919.

Application filed January 27, 1919. Serial No. 273,265.

To all whom it may concern:

Be it known that we, ELMER O. BEARDSLEY and WALTER F. PIPER, both citizens of the United States, and residents of Chicago, in the county of Cook and State of Illinois, and Oak Park, in the county of Cook and State of Illinois, respectively, have invented certain new and useful Improvements in Molding Apparatus, of which the following is a full, clear, and exact description.

The invention relates to molding apparatus and more particularly to that type in which the sand or mold material is forcibly projected into a mold.

In apparatus of this type, in which a ramming head was employed, it has been customary to deliver or feed the sand to the periphery of the rotor. In giving to the sand the high velocity which has been found necessary to form good and efficient molds expeditiously, the centrifugal force of the rotor interfered with the feed of the sand to the rotor and this was not conducive to the formation of good and efficient molds. In practice, we have discovered that a very high velocity in the projected sand, ranging from approximately 4000 to 8000 feet per minute, results in forming good molds for different metals, such as gray iron and steel, and when the rotor is operated at a corresponding speed, feeding of the sand to the periphery of the rotor was deficient.

One object of the invention is to provide an improved apparatus which is adapted for operation with a high-speed rotor for efficient and rapid mold-making and in which the sand will be regularly fed to the rotor to produce a mold of even density.

A further object of the invention is to provide improved apparatus in which the casing or stator which coöperates with the rotor is open as much as possible, so that the likelihood of injury to the head by pieces of castings or other material in the sand will be minimized and so as to minimize atmospheric resistance to the movement of the rotor, which is of importance when the rotor is driven at a high rate of speed.

Another object of the invention is to provide an improved apparatus of this type which can be operated to produce molds economically.

Another object of the invention is to provide a molding machine in which the rotor for projecting the sand is operated directly

from a motor, to simplify the structure and to dispense with exposed driving connections between the rotor and the motor.

Another object of the invention is to provide improved molding apparatus in which the movable support for the ramming head is such that a light construction can be utilized, it being desirable to avoid excessive weight, so that the ramming head can be moved laterally by the operator with the greatest ease and facility.

Another object of the invention is to provide an improved form of blade on the rotor, which, when operated at a high speed, will cause the sand to be packed in wads between the point where the sand passes onto the rotor and the point where it is discharged or projected therefrom.

Another object of the invention is to provide an improved form of rotor-blade in which there is a wall which acts as a cut-off between the sand-supply and the rotor, to render the feed uniform in quantity and to prevent the rotor from spattering the sand at its point of entry into the ramming head or onto the rotor.

Other objects of the invention will appear from the specification.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings: Figure 1 is a side elevation of molding apparatus embodying the invention. Fig. 2 is a plan. Fig. 3 is a vertical longitudinal section. Fig. 3^a is a section taken on line 3^a—3^a of Fig. 3. Fig. 3^b is a detail of the operating mechanism for the vibratory conveyer and riddle. Fig. 4 is a section taken on line 4—4 of Fig. 3. Fig. 5 is a plan of the ramming head. Fig. 6 is a vertical axial section of the ramming head. Fig. 7 is a perspective of the rotor. Fig. 8 is a section taken on line 8—8 of Fig. 6. Fig. 9 is a section through the protective housing taken on line 9—9 of Fig. 8. Fig. 10 is a detail of the adjustable connection between the projector blade and its support.

The invention is illustrated as embodied in a machine comprising a mast 10 which is provided with a post 11 at its upper end on which is journaled for horizontal rotation a tubular jib 12 which has a socket 13 around the standard 11. Anti-friction bearings 13^a are provided between post 11 and socket 13

to permit easy movement of the jib. An arm 14 is pivoted to the distal end of the jib so that it and the ramming head sustained thereby can be swung horizontally, relatively to the jib. The pivotal connection between the arm and the jib consists of a hollow bracket 15 and a post 16 which is fixed to the jib 12 and mounted in anti-friction bearings 17 in said bracket. This form of connection makes it possible to locate the arm immediately beneath or close to the jib. The body or casing 20 of an electric motor 21 is bolted, as at 22, to one side of the bracket 15, and arm 14 comprises a hollow sleeve 23 which is bolted to one side of the motor-casing 20 and supports the ramming head and serves also as an inclosure for the shaft 24 which extends between the electric motor 21 and the rotor of the ramming head. This shaft is mounted in a bearing 25 in the outer end of the sleeve 23 and a bearing 26 adjacent the inner end of the sleeve. The rotor for the sand for filling the molds is fixed to the outer end of shaft 24.

