June 9, 1936. L. A. CAMEROTA 2,043,956

CENTRIFUGAL CASTING MACHINE

Filed Feb. 8, 1935 5 Sheets-Sheet 1

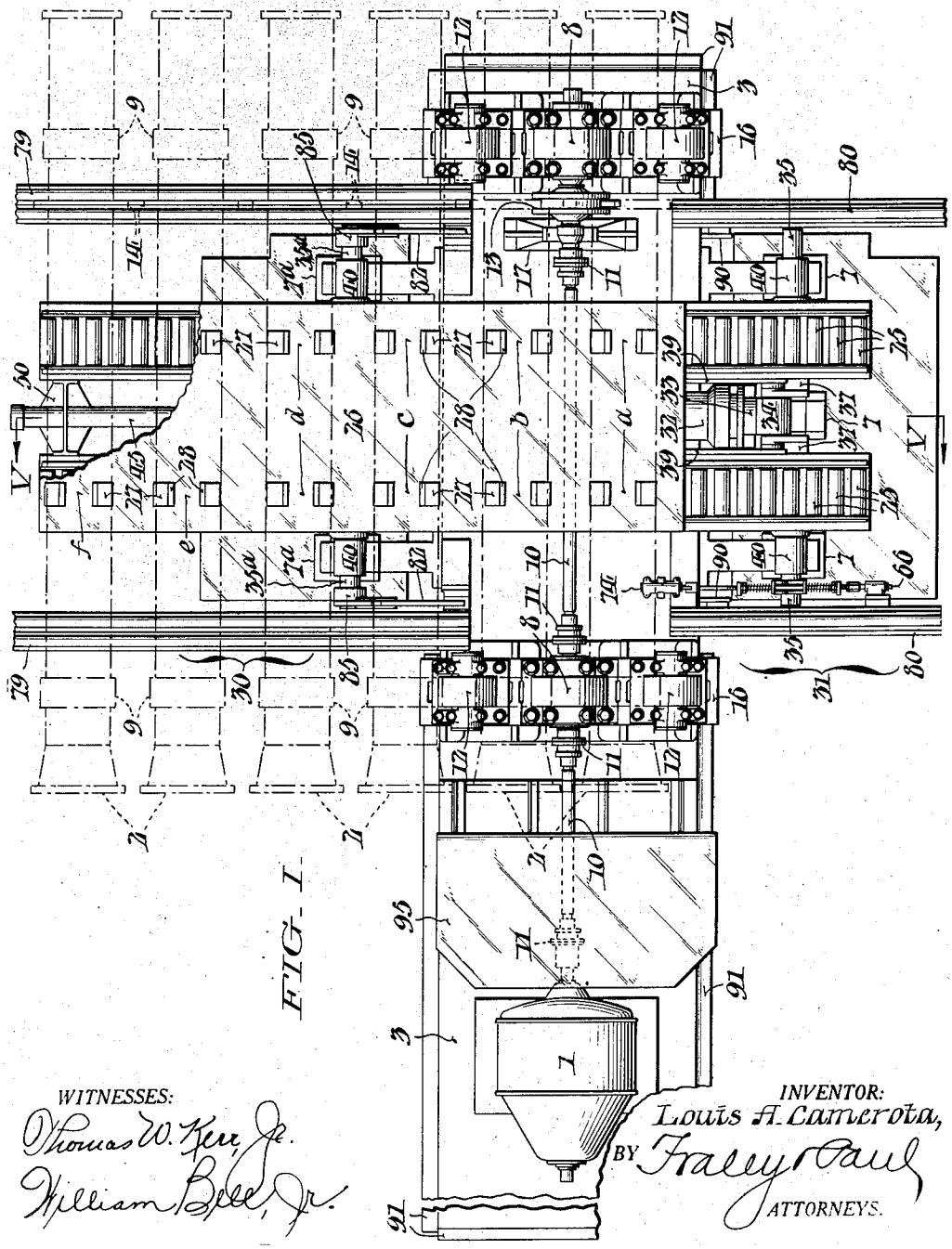


FIG. 1.

