Aug. 11, 1942. J. E. BATIE 2,292,598

CASTING MACHINE

Filed Oct. 10, 1940 5 Sheets-Sheet 1

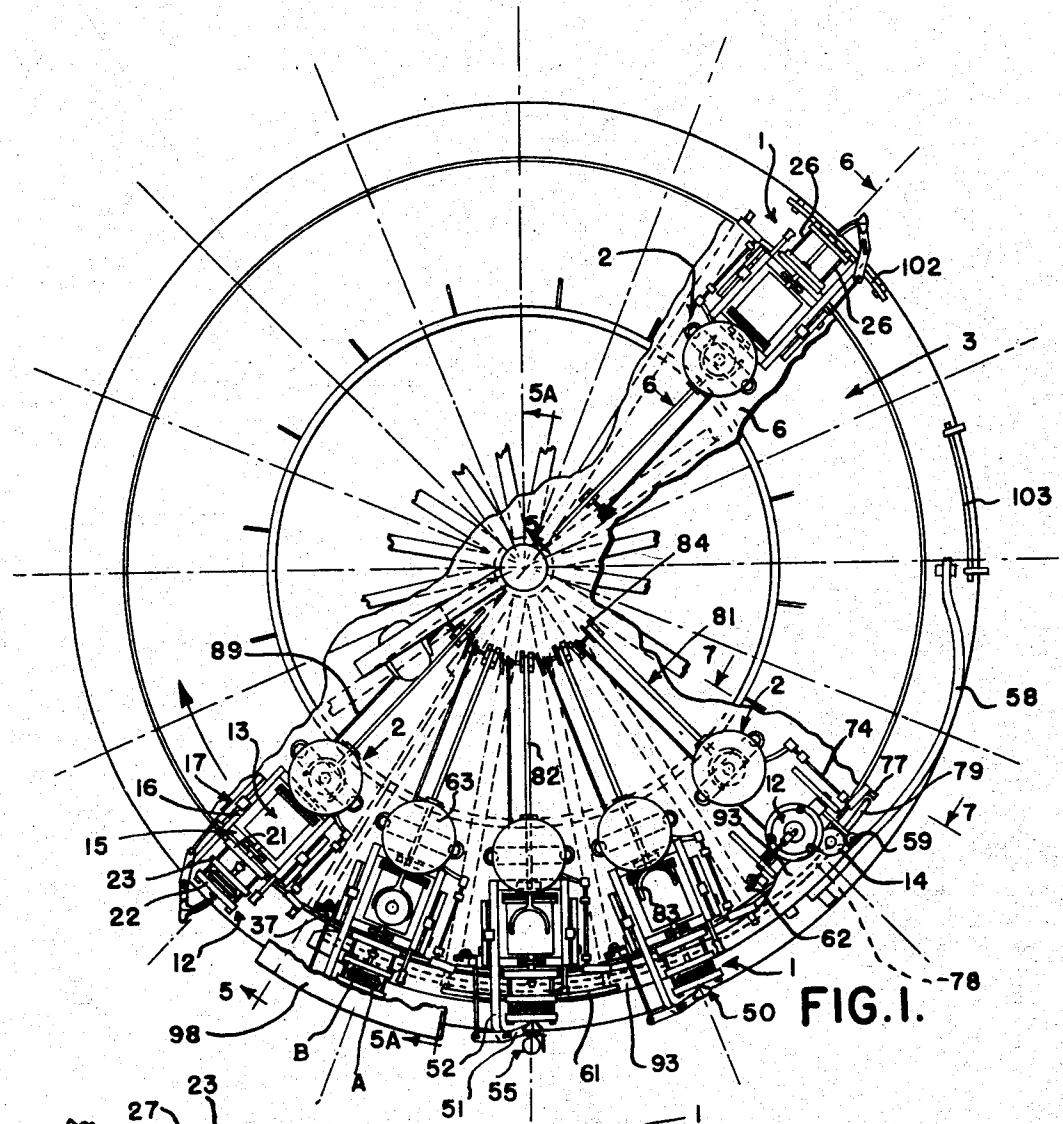


FIG. 1.

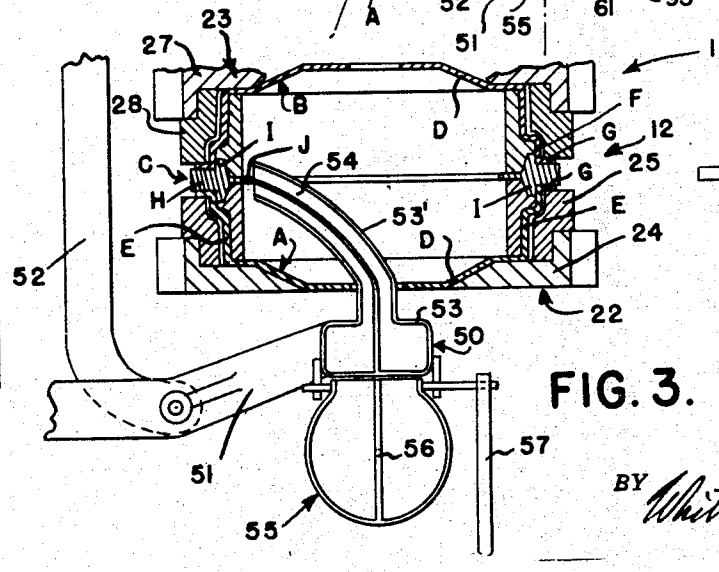


FIG. 3.

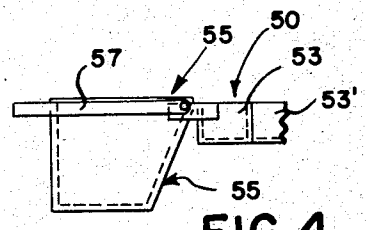


FIG. 4.