A yoke comprising a hub 28 which is fixed and clamped, as at 27, to the sleeve 23, and arms 28' which have outwardly extending members 29 supports the casing or stator of the ramming head. The casing comprises an arcuate or peripheral wall 30 and an integral outer side wall 31. The inner side of the casing or stator is open. This casing is secured to the yoke by bolt-and-slot connections 32 and set-screws 33 which are threaded to lugs 34. These bolt-and-slot-and-screw-connections permit the casing to be adjusted to compensate for wear or other irregularity, so that the rotor will fit truly against its inner periphery, which is desirable for efficiency in ramming the sand.

A conveyer chute 37 containing a suitable sieve or riddle 38 is supported from the jib 12 by resilient bars 39 which have their ends respectively secured to the jib and to the chute. The inner end of chute 37 is adapted to receive sand from a suitable source of supply, such as a hopper 40 to which sand will be fed in any desired manner. The outer end of chute 37 discharges into the upper open end of an inclined chute 35 which is fixedly mounted on the arm 14, and is supported by bars 36 so that the relation between the arm, chute 35 and the ramming head remains fixed. The upper end of the chute 35 and the outer end of the chute 37 are disposed adjacent the axis about which the arm 14 swings, so that the relative movement of the chutes will maintain the discharge into the chute 35. The chute 37 and the riddle therein are vibrated by a pitman 41 which is pivoted to chute 37 and is operatively connected to an eccentric or wrist-pin 42 on a shaft 43 which is journaled in a bracket fixed to the upper end of the socket 13. An electric motor 44 is

also mounted on said bracket and a pinion on the shaft of said motor meshes with a gear 46 which operates the shaft 43 and eccentric 42. This mechanism serves to shake the chute 37 and the riddle to cause it to disintegrate the sand and to discharge it regularly and continuously into the upper end of the chute 35 which is inclined sufficiently to cause the sand to flow lengthwise thereof and be discharged into the ramming head continuously by gravity. This construction exemplifies mechanism for feeding sand to the ramming head in which the chute on the outer arm is rigid therewith, so that no shaking mechanism for said chute is necessary.

A characteristic of the present invention is that the sand is delivered to the inner side of the casing or rotor in lieu of the periphery of the rotor, and for this purpose the lower end of the feed chute 35 is extended to deliver the sand to the inner side of the rotor or casing.

The chute 35, as more clearly seen in Figs. 6 and 8, discharges into the open side of the ramming head. An important characteristic of this is that the centrifugal force has a tendency to suck the sand into the ramming head instead of spattering it outwardly by centrifugal force, as occurs when the sand is delivered to the periphery of the rotor. The rotor is adapted to receive the sand at the open side of the head and to project it downwardly into the mold. The rotor comprises a hub 50 and a cylindrical body 51, integral with the hub and secured to shaft 24, an inclined guide-flange 52 which is flared inwardly from the periphery of the inner side of the cylindrical body 51 and directs the sand onto the body 51. For lightness, the body of the rotor is formed of light metal such as aluminum. The guide flange 52 is formed as a ring and is bolted to said body, as at 53. A curved outwardly extending bed 54 integral with the rotor-body, is adapted to support the projector blade 55. Said blade is curved to fit the bed 54 and is provided with an inner side wall 56 which has a curved edge 57 and is adapted to function as a positive shear blade for the sand, so that as the rotor is revolving, the wall 56 will shear a portion of the sand issuing from the lower end of the chute from the sand in the chute. The rotor is counterweighted, as at 58, to balance the projector blade and its bed 54 and cause the rotor to run evenly at a very high speed. Screws 59 extend through slots (Fig. 10) in the bed 54 to permit the projector-blade to be adjusted toward the arcuate wall of the stator to compensate for wear. When the rotor is operated at a high speed, its curved base and centrifugal force cause the wad of sand which has been separated from the supply in the chute 35 to