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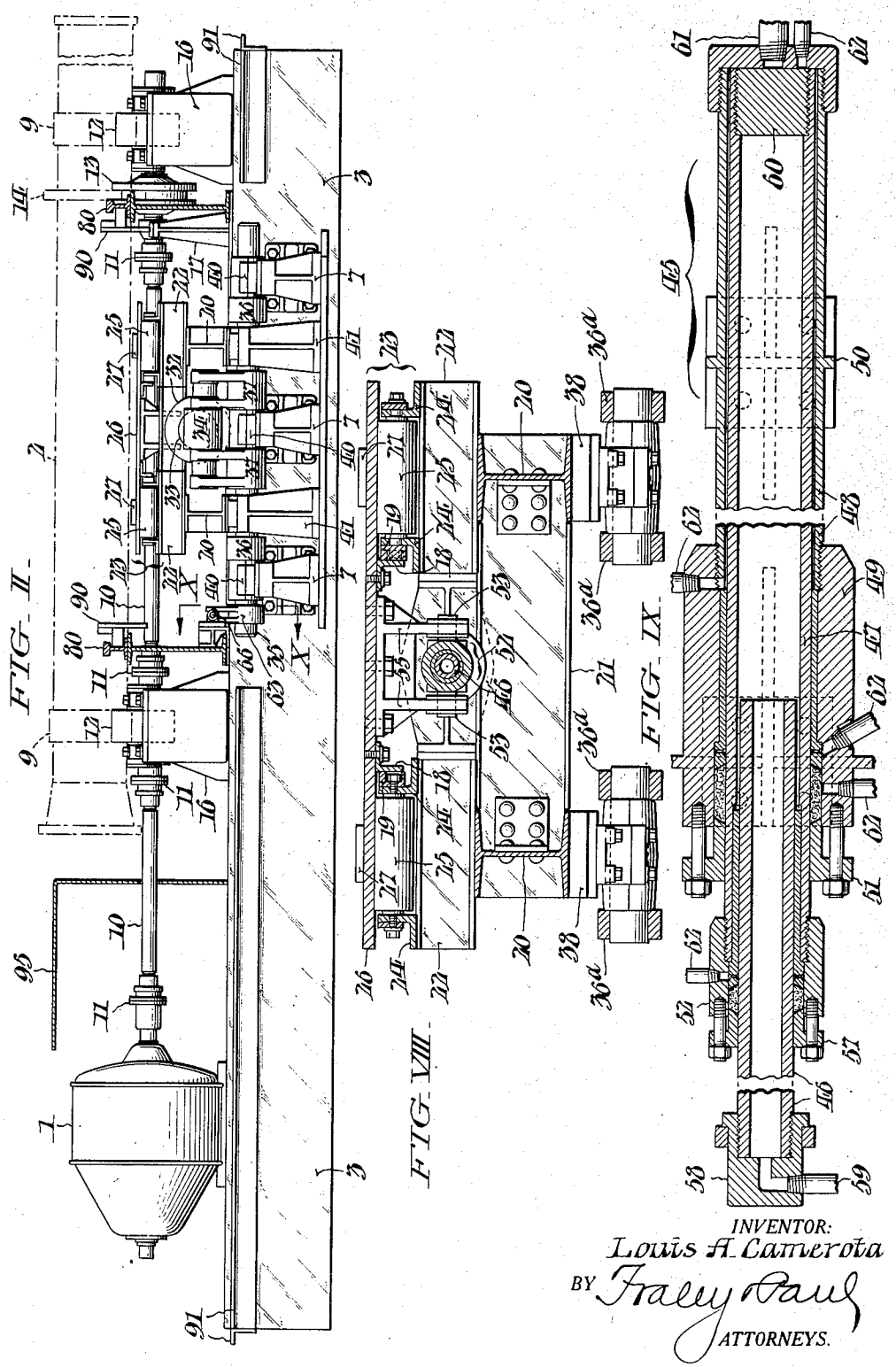


FIG. II.

FIG. VIII.

FIG. IX.

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CENTRIFUGAL CASTING MACHINE

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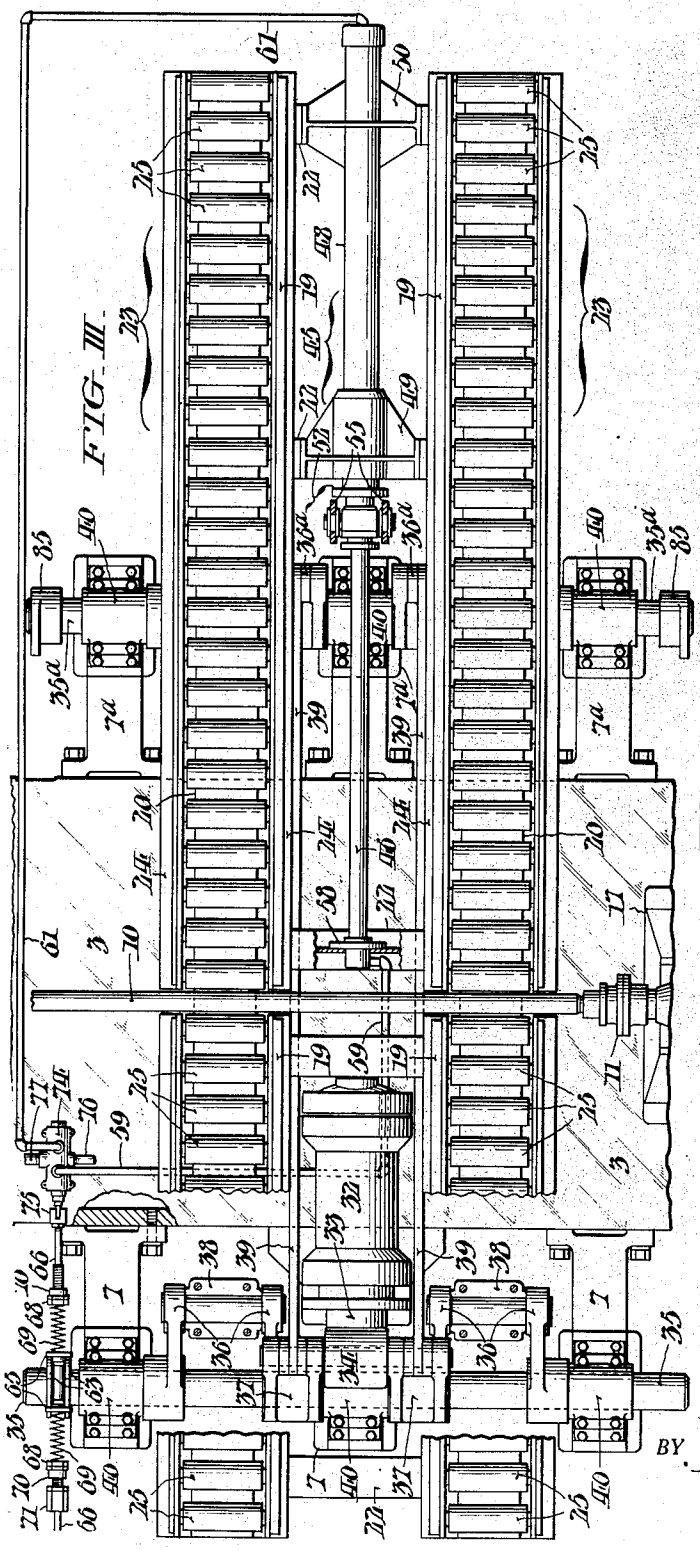


FIG. III.