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CASTING MACHINE

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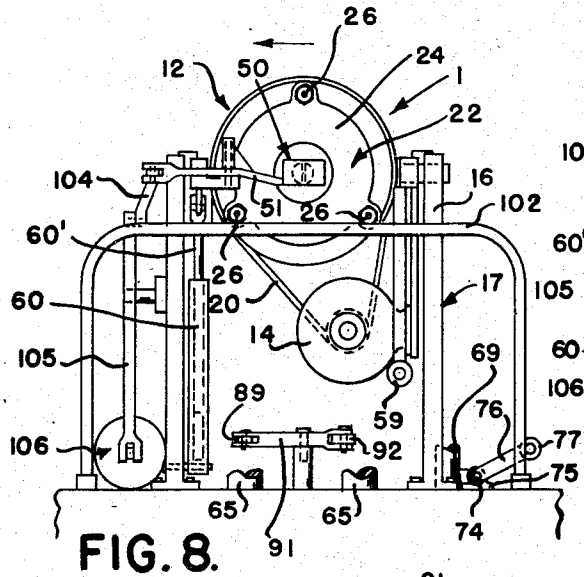


FIG. 8.

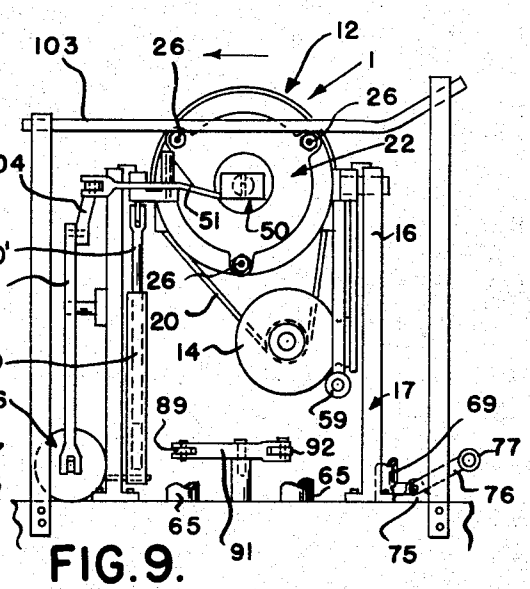


FIG. 9.

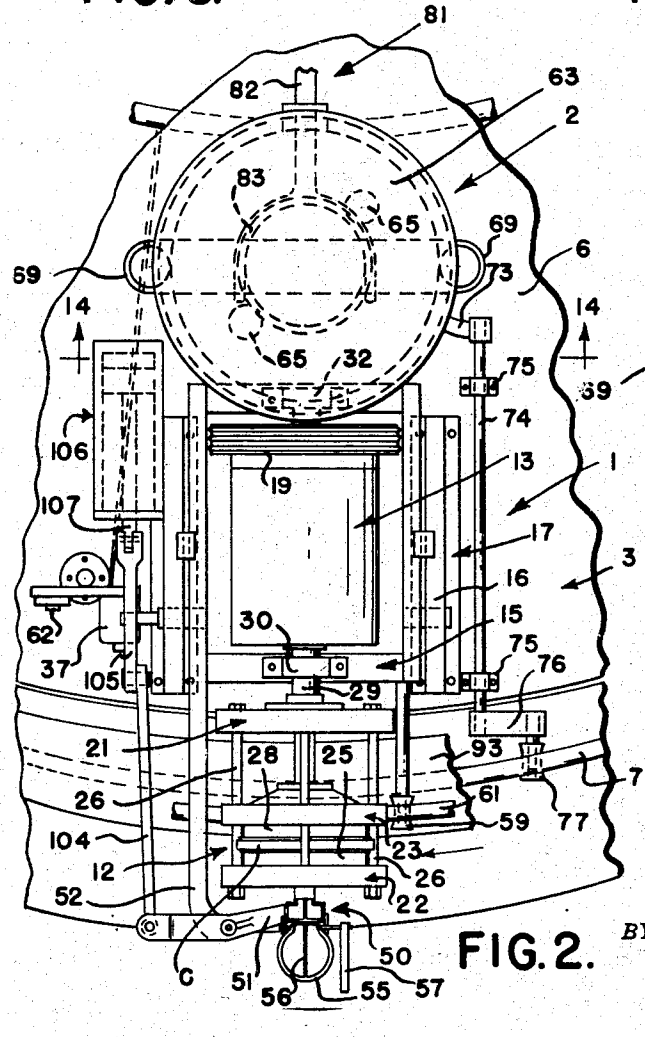


FIG. 2.

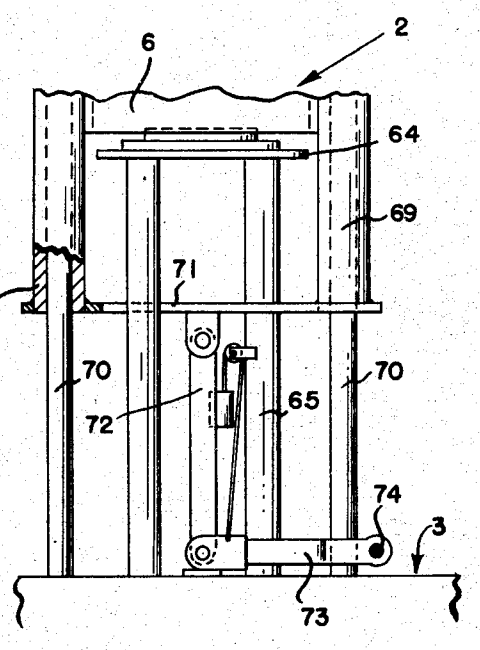


FIG. 14.