wedge and impact itself in the corner between the outer end of the plate and arcuate wall 30 of the casing, as shown in Fig. 8, so that before the wad reaches the point of discharge, at 60, it will have been densified and packed into a proper mass for projection into the mold. This construction of ramming head is peculiarly adapted for high speed operation, such as has been found necessary to form good molds.

A protective housing 61, which is out of contact with the rotor, is suspended from the extensions 29 of the supporting yoke. In the operation of these machines, it is desirable to have the head as open as possible to avoid atmospheric resistance to the high speed rotor and to have as short and rapid an operative stroke of the rammer blade as possible, since otherwise excessive power would be necessary to operate the rotor. For this purpose, the inner side of the stator is open and the wall 30 of the stator or casing begins at a point which is reached by the projector-blade shortly before it reaches the incoming sand stream from chute 35 and terminates at 60, where the wad will be discharged truly downward into the mold. If that portion of the housing adjacent the discharge point is substantially aligned with the casing where the wad is released, great wear occurs and this is measurably overcome by offsetting the wall 64 of the protective housing, so that it will be disposed in offset relation with respect to the discharge point 60. A three sided wear-plate 65 is secured in the housing. A handle 71 is secured to the ramming head, whereby the operator can easily move the head laterally to distribute the projected sand to all portions of the mold.

In the operation of the machine, the flask 70 is placed beneath and within range of movement of the ramming head and approximately about a foot below the lower end of the head. In making molds for gray-iron castings, the apparatus is constructed to operate at a sufficient speed to impart movement to the projector blade and the wads of sand in the ramming head at the rate of approximately 4000 feet per minute and sand is supplied to the head at the rate of approximately seven cubic feet per minute. In making molds for steel castings, the delivery of sand will be at the rate of about 10 cubic feet per minute and the apparatus will be adapted to operate the rotor and move the wads of sand at approximately 8000 feet per minute or over.

The delivery of the sand from the chute 35 is substantially continuous, but the rotor moving at high speed is operated so rapidly that the continuous stream will be sharply divided or sheared into wads by the side wall of the projector blade. The wads will be rotated a short distance by the rotor and

projected downwardly in rapid succession (approximately 1140 wads per minute in making molds for gray-iron castings) into the flask. The sand will be compacted by centrifugal force and the action of the curved blade will tend to force the sand toward the arcuate wall of the casing while it is on the projector blade and in transit between the delivery and discharge points of the stator. The operation of this apparatus at the high speed indicated has been found, in practice, to produce good molds very rapidly. When the rotor reaches the discharge terminal 60 of the stator, the wads of sand will be released and will be projected downwardly into the flask. The wear-plate 65 in the housing assists in guiding the sand downwardly toward the mold.

As a result of delivering the sand to the side of the rotor as contradistinguished from its periphery and using a blade or wall for sharply severing or transversely shearing the sand in the head from that in the feed-chute, the sand will be fed to the ramming-head regularly and evenly to form wads which are adapted for projection into the mold. The sand, while the rotor is revolving at high speed, is not spattered by the projector-blade, and by avoiding this spattering, regular and even delivery of the sand necessary to form good molds is attained.

A characteristic of supporting the ramming head by a jib and arm which are pivotally connected so as to permit only lateral movement, and which permit the ramming head to be moved laterally to discharge the sand into all portions of the flask, is that the angle of delivery of the sand into the flask is not varied by the movement of the ramming head to fill all parts of the flask. In practice, it has been found that the most efficient angle of delivery is substantially vertical when the flask is horizontal, because at such angle of delivery, the wads will successively pack in or build up the mold with the least displacement of the previously delivered sand in the mold. When the angle of delivery is substantially obtuse or acute with respect to the plane of the mold, the wads of sand, when projected into the flask at high speed, will tend to displace and disrupt the sand which has been previously delivered into the mold.