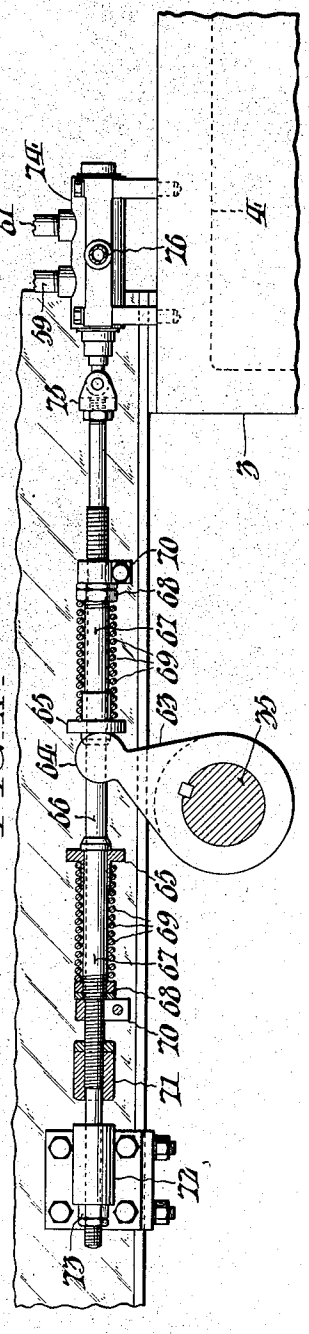


FIG. X.

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CENTRIFUGAL CASTING MACHINE

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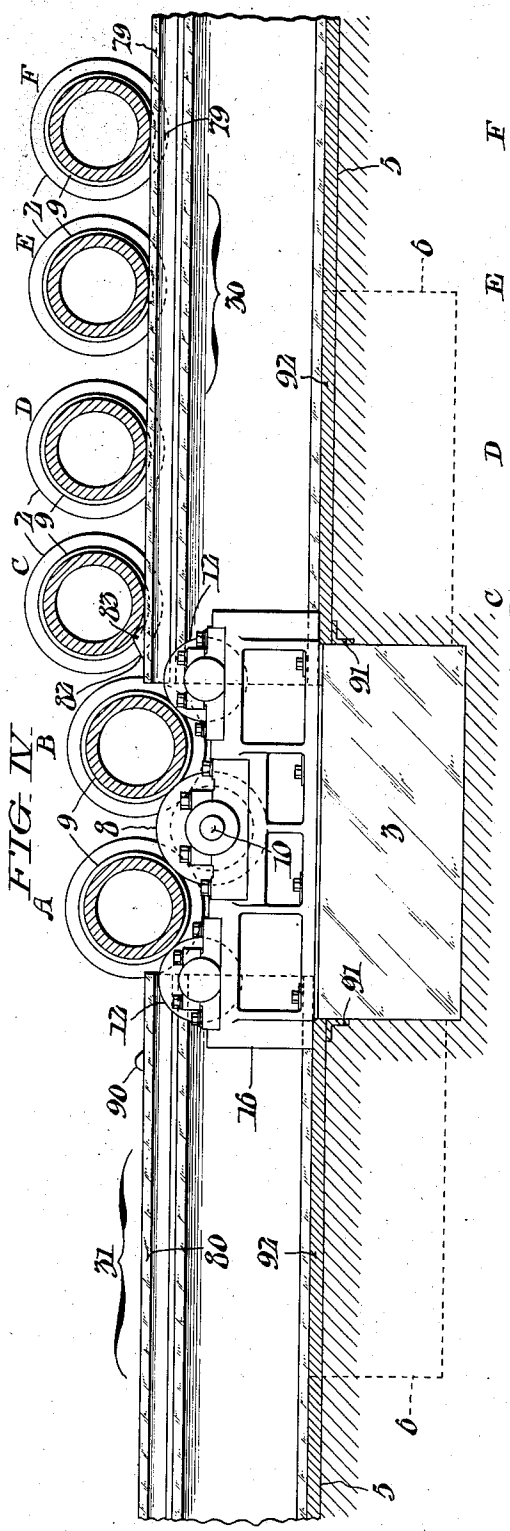


FIG. IV.

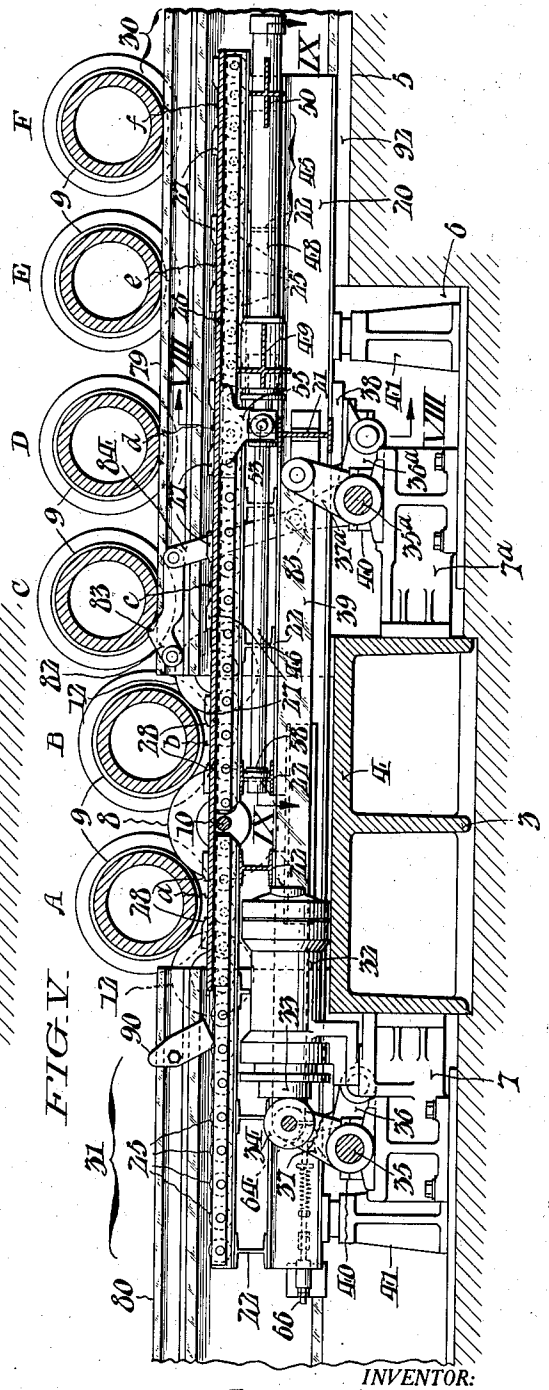


FIG. V.