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CASTING MACHINE

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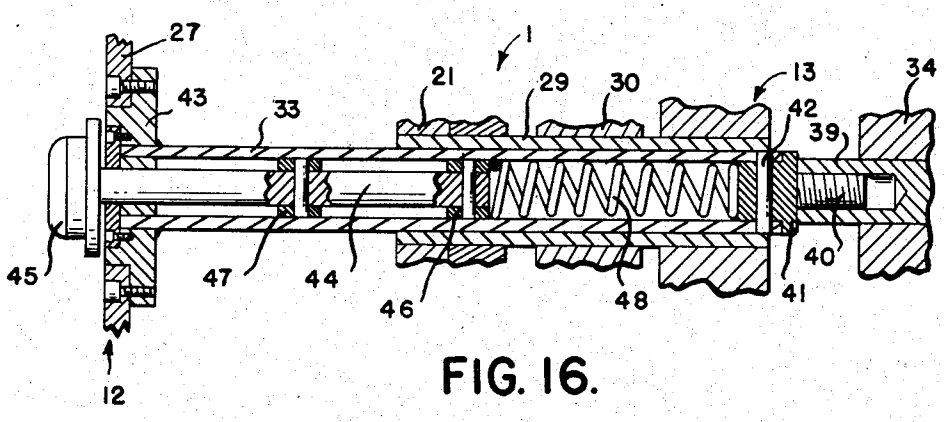


FIG. 16.

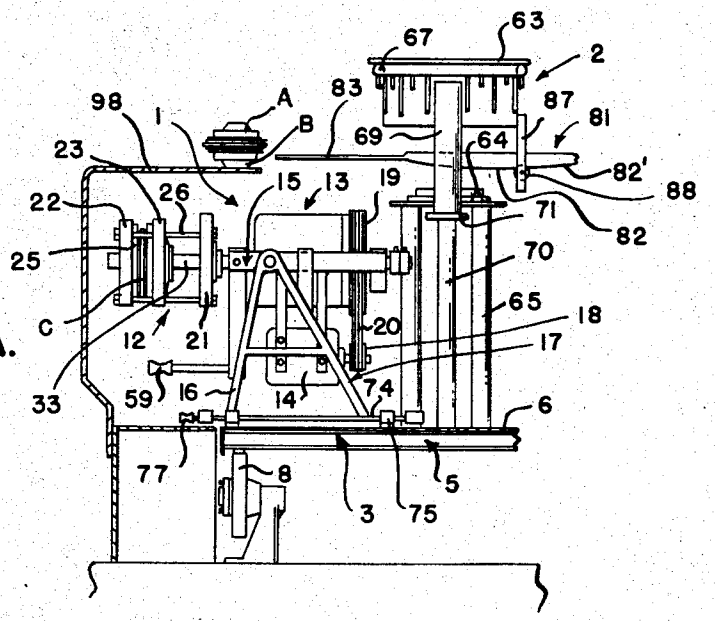


FIG. 5A.

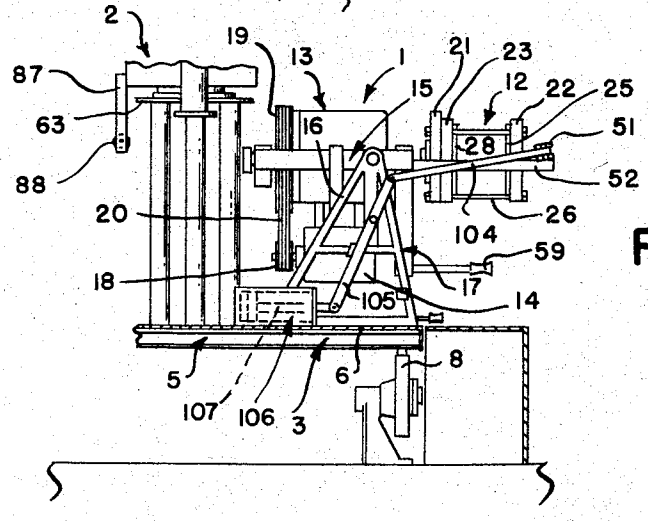


FIG. 2A.

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CASTING MACHINE

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FIG. 15.

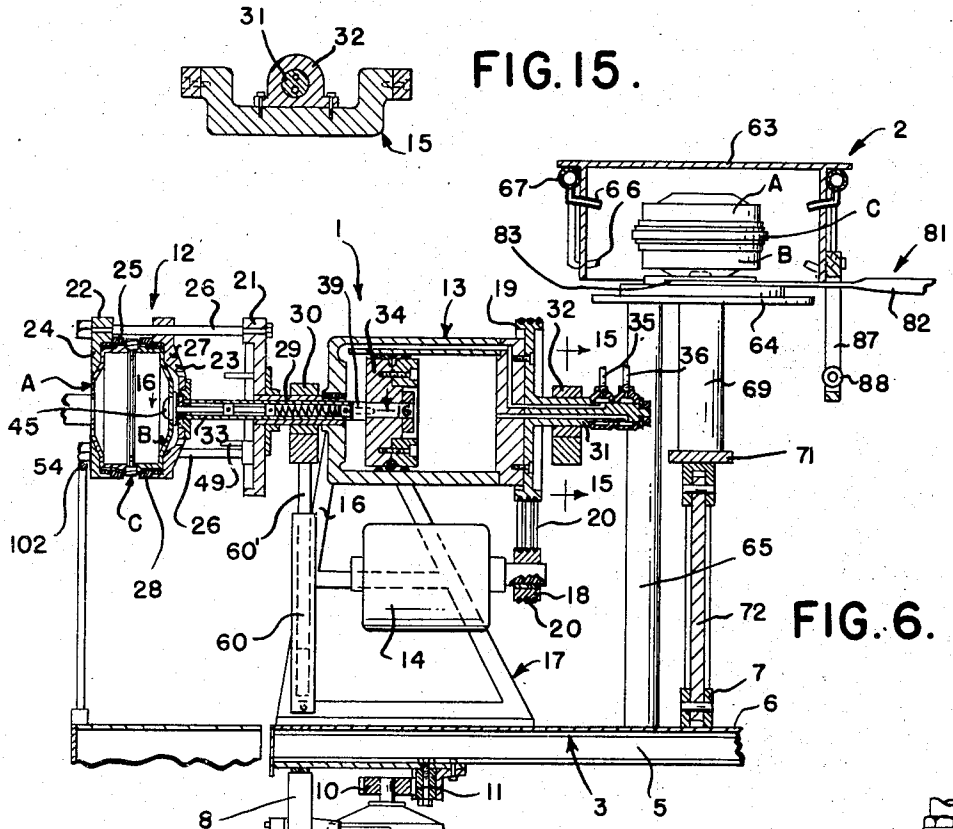


FIG. 6.