A result of supporting the motor for driving the rotor at one side of the pivotal connection between the jib and the arm is that the chute 35, which extends from a point which is substantially aligned with the pivot between the jib and arm to a point centrally and vertically aligned with the rotor shaft, is inclined laterally relatively to the axis of the rotor. This inclination causes the sand to be delivered laterally in a direction oblique to the axis of the rotor and in the di-

rection in which the rotor is moving, and this delivery aids in avoiding spattering of the sand by the rotor.

A resultant characteristic of providing a stator which is open as much as possible is that the atmospheric resistance which would retard the rotor, particularly when operated at high speed, is minimized, and furthermore, the open sided stator provides an exit for scrap or other matter which is frequently found in molding sand.

As the result of providing a shaft directly connecting the motor and the rotor of the ramming head, it is possible to use a swinging arm which is light in weight, and by reducing the weight of the mechanism on the arm, the movement of the ramming head by the operator is greatly facilitated.

As the result of employing a sleeve for supporting the ramming head, there is no exposed running connection between the ramming head and the motor.

The invention exemplifies a molding machine which is particularly adapted for high speed projection of the sand or molding material and in which provision is made for overcoming heretofore existent difficulties in feeding the sand in desired volume to a high speed rotor. The invention also exemplifies a rotor which is constructed to compact the sand into wads while the sand is in transit through the head. The invention also exemplifies a construction in which the rammer head can be moved with ease and facility to form and compact all portions of a mold without varying the angle of the delivery of the sand. The invention also exemplifies a rotor which is directly driven by a motor on the supporting arm for the ramming head so that gearing between the motor and the ramming head is dispensed with and in which the support for the rammer head serves as an inclosure for the combined motor and rotor shaft. The invention also exemplifies a machine in which the feed chute for delivering sand to the ramming head is fixed on the swinging arm so that the necessity of providing shaking mechanism on the arm is avoided.

The invention also exemplifies a structure which is adapted to be manually manipulated over a flask to form all portions of a mold, by an operator standing at the end of the arm and adjacent the projector and flask.

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 we claim as new and desire to secure by Letters Patent, is:

1. In a molding machine, the combination

of a ramming head comprising a rotor, mechanism for driving the rotor, and means for feeding mold material to one side of the rotor.

2. In a molding machine, the combination of a ramming head comprising a rotor, mechanism for driving the rotor, and means for feeding mold material in a direction longitudinally of the axis of and to one side of the rotor.

3. In a molding machine, the combination of a ramming head comprising a stator and a rotor, mechanism for driving the rotor, and means for feeding mold material in a direction longitudinally of the axis of and to one side of the rotor.

4. In a molding machine, the combination of a ramming head comprising a stator and a rotor, mechanism for driving the rotor, and means for feeding mold material in a direction longitudinally of and obliquely to the axis of and to one side of the rotor.

5. In a molding machine, the combination of a ramming head comprising a rotor, mechanism for driving the rotor, and a chute disposed to feed mold-material by gravity and having its discharge terminal disposed to deliver the material to one side of the rotor.

6. In a molding machine, the combination of a ramming head comprising a rotor and a stator, mechanism for driving the rotor, and a chute disposed to feed mold-material by gravity and having its discharge terminal disposed to deliver the material to one side of the rotor.

7. In a molding machine, the combination of a ramming head comprising a rotor, means for feeding mold-material to the rotor, means for driving the rotor, and a blade on the rotor extended in the plane of rotation for shearing the material in the path of the rotor from that in the feed-means.

8. In a molding machine, the combination of a ramming head comprising a rotor, a device for delivering mold-material to one side of the rotor, means on the rotor for shearing the material in the path of the rotor from that in said device, and means for driving the rotor.

9. In a molding machine, the combination of a ramming head comprising a rotor, a device for delivering mold-material to the rotor, means for driving the rotor, a projector blade on the rotor, and a shear-blade on and angularly extended with respect to the said projector blade.