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CENTRIFUGAL CASTING MACHINE

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FIG. VII.

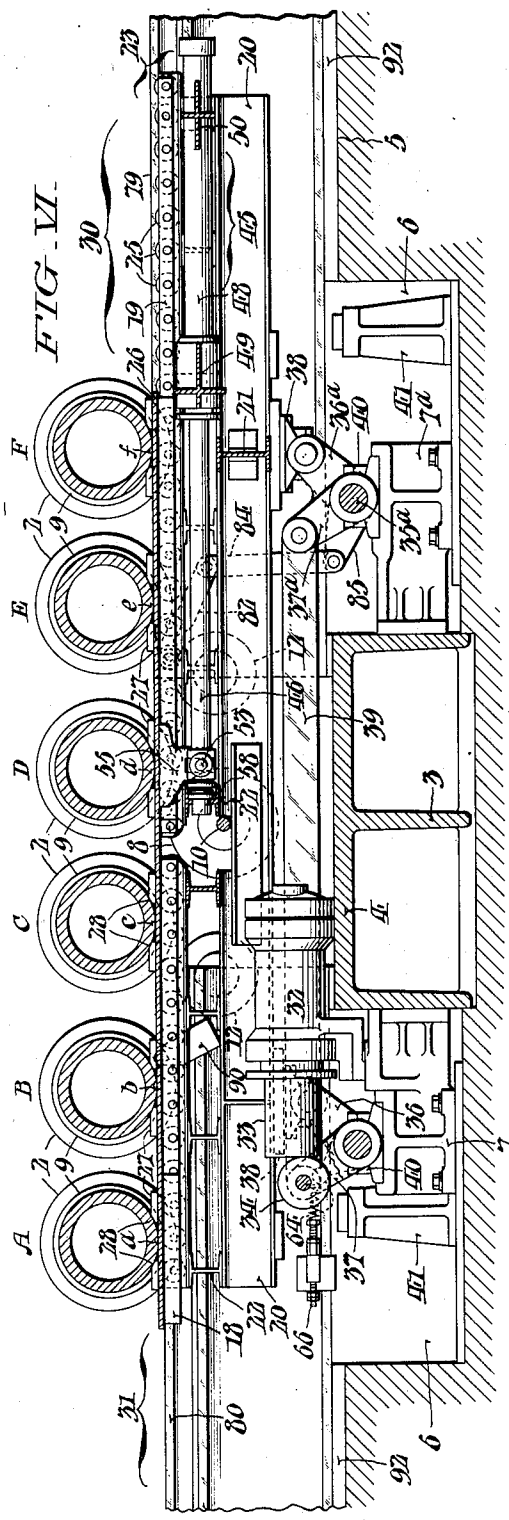
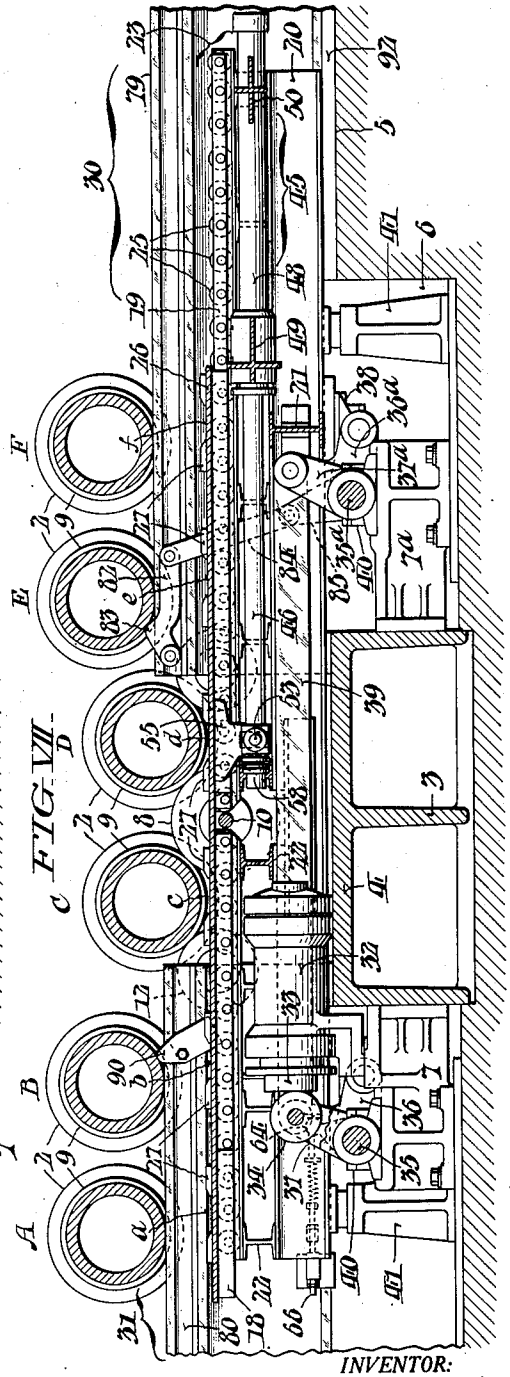


FIG. VIII.



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Patented June 9, 1936

2,043,956

UNITED STATES PATENT OFFICE

2,043,956

CENTRIFUGAL CASTING MACHINE

Louis A. Camerota, Burlington, N. J., assignor to Florence Pipe Foundry & Machine Company, Florence, N. J., a corporation of New Jersey

Application February 8, 1935, Serial No. 5,602

7 Claims. (Cl. 22—65)

This invention relates to centrifugal casting machines, and while applicable generally to apparatus for casting hollow metal bodies in rotary molds, it is especially useful in its application to machines wherein a number of molds are rotated simultaneously, with their axes in parallel relation.