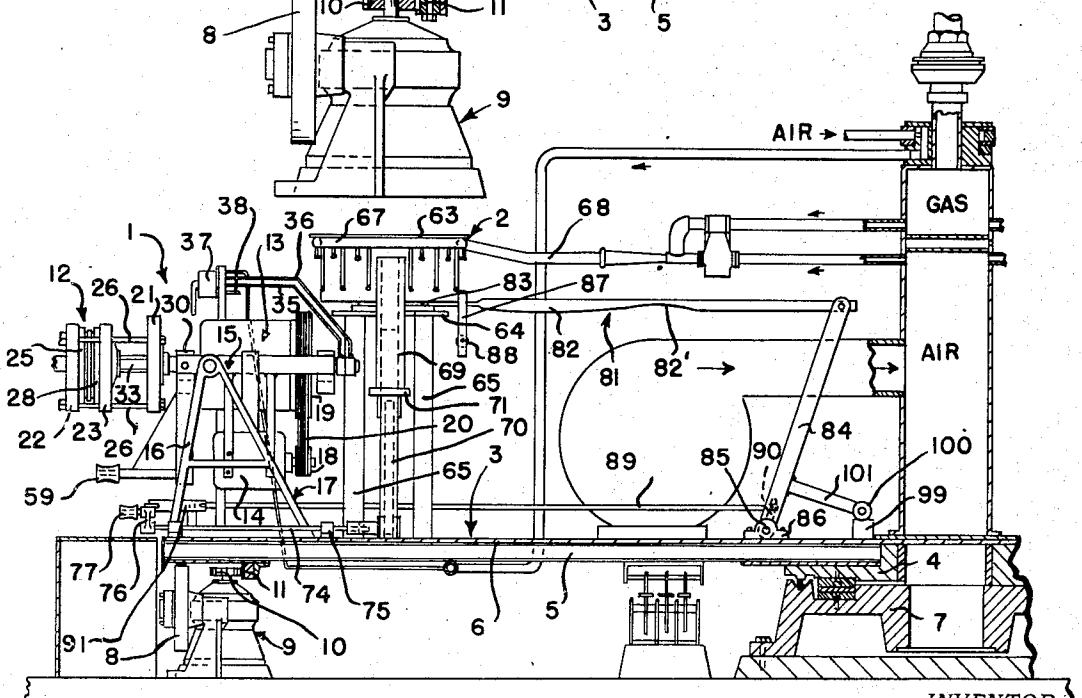


FIG. 5.

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Aug. 11, 1942. J. E. BATIE 2,292,598

CASTING MACHINE

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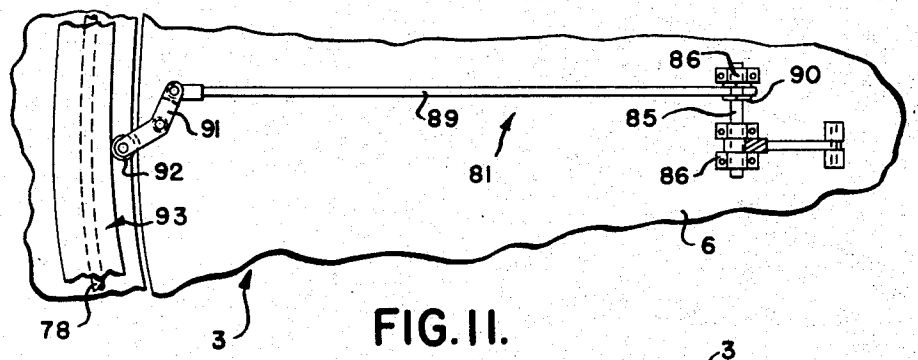


FIG. 11.

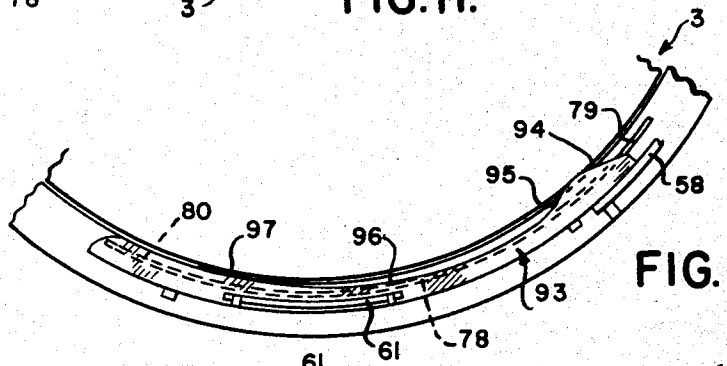


FIG. 12.

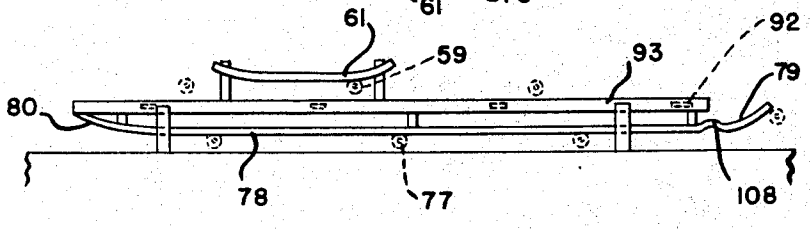


FIG. 13.