10. In a molding machine, the combination of a ramming head comprising a rotor and a stator, a device for delivering mold-material to one side of the rotor, means for driving the rotor, a projector blade on the rotor and a shear blade on said projector blade.

11. In a molding machine, the combination of a ramming head comprising a rotor having a radially oblique projector blade, means to deliver mold-material to the rotor, and means for driving the rotor at high speed to cause the material on the rotor to be compacted by the blade.
12. In a molding machine, the combination of a ramming head comprising a rotor and a stator, the rotor having a radially curved projector blade, and means for driving the rotor at high speed to cause the blade to compact the material between the stator and the outer portion of the blade.
13. In a molding machine, the combination of a ramming head comprising a rotor having a projector blade and a transverse cut-off wall having a curved edge, means for delivering material to one side of the rotor, and means for driving the rotor.
14. In a molding machine, the combination of a ramming head comprising a stator and a rotor having a curved projector blade, means to deliver mold material to one side of the rotor, a transverse blade at one side of the projector blade, and means for driving the rotor, the other side of the projector blade being open, the stator having a wall adjacent said open side of the rotor.
15. In a molding machine, the combination of a ramming head comprising a rotor and a stator, the stator having one of its sides open, a transverse wall on the rotor and at the open side of the stator, means to deliver mold-material to said rotor, and means to drive the rotor.
16. In a molding machine, the combination of a ramming head comprising a rotor and a stator, the stator having one of its sides open, a transverse wall on the rotor and at the open side of the stator, means to deliver mold material into said open side, and means to drive the rotor.
17. In a molding machine, the combination of a ramming head comprising a rotor and a stator, the latter having an open side, the rotor having a flared flange at said open side, means for driving the rotor, and means to deliver mold-material to said head.
18. In a molding machine, the combination of a ramming head comprising a rotor and a stator, the latter having an open side, the rotor having a flared flange at said open side, means for driving the rotor, and means to deliver mold material through said open side and onto the rotor.
19. In a molding machine, the combination of a ramming head comprising a rotor and a stator, means for delivering mold-material to the rotor, the latter being provided with a projecting-blade, means for counterbalancing the blade to adapt the rotor for operation at a high speed, and means for driving the rotor at high speed.
20. In a molding machine, the combination of a ramming head comprising a rotor and a stator, means for delivering mold-material to the rotor, the latter comprising a body and hub of light metal, and a ring and a projecting blade of heavier metal, and means for driving the rotor.
21. In a molding machine, the combination of a support, a yoke secured to said support, a shaft mounted in said support, a rotor on the shaft, and a stator adjustably supported on said yoke.
22. In a molding machine, the combination of a supporting sleeve, a yoke secured to said sleeve and having arms, a shaft mounted in said support, a rotor on the shaft and a stator adjustably supported on said arms.
23. In a molding machine, the combination of a ramming head comprising a rotor and a stator having an arcuate periphery cooperating with the rotor, a protective guard for the mold-material after it has been discharged by the rotor, located in offset relation with respect to the point at which the material is released by the stator, and means for driving the rotor.
24. In a molding machine, the combination of a ramming head comprising a rotor and a stator having an arcuate periphery cooperating with the rotor, a protective guard for the mold-material after it has been discharged from the rotor, located in offset relation with respect to the point at which the material is released by the stator, a wear-plate on said guard, and means for driving the rotor.
25. In a molding machine, the combination of a motor, means for movably supporting the motor, a shaft for said motor and a ramming head comprising a rotor fixed to said shaft.
26. In a molding machine, the combination of a motor, a pivotally movable arm on which the motor is supported, a shaft for said motor extending longitudinally of the arm, and a ramming head mounted on the arm and comprising a rotor driven by said shaft.
27. In a molding machine, the combination of a motor, a support for the motor, a shaft, a supporting sleeve secured to the motor and through which said shaft extends, and a ramming head supported by the sleeve and comprising a rotor operated by said shaft.
28. In a molding machine, the combination of a motor, a support for the motor, a shaft for the motor, a supporting sleeve secured to the motor and through which said shaft extends, and a ramming head comprising a stator supported by the sleeve and a rotor fixed to said shaft.
29. In a molding machine, the combination of a support, a jib pivotally sustained

by said support, an arm pivoted to the outer end of the jib, a ramming head supported at the outer end of said arm and comprising a rotor, a motor supported on said arm and a shaft between said rotor and said motor.