In certain respects the present invention constitutes an improvement upon centrifugal casting machines of the type shown in U. S. Letters Patent No. 1,944,168, granted to me January 23, 1934, and one object of the present invention is to simplify apparatus of the type shown in the above patent by reducing the number and weight of the moving parts, by eliminating objectionable vibration, and by providing a more compact and less expensive construction.

Another object of the invention is to provide in such apparatus a flask conveyor which serves to transport flasks from one side of the machine to the casting bed, and from thence to the other side of the machine, and which is characterized by certain automatic movements which simplify materially the operation of the machine.

Other objects and advantages characterizing my invention, including those derived from the use of novel means for supporting and balancing the flask conveying mechanism aforesaid, will become more fully apparent from the description hereinafter set forth of one example or embodiment of the invention, having reference to the accompanying drawings. Of the drawings:

Fig. I represents a plan view of centrifugal casting apparatus embodying my invention, such apparatus including flask runways leading to and from each side of the casting bed.

Fig. II represents a side elevation of the casting machine.

Fig. III represents an enlarged plan view of a portion of the casting machine with parts of the flask conveyer broken away to reveal the mechanism therebeneath.

Fig. IV represents an end elevation of the casting machine as viewed from the right hand end of Fig. I, with the pipe flasks shown in section.

Figs. V, VI and VII represent enlarged vertical sections of the flask conveyor of the machine, taken as indicated by the lines V—V of Fig. I, the several views showing the conveyor in different successive positions which it occupies in operation.

Fig. VIII represents an enlarged cross section of the casting machine, taken as indicated by the lines VIII—VIII of Fig. V.

Fig. IX represents a cross section of the operating cylinder employed for actuating the flask carrier; and,

Fig. X represents a cross section taken as indicated by the lines X—X in Fig. II, showing the valve controlling mechanism for the operating cylinder of the flask carrier.

In the drawings there is illustrated one example of a centrifugal casting machine embodying my present invention, the apparatus comprising generally a motor 1 connected to driving mechanism which is adapted to rotate a plurality of pipe flasks 2. The driving mechanism for rotating the cylindrical flasks 2 is mounted on a stationary casting bed 3 which is conveniently made of E-shaped cross section with its horizontal web portion 4 disposed substantially at the level of the surrounding floor 5 of the building in which the apparatus is installed. Desirably the casting bed 3 is disposed within a shallow pit 6, and is rigidly secured to the underlying foundations by means of relatively large brackets 7, 7a which additionally serve as bearing supports for the means employed to raise and lower the flask conveyor which is hereinafter described.

The flasks 2 are supported for rotation on bearings in the following manner. Centrally of the bed frame 3 there are driving rollers 8 adapted to engage accurately machined annular surfaces 9 on the flasks 2. The driving rollers 8 are connected to each other as well as to the motor 1 by a shaft 10 made up of a number of sections joined together by flexible couplings 11. At each side of the driving rollers 8 on the casting bed 3, idle rollers 12 are mounted in transverse alignment with the driving rollers 8. Thus in the particular machine shown, two flasks are rotated simultaneously about their respective longitudinal axes on the bed frame 3 by operation of the motor 1. The flasks 2 when mounted between the driving rollers 8 and the idle rollers 12 are restrained against movement in the direction of their longitudinal axes by a guide roller 13 which turns loosely on a portion of the shaft 10 and engages guide flanges 14 on the flasks 2.

The driving rollers 8 and idle rollers 12 are desirably mounted on bearing stands 16 disposed on top of the casting bed 3. To provide intermediate support for the driving shaft 10 adjacent to the guide roller 13 a pedestal 17 is preferably interposed between the bearing stands 16.

It will be understood, of course, that while the machine illustrated in the drawings is shown as adapted for the simultaneous casting of a pair of pipe flasks, the arrangement of the bearings on the casting bed may be varied to provide for the casting of any desired number of flasks.

Flask conveying mechanism is disposed above the casting bed 3 in the following manner. The conveyor comprises a frame which, as shown most clearly in Fig. VIII, may be conveniently made up of a series of I-beams 20 disposed transversely of the casting bed 3 and forming with like cross beams 21 a box-shaped lower section, and an additional series of I-beams 22 superimposed thereon in parallel relation to the longitudinal axis of the casting bed 3 and forming an upper section for the frame. Above the I-beams 22 there is supported a roller table 23 comprising pairs of angle bars 24 with rollers 25 journaled therein. Above the roller table 23 there is provided a carrier plate 26 which has thereon flask receiving pockets *a*, *b*, *c*, *d*, *e*, *f*, consisting of paired lugs 27 with oppositely directed inclined surfaces 28. Other forms of pockets or seats may obviously be employed on the flask carrier for the same purpose, it being understood that the pockets serve to carry or roll the flasks 2 in predetermined spaced parallel relation to each other from positions on the supply runway, comprehensively designated at 30, to the rollers 8, 12, and from positions on the rollers 8, 12 to positions on the discharge runway, comprehensively designated at 31. The carrier plate 26 is provided at its underside with depending angle bars 18, which engage guide members 19 on the roller table 23, thus maintaining the carrier plate at all times in transverse alignment with the roller table.

The flask conveyor frame is adapted to be raised and lowered by mechanism actuated by an elevating cylinder 32, shown most clearly in Figs. V, VI and VII. The elevating cylinder 32 is rigidly secured in fixed relation to the casting bed 3, and preferably above the top of this bed. Any suitable pressure medium may be employed to actuate the piston 33 of the elevating cylinder 32. At its end the piston 33 bears against a roller 34 carried by a pair of rocker arms 37 which are fixed to a shaft 35. The shaft 35 is supported for rotation within bearings 40 on the bracket member 7. On the shaft 35 there are additional pairs of rocker arms 36 which have their ends pivotally connected to brackets 38 disposed beneath the I-beams 20 of the conveyor frame. The rocker arms 36 form with the rocker arms 37 bell crank levers. Outward movement of the piston 33 of the operating cylinder 32 imparts a swinging counterclockwise movement to the rocker arms 37 which in turn rotates the shaft 35, and causes a swinging movement of the rocker arms 36.