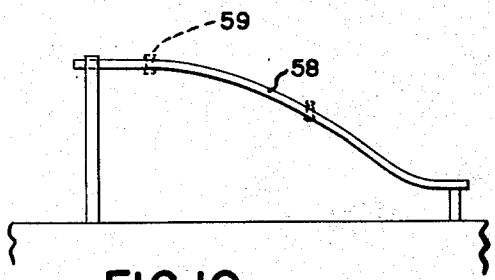


FIG. 10.

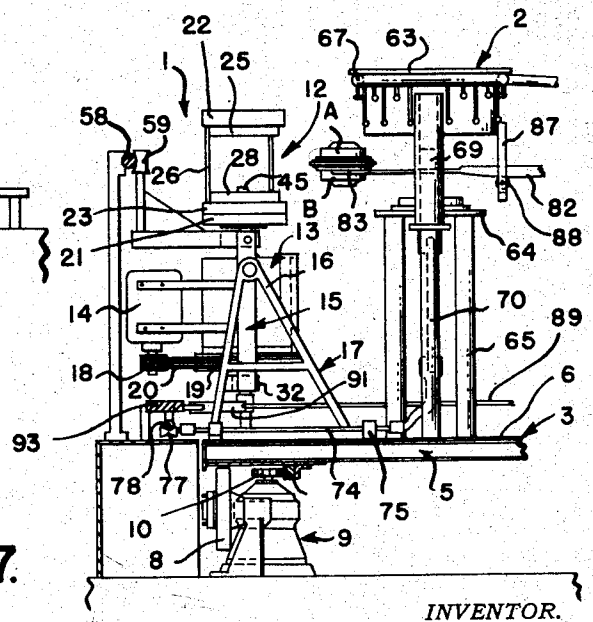


FIG. 7.

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Patented Aug. 11, 1942 2,292,598

UNITED STATES PATENT OFFICE

2,292,598

CASTING MACHINE

Joseph E. Batie, Detroit, Mich., assignor to Kelsey-Hayes Wheel Company, Detroit, Mich., a corporation of Delaware

Application October 10, 1940, Serial No. 360,655

13 Claims. (Cl. 22—77)

The invention relates to casting machines and refers more particularly to machines for casting liners in brake drum shells.

The invention has for some of its objects to provide an improved casting machine for casting liners in a plurality of brake drum shells at one time and to provide an improved casting machine comprising a casting unit, a furnace for preheating the shells, and a transfer device for transferring shells from the furnace to the casting unit.

The invention has for other objects to provide an improved casting unit which is angularly movable between a work receiving position and a casting position; to provide an improved work holder forming part of the casting unit constructed to hold a plurality of brake drum shells in place and to permit pouring of the liner material into the shells; to provide an improved furnace; and to provide an improved transfer device for the shells.

The invention has for a further object to provide improved mechanism for automatically controlling various operations of the machine in timed relation.

With these as well as other objects in view, the invention resides in the novel features of construction and combinations and arrangements of parts as more fully hereinafter set forth.

In the drawings:

Figure 1 is a plan view, partly broken away, of a casting machine embodying my invention;

Figure 2 is an enlarged view of a portion of Figure 1;

Figure 2A is a reduced left hand side elevation of Figure 2;

Figure 3 is an enlarged view, partly in section, of a portion of Figure 2;

Figure 4 is a side elevation of a portion of Figure 3;

Figures 5, 5A, 6 and 7 are cross sections on the lines 5—5, 5A—5A, 6—6 and 7—7, respectively, of Figure 1;

Figure 8 is an end elevation of Figure 6;

Figure 9 is a similar view in an advanced position;

Figure 10 is an end elevation of a part of the machine in advanced position;

Figure 11 is a plan view with parts removed of another part of the machine;

Figure 12 is a plan view of another part of the machine;

Figure 13 is an end elevation of Figure 12;

Figure 14 is a cross section on the line 14—14 of Figure 2;

Figures 15 and 16 are cross sections on the lines 15—15 and 16—16, respectively, of Figure 6.

The machine, as illustrated in the present instance, is used in the manufacture of composite brake drums of that type having wrought metal shells and cast iron liners centrifugally cast into and fused or molecularly bonded to the annular flanges of the shells and also to the peripheral parts of the webs of the shells. The shells are preferably formed from flat sheet steel blanks by suitable drawing operations.

The casting machine comprises the annular series of casting units 1 and the annular series of furnace units 2, both of which are mounted upon the horizontally rotatable table 3 near its periphery with one furnace unit radially inwardly of each casting unit. The table is formed of the central hub 4, the I-beams 5 extending radially from the hub, and the plates 6 secured to the I-beams. The table is supported at its central portion by the bed 7 and at its peripheral portion by the peripherally spaced rolls 8. The table is rotated in the direction of the arrow indicated in Figure 1 by means of the electric drive unit 9 below the table and having the driving pinion 10 in engagement with the annular rack 11 secured to the underside of the table.

Each casting unit 1 comprises the work holder 12, the cylinder 13 in axial alignment with the work holder, the electric motor 14 and the support 15 for the holder, cylinder and electric motor. The support is located between and pivotally mounted upon the furcations 16 of the base 17, which is mounted upon the table near its periphery with the pivots for the support 15 extending chordwise of the table so that the casting unit may swing in a direction radially of the table. The holder 12 and the cylinder 13 together form a sub-unit rotatable about the axis common to the holder and cylinder. The motor 14 is connected to the sub-unit to rotate the same by suitable means which, in the present instance, comprises the pulley 18 upon the motor shaft, the pulley 19 secured to the inner end of the cylinder 13, and the belt 20 running over the pulleys.