30. In a molding machine, the combination of a support, a jib pivotally sustained by said support, a sleeve serving as an arm and pivoted to the outer end of the jib, a ramming head supported at the outer end of said sleeve and comprising a rotor, a motor supported on said arm and a shaft between said rotor and said motor and in said sleeve.

31. In a molding machine, the combination of a support, a jib pivotally sustained by said support, an arm pivoted to the outer end of the jib, a ramming head supported at the outer end of said arm and comprising a rotor, means for driving the rotor, a chute supported above the jib, and a chute fixedly mounted on said arm and adapted to conduct molding material from the chute above the jib to the ramming head by gravity.

32. In a molding machine, the combination of a support, a jib pivotally sustained by said support, an arm pivoted to the outer end of the jib, a ramming head supported at the outer end of said arm and comprising a rotor, means for driving the rotor, a chute movably supported above and on the jib, mechanism for shaking said movable chute, and a chute fixedly mounted on said arm and adapted to conduct molding material from the shaker chute to the ramming head by gravity.

33. In a molding machine, the combination of a support, a jib pivotally sustained by said support, a ramming head, means for supporting the head supported by the jib, said head comprising a rotor, a chute above the jib, resilient supports between the jib and the chute, and means for vibrating the chute.

34. In a molding machine, the combination of a support, a jib pivotally sustained by said support, an arm pivoted to the outer end of the jib, a ramming head supported at the outer end of said arm and comprising a rotor, a chute above the jib, resilient supports between the jib and the chute, and means for vibrating the chute.

35. In a molding machine, the combination of a support, a jib pivotally sustained by said support, an arm pivoted to the outer end of the jib and having its inner end offset laterally relatively to the jib, a ramming head supported at the outer end of said arm and comprising a rotor, a motor for driving the rotor at one side of the pivotal connection between the arm and jib, a conveyer

above the jib, and an inclined conveyer on the arm and extending from the conveyer above the jib to conduct material to the ramming head in a direction laterally oblique to the axis of the ramming head.

36. In a molding machine the combination of a support, a jib pivotally sustained by said support, an arm pivoted to the outer end of the jib and having its inner end offset laterally relatively to the jib, a ramming head supported at the outer end of said arm and comprising a rotor, a motor for driving the rotor disposed laterally of the pivotal connection between the arm and jib, a conveyer above the jib, and a conveyer supported on the arm and extending from the conveyer above the jib to the ramming head, in a direction vertically and laterally oblique to the axis of the ramming head.

37. In a molding machine, the combination of a ramming head comprising a rotor and a stator having a discharge-opening, mechanism for driving the rotor, and means for feeding mold-material into the head, said stator having an opening therein to lessen the atmospheric resistance to the rotor.

38. In a molding machine, the combination of a ramming head comprising a rotor and a stator, mechanism for driving the rotor, said stator having an opening in one side to lessen the atmospheric resistance to the rotor, and means for feeding molding material into the open side.

39. In a molding machine, the combination of a ramming head comprising a rotor and a stator, mechanism for driving the rotor, and means for feeding mold material to the head, said stator comprising an arcuate peripheral wall and a side wall and having its other side open.

40. In a molding machine, the combination of a ramming head comprising a rotor and a stator, mechanism for driving the rotor, and means for feeding mold-material to the head, said stator comprising an arcuate peripheral wall and a side wall and having its other side open, and a protective housing having an opening therein to lessen atmospheric resistance to the rotor.

41. In a molding machine, the combination of a ramming head comprising a rotor and a stator, the rotor having a projector blade and a bed to which the blade is adjustably secured, mechanism for driving the rotor, and means for feeding mold-material to the head, said stator comprising an arcuate peripheral wall meeting the blade.

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