At the opposite side of the casting bed 3 from the side on which the elevating cylinder 32 is mounted, there is provided an additional shaft 35*a* mounted for rotation in bearings 40 supported on the bracket 7*a*. The shaft 35*a* has affixed thereon rocker arms 36*a* pivotally connected to brackets 38 beneath the I-beams 20. On the shaft 35*a* there is an additional pair of rocker arms 37*a* cross connected by parallel links 39 with the corresponding rocker arms 37 at the opposite side of the machine. Accordingly, the conveyor frame bridges the casting bed and is supported at each side thereof by the elevating mechanism. The shafts 35, 35*a* are operated simultaneously and the rocker arms 36, 36*a* thereon serve to raise the frame in a substantially vertical direction and in parallel relation to the top of the casting bed 3. The weight of the conveyor frame serves to lower it to depressed position when the piston 33 moves inwardly in the cylinder 32.

Normally, when the casting machine is at rest, the I-beams 20 of the lower section of the conveyor frame rest upon foundation supports in the form of pedestals 41 disposed at each side of the casting bed 3, thus relieving the operating mechanism of the weight of the conveyor frame.

For effecting horizontal movement of the flask carrier plate 26 there is employed an operating cylinder 45, the details of which are most clearly shown in Fig. IX. The cylinder 45 comprises generally three interfitting telescopic sections 46, 47, 48. The outermost section 48 has thereon laterally extending webs 49, 50 which are rigidly secured to the beams 22 of the upper part of the conveyor frame. In this manner the operating cylinder 45 for the flask carrier plate 26 is incorporated within and carried by the conveyor frame. The intermediate section 47 of the operating cylinder 45 is adapted for sliding movement within a stuffing box 51. This section 47 carries a crosshead 52 with outwardly extending projections 53 which engage slotted depending brackets 55 attached to the carrier plate 26. The intermediate section 47 is provided with a stuffing box 57 which prevents leakage between it and the innermost telescopic section 46. The innermost section 46 is rigidly secured at its end to the conveyor frame by a connection 58. The pressure medium is admitted to the interior of the innermost cylindrical section 46 through a pipe 59 and the connection 58, and operates against the cylinder head 60 of the intermediate section 47. In an obvious manner this causes the intermediate section to move to the right, as viewed in Figs. V and IX, between the innermost section 46 and the outermost section 48. This movement of the intermediate section 47 imparts a corresponding movement to the flask carrier plate 26.

In order to effect a reverse movement of the intermediate cylindrical section 47, pressure is admitted through an additional pipe 61 to the outer end of the cylinder head 60. Obviously the direction of movement of the carrier plate 26 is dependent upon whether the pressure medium is admitted through the pipe 59 or through the pipe 61. To provide proper lubrication for the parts of the operating cylinder 45, there is provided a series of lubricant fittings each designated by the numeral 62.

The operation of the cylinder 45 is automatically controlled by the raising and lowering of the conveyor frame in the following manner. At one end of the rock shaft 35 there is provided an arm 63, shown most clearly in Figs. III and X, which has a bifurcated extremity 64 adapted to engage one or the other of two collars 65 surrounding a valve rod 66. Each collar 65 is slidably mounted on a sleeve 67 which in turn slides freely on the valve rod 66. Each sleeve 67 has at the end thereof lock nuts 68, and interposed between the lock nuts 68 and collars 65 there are springs 69. On the valve rod 66 there are two clamps 70 which are adapted to be engaged by the lock nuts 68.

Swinging movement of the arm 63 on the shaft 35, incident to the raising and lowering of the conveyor frame, causes the valve rod 66 to be

moved to the right or the left as viewed in Fig. X. Movement to the left is limited by engagement of an adjusting nut 71 on the shaft 66 against the bearing 72. Movement to the right is limited by engagement of an additional adjusting nut 73 against the opposite side of the bearing 72. The movement of the shaft 66 is designed to be just sufficient to open or close the valve 74. A flexible joint 75 is desirably interposed between sections of the valve rod 66. It will be noted that when the arm 63 on the shaft 35 commences to swing to the right or to the left, it strikes one of the collars 65. On account of the friction opposing movement of the valve rod 66, the valve rod will not move immediately. Accordingly, the collar 65 will slide along the sleeve 67 with incidental compression of the spring 69. As pressure builds up in the spring 69, the friction opposing movement of the valve rod 66 will be overcome, and the rod 66 will be propelled in the direction in which it is urged by the collar 65. Thus the valve 74 is opened and closed by rotation of the shaft 35, and the movements of the valve rod 66 instantaneously follow completion of the swinging movements of the arm 63.

The valve 74, as shown most clearly in Fig. III, has an intake pipe connection 76 at one side thereof, and an exhaust pipe 77 at the opposite side. From the top of the valve 74 the pipe connection 59 leads to one end of the operating cylinder 45, which controls the movement of the carrier plate 26. The pipe connection 61 leads from the top of the valve 74 to the other end of the operating cylinder 45. The apparatus is so designed that when the conveyor frame is in its lowermost position resting on the pedestals 41, the valve rod 66 is in such position as to cause the pressure medium to be admitted to the operating cylinder 25 through the pipe connection 59, and thus the carrier plate 26 normally occupies the position shown in Fig. V at the right hand limit of its travel. When the conveyor frame is raised by actuation of the elevating cylinder 32, the shaft 35 turns in a counterclockwise direction, and the arm 63 thereon swings to the left urging the valve rod 66 in that direction and changing the path of the pressure medium so that it flows through the pipe 61 to the right hand end of the operating cylinder 45. This causes the cylinder 45 to operate, and moves the carrier plate 26 to the left to the position indicated in Fig. VI. Subsequently when the elevating cylinder 32 is actuated again to lower the conveyor frame, the shaft 35 is rotated in a clockwise direction and the arm 63 thereon returns the valve rod 66 to the right, reversing the operation of the valve 74. Thus when the conveyor frame reaches its lowermost position as represented in Fig. VII, the operating cylinder 45 will again be actuated, and the carrier plate 26 will be returned to its original position. In Fig. VII the apparatus is shown with the conveyor frame lowered, but before the carrier plate 26 has commenced to move to the right.