The work for which the holder 12 is adapted comprises, as shown particularly in Figure 3, an assembly unit formed of the two opposed sheet metal brake drum shells A and B and the annular insert C preferably formed of cast iron having its surface coated with a suitable refractory or heat-resistant material. The shells are each formed with the web D and the integral annular flange E extending axially from the periphery of the web. Each annular flange has the

enlarged free end portion F which terminates in the radial flange G. The annular insert C has the outer radial portion H which is located between the radial flanges G, the oppositely extending axial portions I which are preferably tapered toward their edges and closely fit within the enlarged free end portions F, and the inner radial portion J which is preferably of less width than the outer radial portion.

The holder 12 comprises the head 21 and the outer and inner chuck sections 22 and 23, respectively, carried by the head. The outer chuck section comprises the annular body 24 and the concentric ring 25 mounted at the inner side of the body. The body is fixedly secured upon the outer ends of the rods 26 which extend transversely from and are fixedly secured at their inner ends to the head 21. The inner chuck section comprises the plate 27 and the concentric ring 28 mounted at the outer side of the plate. The plate is slidably mounted upon the rods 26. The rings 25 and 28 are constructed to encircle the annular flanges E of the shells A and B, respectively, and to abut the radial flanges G of the shells. To reduce loss of heat from the annular flanges, the rings are formed with peripherally spaced axial ribs or lands for engaging the annular flanges. The annular body 24 and the plate 27 are constructed to conform to the contours of the radially outer portions of the webs D of the shells A and B, respectively. With this construction, the holder is adapted to directly clamp the radial flanges at the free ends of the shells against the annular insert, to engage and hold the annular flanges of the shells circular and to predetermined size and to true the annular flanges of the shells if they should happen to be out of round when the work is inserted into the holder.

29 is an outer hollow shaft in axial alignment with and connecting the holder 12 and the cylinder 13, the head 21 of the holder being mounted on the outer end of the shaft and the outer end of the cylinder being mounted on the inner end of the shaft. The shaft is journaled intermediate its ends in the bearing 30 upon the outer end of the support 15. 31 is a shaft in axial alignment with the shaft 29 and located at the inner end of the cylinder 13 and journaled in the bearing 32 upon the inner end of the support 15. The shaft 31, as shown, is an integral part of the pulley 19. The two shafts 29 and 31 support the sub-unit comprising the holder 12 and the cylinder 13 in the support 15 and rotate with and also provide for rotation of the sub-unit about the axis common to both the holder and cylinder.

33 is a second hollow shaft axially slidable within and guided by the shaft 29. The shaft 33 is adapted to be reciprocated by the piston 34 which is reciprocable in the cylinder 13. A suitable medium under pressure, preferably compressed air, may be admitted to and exhausted from either side of the piston through the pipes 35 and 36 under the control of the valve 37, the exhaust from the valve being through the pipe 38. The valve is adapted to be manually operated and is of standard construction manufactured by a well known manufacturing concern. The connection between the shaft 33 and the piston 34 comprises the piston rod 39, the stud 40 threaded into the outer end of the piston rod and having the integral collar 41 abutting the inner end of the second shaft 33, and the pin 42 which extends through the outer end of the stud and the inner end of the second shaft. The arrangement is such that the second shaft is positively reciprocated in both directions and in its outer direction the pin is relieved from shear by the collar upon the stud. Fixed upon the outer end of the second shaft 33 is the central abutment 43 upon which is mounted the plate 27 of the inner chuck section.

44 is a third shaft which is axially slidably mounted in and guided by the second shaft 33. The third shaft has fixedly secured to its outer end the pilot abutment 45 and as shown, is provided with the inner and outer collars 46 and 47 for slidably engaging the second shaft 33. 48 is a coil spring within the second shaft and located between the stud 40 and the inner collar 46 for yieldably urging the third shaft axially outwardly. It will be noted that the central abutment 43 is adapted to engage the outer collar 47 to limit the outward movement of the third shaft. The pilot abutment 45 is adapted to receive the web of the inner wrought metal brake drum shell, the pilot portion being adapted to extend through the central opening in the web and the abutment portion being adapted to abut the adjacent portion of the web.

With this construction it will be seen that when the medium under pressure is admitted to the inner end of the cylinder 13 by manually manipulating the valve 37, the piston 34 is forced outwardly and moves the inner chuck section 23 toward the outer chuck section 22. Also, when the medium under pressure is admitted to the outer end of the cylinder and the medium under pressure at the inner end of the cylinder is permitted to exhaust, the piston will be moved inwardly and move the inner chuck section away from the outer chuck section a distance such that the chuck sections and also the pilot abutment completely release the work. To assure disengagement of the work, suitable ejector rods 49, as shown in Figure 6, are engageable with the web of the inner shell when the inner chuck section is moved inwardly. The ejector rods extend transversely from and are secured to the head 21 of the holder and are adapted to extend through the plate 27 of the inner chuck section.

50 is a pouring spout for each casting unit carried upon the arm 51 which is pivotally mounted upon the stationary arm 52 secured to and carried by the support 15. Each pouring spout has the body portion 53 and the arcuate guide portion 53' leading from the body portion. Both the body portion and the guide portion are open at their upper sides and both are provided with the partition wall 54 extending upwardly from their bottom walls midway between their side walls. The free end of the guide portion is open and the free end of the partition wall is adapted to register with the end of the inner radial portion J of the annular insert when the pouring spout is in operative or pouring position so that the liner material, which is preferably molten cast iron, will be poured into the shells on opposite sides of the inner radial portion of the insert. The size of the guide portion and its radius of curvature and also the position of the pivotal connection between the arms 51 and 52 are such that the guide portion may be readily swung into the central opening in the web D of the outer hub shell A when the work is clamped in the holder. 55 is a measuring ladle pivotally mounted upon the body portion 53 of each pouring spout to be swung upwardly to pour the liner material therefrom into the body portion of the pouring spout. The measuring ladle is

provided with the central partition wall 56 for securing the desired amount of liner material to be poured into each brake drum shell. As shown, the measuring ladle is adapted to be tilted or swung by means of the lever 57 which is fixedly secured to one of the pins forming part of the pivotal connection between the measuring ladle and the pouring spout.