The flask supply station comprehensively designated at 30 desirably takes the form of a runway upon which the flasks 2 are free to roll. In the illustrated example, this runway comprises two pairs of rails 79 elevated substantially above the floor 5, the rails of each pair being spaced apart a sufficient distance to accommodate the guiding flanges 14 of the flasks 2. One pair of rails 79 is in alignment with the guide roller 13. In this manner the proper positioning of the flasks longitudinally of the bed 3 of the casting machine is insured. The rails 79 preferably extend over the top of the casting bed 3 with their ends disposed adjacent to the idle rollers 12.

The flask discharge station comprehensively designated at 31 is constructed in a similar manner. It comprises spaced rails 80 elevated above the floor 5 with their ends disposed above the casting bed 3 adjacent to the idle rollers 12 on that side of the machine. It will be observed that the top surfaces of the supply rails 79 are disposed in a plane slightly above the plane of the top surfaces of the rails 80, and that the flask carrier plate 26, while it is transporting flasks from the supply station to the bearings 8, 12, moves in a horizontal plane just below the top surfaces of the supply rails 79 and just above the top surfaces of the discharge rails 80, as well as above the rolling surfaces of the bearings 8, 12. With this construction the carrier plate 26 is adapted to roll the flasks 2 along the rails 79, without carrying the full weight thereof, and to transport the flasks bodily from the supply station to the bearings, and from the bearings to the discharge station.

At the flask supply station, there is provided a stop device for preventing accidental rolling of the flasks onto the bearings of the machine. This device comprises a pair of curved arms 82 pivoted to the rails 79, as shown most clearly in Figs. V and VII, the arms having upwardly directed projections 83 which normally obstruct movement of the flasks 2 beyond the ends of the rails 79. The arms 82 are connected by links 84 with crank arms 85 fixed to the shaft 35a. When the bearings 8, 12 are rotating with flasks thereon incident to the centrifugal casting of pipes within the flasks, the conveyor frame is in its lowered position, illustrated in Figs. V and VII, and the stop arms 82 extend upwardly above the top surfaces of the rails 79. On the other hand, when the conveyor frame is raised, as shown in Fig. VI, and while the flasks are being transported from one point to another, the stop arms 82 are lowered by the angular movement of the crank arms 85 through the action of the links 84.

At the discharge station, check devices 90 are provided to prevent flasks from rolling back onto the casting bed. These devices take the form of swinging arms loosely pivoted at the ends of the rails 80, and they permit passage of the flasks in a direction toward the discharge station, but prevent movement of the flasks in the opposite direction.

The manner in which the casting machine of this invention is supported upon the floor of the building where it is situated may, of course, be varied to considerable extent. In the present example, the casting bed 3 is provided with angle irons 91 which are adapted to accommodate the ends of floor plates 92 which extend to the sides and ends of the casting bed, as shown in Figs. II and IV. Between the motor 1 and the area embracing the bearings on the casting bed 3 there is provided a hood 95.

The operation of the centrifugal casting machine is as follows. Let it be assumed that two flasks A, B are disposed on the rollers 8, 12, and that other flasks C, D, E, F are disposed upon the rails 79 of the supply station, as shown in Fig. V. The flasks A, B are rotated by the motor 1, and metal is charged therein in the manner customary with centrifugal casting machines. After the two flasks A, B have been rotated for the desired length of time, the motor 1 is stopped. The elevating cylinder 32 for the conveyor frame is then actuated to raise the roller table 23.

Raising of the roller table 23 causes the two flasks A, B, as to which the casting operation has been completed, to be engaged by the flask receiving pockets *a*, *b* of the flask carrier plate 26. It also causes the four additional flasks C, D, E, F to occupy positions within the remaining pockets *c*, *d*, *e*, *f* of the flask plate 26. It will be noted that the flasks C, D, E, F are not bodily lifted from the rails 79, but are engaged in such manner that with horizontal movement of the carrier plate 26 they will be rolled along the rails 79.

As soon as the conveyor frame reaches its position of maximum elevation, the valve 74 operates automatically to reverse the pressure connections to the operating cylinder 45, and the carrier plate 26 is then automatically moved in a horizontal plane along the roller table 23 until the flasks occupy the positions shown in Fig. VI. Thereafter the roller table 23 is depressed by operation of the elevating cylinder 32. Downward movement of the flask carrier causes the two flasks A, B, as to which the casting operation has been completed, to be deposited on the discharge rails 80. This movement also causes two empty flasks C, D to be deposited on the rollers 8, 12, and causes two additional flasks E, F to be advanced in position on the supply rails 79, the parts then assuming the positions shown in Fig. VII.

Obviously a fresh supply of flasks may be brought to the supply station 30 in any desired manner, as by an overhead crane or by rolling them along the rails 79. It will be observed that incident to upward movement of the roller table 23, the automatic flask stop 82 is moved out of the way so as not to interfere with the progression of the flasks onto the rollers 8, 12. Moreover, incident to the horizontal movement of the flask carrier plate 26, the flasks are caused to pass over the check device 90, causing it to swing back and forth from its normal position, the check device preventing accidental reverse movement of a flask.

The casting machine of my present invention constitutes a particular improvement upon the casting machine shown and described in my Patent #1,944,168 in many important respects.

In the machine of my prior patent the conveyor frame is supported by raising and lowering means which come within the area embracing the bearings on which the flasks are rotated. With such a construction, particularly where a relatively long roller table and carrier plate are employed, I have found that there is a tendency for the carrier plate to rock, due especially to the weight of the flasks carried at the ends thereof. In the present machine, the supports for the conveyor frame are spaced at substantial distances laterally of the casting bed 3 and outside the area embracing the bearings on which the flasks are supported, and accordingly the conveyor frame is well balanced and capable of accommodating a larger number of flasks without having a tendency to rock about the center of the casting bed 3.

In the machine of my prior patent, the actuating means for the carrier plate is shown in the form of a cylinder supported upon a stationary part of the apparatus with its piston joined by connecting rods to one end of the carrier plate. Such apparatus tends to produce a rocking of the carrier plate in the manner described above. In the machine of my present invention, the operating cylinder 45 for the carrier plate 26 is incorporated within and made an integral part of the conveyor frame. The construction of the operating parts of the mechanism is thus considerably simplified, and there is no appreciable tendency to produce a rocking movement of the carrier plate.

In the machine of my prior patent the elevating cylinder for raising and lowering the conveyor frame is disposed beneath the casting bed and operates the conveyor through a relatively heavy and bulky mechanism including a large frame mounted in a deep pit. In the machine of my present invention this apparatus has been greatly simplified, for the operating cylinder for the conveyor frame is disposed above the casting bed, and relatively simple mechanism is employed for translating reciprocatory motion of the elevating cylinder to a vertical motion of the conveyor frame. The new arrangement does away with the necessity for a deep pit and produces a more efficient and considerably less expensive machine. Moreover, the conveyor frame is relieved of the weight of the elevating cylinder and the mechanism associated therewith.

In the machine of my prior patent horizontal movement of the carrier plate, as well as elevation and depression of the conveyor frame, is accomplished by separate control devices which must be manually actuated in the proper sequence by the operator. In the machine of my present invention, movement of the carrier plate is rendered entirely automatic and the controls are so designed that this movement is initiated at the proper time and discontinued at the proper time. This simplifies considerably the work of the operator, and reduces the time required for the completion of each casting operation.

In the machine of my prior patent, the flasks from the supply station are carried bodily to the bearings with the full weight of the flasks imposed upon the carrier plate. The downward pressure upon the carrier plate is one of the factors which tends to upset the balance of the conveying mechanism. In the machine of my present invention the flasks are caused to be rolled from the supply station to the bearings on the casting bed. Thus less power is required for progression of the flasks, and the conveyor is subjected to less pressure near the ends thereof.

While I have described in detail a particular example of the practice of my invention, it will be readily apparent that various changes may be made in the form of the apparatus herein described and illustrated without departing from the spirit of the invention as defined in the annexed claims.

Having thus described my invention, I claim:

1. Apparatus for centrifugally casting hollow metal bodies comprising bearings for supporting a flask for rotation, a flask supply station at one side of the area embracing said bearings, a flask discharge station at the other side of said area, and a conveyor for transporting a flask laterally from said supply station to said bearings and from said bearings to said discharge station; said conveyor including a frame having a horizontally movable flask carrier thereon, and means for raising and lowering said frame, said means supporting the frame at points beneath the supply and discharge stations spaced at a substantial distance laterally from the area embracing said bearings.

2. Apparatus for centrifugally casting hollow metal bodies comprising a casting bed having bearings thereon for supporting a rotary flask, a flask supply station extending to one side of said bed, a flask discharge station extending to the

other side of said bed, and a conveyor for transporting a flask laterally from said supply station to said bearings and from thence to said discharge station; said conveyor including a frame bridging the top of the casting bed and having a horizontally movable flask carrier thereon, and means for raising and lowering said frame with the weight thereof supported at points beneath the supply and discharge stations and spaced at a substantial distance laterally from said casting bed.

3. Apparatus for centrifugally casting hollow metal bodies comprising a casting bed having bearings thereon for supporting a rotary flask, a flask supply station extending to one side of said bed, a flask discharge station extending to the other side of said bed, a conveyor for transporting a flask laterally from said supply station to said bearings and from thence to said discharge station, said conveyor including a vertically movable frame bridging the top of the casting bed and having a horizontally movable flask carrier thereon, foundation supports beneath said supply and discharge stations for supporting said frame in a position of rest, and means for raising and lowering said frame with the weight thereof supported at points beneath the supply and discharge stations and spaced at a substantial distance laterally from said casting bed.

4. Apparatus for centrifugally casting hollow metal bodies comprising a casting bed having bearings for supporting a rotary flask, and a conveyor for transporting a flask to and from said bearings; said conveyor including a vertically movable frame bridging the casting bed transversely below the level of said bearings, a horizontally movable flask carrier thereon, and means for reciprocating said carrier including an operating cylinder incorporated within and carried by said frame.

5. Apparatus for centrifugally casting hollow metal bodies comprising a casting bed having bearings for supporting a rotary flask, and a conveyor for transporting a flask to and from said bearings; said conveyor including a vertically movable frame bridging the casting bed transversely below the level of said bearings, a horizontally movable flask carrier thereon, and means for reciprocating said carrier in the form of telescoping pressure-operated cylinders incorporated within said frame and extending transversely of the casting bed.

6. Apparatus for centrifugally casting hollow metal bodies comprising a casting bed having bearings for supporting a rotary flask, and a conveyor for transporting a flask to and from said bearings; said conveyor including a vertically movable frame extending transversely over the casting bed, means for raising and lowering said frame including an operating cylinder mounted above the casting bed, and rocker arms actuated thereby, said rocker arms being disposed at each side of the casting bed and interconnected across the top thereof, a flask carrier movable horizontally on said frame, and means for reciprocating said carrier.

7. Apparatus for centrifugally casting hollow metal bodies comprising a casting bed having bearings for supporting a rotary flask, and a conveyor for transporting a flask to and from said bearings; said conveyor including a vertically movable frame extending transversely over the casting bed, means for raising and lowering said frame including a cylinder mounted above the casting bed, and rocker arms actuated thereby, said rocker arms being disposed at each side of the casting bed and interconnected across the top thereof, a flask carrier movable horizontally on said frame, and means for reciprocating said carrier including an operating cylinder incorporated within said frame.

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