For the purpose of swinging each holder from its substantially horizontal casting position to its substantially vertical work receiving position, a cam is engageable with the support of each casting unit. As shown, 58 is a stationary cam beyond the periphery of the table 3 and 59 is a roll upon the support 15 of each casting unit engageable with the cam during the rotation of the table. The face of the cam engaged by the roll is arcuate with respect to the table and is curved upwardly and twists from the front end to the rear end of the cam, the twist being through an angle of substantially 90° from an upper approximately horizontal position to an inner approximately vertical position. Each casting unit is unbalanced about its pivots and when released by the cam 58 will swing by gravity from its substantially vertical position to its substantially horizontal position. The return of the casting unit to its substantially horizontal position is cushioned by a dampening device comprising the cylinder 60 pivotally connected to a furcation 16 of the base 17 and a cooperating piston 60' pivotally connected to the support 15.

To assure each casting unit remaining in its substantially horizontal casting position during the casting operation, I have provided the hold-down stationary cam 61 which is located beyond the periphery of the table 3 and is arcuate with respect thereto. This cam is engageable with the roll 59 after the casting unit has been swung down from its substantially vertical position to its substantially horizontal position upon release from the cam 58. Both the front and rear ends of the cam 61 are preferably curved upwardly, the major portion between the ends being horizontal. During the time the roll 59 is in engagement with the horizontal portion of the cam, the pouring spout is swung into casting position and the molten liner material is poured into the pouring spout. However, before the liner material is poured into the pouring spout, the electric motor 14 is connected to a source of electric current through the manually operable electric switch 62 and the holder 12 is brought up to the desired R. P. M.

Each furnace unit 2 comprises the upper and lower furnace sections 63 and 64, respectively. The lower section is supported upon the columns 65 which extend upwardly from and are mounted on the table 3. The upper section forms a dome and is concentric with the lower section and is provided with a suitable gas or gaseous mixture through the nozzles 66 extending through the side wall of the upper section, the annular pipe 67 encircling the upper section, and the flexible pipe 68 connected to the source of gas or gaseous mixture. As shown, the source is the same as shown and described in my copending application Serial No. 306,418, filed November 27, 1939. The upper section is adapted to be raised and lowered with respect to the lower section and, as shown, the upper section is carried by the diametrically opposite supports 69 which are guided by the columns 70 extending upwardly from and mounted on the table. As shown, the supports 69 are tubular and are sleeved over the columns 70. 71 is a cross bar sleeved over and guided at its ends by the columns 70 and carrying the supports 69. 72 is a pitman pivotally connected at its upper end to the middle of the cross bar 71 and pivotally connected at its lower end to the arm 73 which is fixed upon the inner end of the shaft 74. The shaft extends substantially radially of the table 3 and is journaled in the bearings 75 upon the table and it has secured to its outer end the crank 76 having the roll 77 engageable with the stationary cam 78 peripherally beyond the table. The cam is arcuate with respect to the table and has the up-turned front and rear end portions 79 and 80, respectively.

For the purpose of transferring the work to the furnace to be heated and subsequently transferring the work from the furnace to the holder, the transfer device 81 is provided. The transfer device comprises the arm 82 having at its outer end the work receiving yoke 83. The arm is pivotally connected at its inner end to the upper end of the lever 84, the lower end of which is fixed to the shaft 85 journaled in the bearings 86 which are secured to the table 3 radially inwardly of the associated furnace. The arm 82 is also supported by the upper furnace section 63 and, as shown, the upper furnace section has the depending arm 87 which is provided with the roll 88 engaging and supporting the arm 82. 89 is a link extending substantially radially of the table and pivotally connected at its inner end to the arm 90 secured to the shaft 85 and at its outer end to one arm of the bell crank 91. The bell crank is pivotally mounted upon the table near its periphery to swing horizontally and the other arm of the bell crank carries the roll 92 which is engageable with the stationary cam 93 peripherally beyond the table. The cam has the inclined cam face 94 at its front end which upon being engaged by the roll 92 compels the arm 82 to move forwardly from its normal position in registration with the furnace. The cam also has the reversely inclined cam face 95 following the cam face 94 and permitting the arm 82 to move rearwardly to a position in which the yoke 83 is located radially inside the work holder when in substantially vertical position to clear the work holder. The cam also has the arcuate cam face 96 following the cam face 95 and adapted to hold the yoke in a position clearing the work holder until it has been swung from substantially vertical position. The cam further has the cam face 97 following the cam face 96 and adapted to cause the arm to move forwardly to position the yoke in work receiving position adjacent to the stationary platform 98. The rear end of the cam is rounded away from the cam face 97 so that as the roll 92 rides over the rear end the yoke returns to its normal position centrally of the associated furnace. This normal position is determined by the stop 99 upon the table 3 engageable with the weight 100 at the end of the arm 101 upon the lever 84. The weight 100 constantly exerts a force on the transfer device sufficient to return it to its normal position when it is under the control of the cam 93.

To provide for disengaging the work from the holder after the work has been lined, I have provided the stationary cam 102 peripherally beyond the table and engageable with the outer end or, more properly speaking, the clamping nut at the outer end of the lowermost rod 26 of the holder to cause the holder to turn as the table is being rotated to assume a position such that the two lowermost rods 26 will be at the same elevation.

As shown, there are three rods 26 and sufficient space is provided between adjacent rods to permit the work to freely pass therebetween. After the two lowermost rods have been compelled to assume the same elevation, the work is free to drop without interference thereby when the inner chuck section 23 of the holder is moved inwardly.

To turn the holder so that the rods 26 will not interfere with the transfer of the work from the furnace to the holder, I have provided the stationary cam 103, as shown in Figures 1 and 9, located beyond the periphery of the table and adapted to engage the outer end or, more properly speaking, the clamping nut at the outer end of the uppermost rod 26 of the holder to compel the holder to turn as the table is being rotated to assume a position with the two uppermost rods at the same elevation. As a result, it will be seen that when the casting unit is swung from horizontal position to vertical position none of the rods 26 of the holder will interfere with the passing therebetween of the work by the work transfer device.

Each pouring spout 50 is adapted to be swung to operative and inoperative positions by means of the link 104, the lever 105 and the fluid pressure device 106. The link 104 is pivotally connected at its outer and inner ends respectively to the free end of the arm 51 and the upper end of the lever 105. The lever is pivotally mounted intermediate its ends on one of the furcations of the base 17 and pivotally connected at its lower end to the piston rod 107. The fluid pressure device is preferably an air cylinder in which the piston is connected to the piston rod 107. The construction is such that after the molten liner material has been poured with the spout in operative position, compressed air is admitted to the inner end of the cylinder by manually operating the valve controlling the same. The compressed air forces the piston outwardly and through the piston rod, lever, link and arm swings the pouring spout to its inoperative position clearing at least the inner face of the outer chuck section of the work holder. As a result, the pouring spout cannot interfere with the disengagement of the work from the work holder after the work has been lined. The construction is also such that after the work has been disengaged from the work holder and before the work to be lined has been inserted into the work holder compressed air can be admitted to the outer end of the cylinder and the air at the inner end permitted to exhaust to return the pouring spout to operative position. This can be done because the pivot between the lever 105 and a furcation of the base 17 is located at such a distance below the pivot connecting the support 15 and the furcations of the base 17 that when the casting unit is swung from substantially horizontal position to substantially vertical position the pouring spout is automatically swung to inoperative position so that it will not interfere with the insertion of the work to be lined into the work holder.

To compensate for vertical movement of the inner end of the arm 82 during longitudinal movement of the arm, it is formed with the cam surface 82' engageable with the roll 88 so that the yoke 83 upon the arm will normally be moved through a horizontal path.

In operation, assuming the table 3 to be rotating in the direction indicated by the arrow in Figure 1 and the casting unit to be leaving the stationary cam 103, at which time the inner chuck section 23 is in its innermost position, the cam 58 upon being engaged by the roll 59 swings the casting unit from horizontal position to vertical position. As the casting unit is approaching its vertical position, the cam 78 upon being engaged by the roll 77 causes the upper section 63 of the furnace 2 to raise. After the upper furnace section has been raised, the front end portion 94 of the cam 93 upon being engaged by the roll 92 causes the arm 82 to be advanced or moved forwardly from its normal position with its yoke 83 centrally within the furnace to a position registering the work carried by the yoke with the inner chuck section 23 of the holder, the chuck section at this time being below the outer chuck section 22. After the work has been registered with the inner chuck section, the yoke 83 is lowered by slightly lowering the upper furnace section 63. This slight lowering is accomplished by forming the cam 78 with the raised portion 108 which holds the upper furnace section in its slightly lowered position until the yoke has been retracted to clear the holder of the casting unit. The retracting is accomplished by the weight 100 and permitted by the cam face 95 of the cam 93. The cam face 96 of the cam 93 holds the yoke in this position during which time the work holder swings downwardly to its horizontal position. As the roll rides over the cam face 97 of the cam 93 the yoke is moved outwardly to a position adjacent the platform 98 at which time the work to be lined can be moved onto the yoke. As the roll rides over the rear end of the cam 93, the arm 82 and its yoke and the work thereon are moved inwardly to normal position with the work centrally of the lower furnace section 64, after which the upper furnace section 63 is lowered to its normal position by reason of the roll leaving the cam 78. After the work has been moved to a position clearing the work holder, the work which was transferred to the work holder is sections of the work holder by manually or automatically manipulating the valve 37. Then the casting unit is returned from vertical work receiving position to horizontal casting position by gravity after the roll 59 has left the cam 58. Then the roll 59 engages the cam 61 to hold the casting unit in horizontal position, after which the electric switch 62 is manually or automatically operated to start the electric motor, which in turn rotates the holder and the work carried thereby. The pouring spout at this time is in inoperative position and the molten iron at a temperature of approximately 2900° to 3000° F. has been placed in the measuring ladle. When the desired R. P. M. of the work has been secured, the ladle is manually or automatically tilted to pour the molten iron into the pouring spout which directs the molten iron against the annular flanges of the two brake drum shells of the work. After the pouring, the pouring spout is moved to inoperative position. The rotation of the work is continued through approximately 180° of rotation of the table to give the molten iron sufficient time to cool and solidify to the desired extent. When the table has rotated through this zone, the electric switch 62 is manually or automatically operated to disconnect the electric motor 14 from the source of current and the holder and work cease rotating. Then the cam 102 causes the work holder to rotate to place two of its rods 26 in lowermost and horizontal position, if the holder is not already in this position, after which the valve 37 is operated to move the inner

chuck section 23 of the holder inwardly to release the work and allow it to drop from the work holder. After the work has been released from the work holder, the cam 103 then compels the holder to rotate to assume a position with two of its rods 26 uppermost and horizontal, the casting unit then being in position to be tilted from horizontal position to vertical position. Also, after the work has been released from the work holder the pouring spout can be returned from its inoperative position to its operative position. It will be noted that the work is being heated from the time the upper furnace section is lowered to operative position until it is raised to inoperative position, or through an angle of approximately 270° of rotation of the table. This provides for sufficient time interval to heat the work to approximately 1300° F. without subjecting it to an excessive temperature.

What I claim as my invention is:

1. In a casting apparatus, the combination with a work holder comprising chuck sections relatively movable toward and away from each other, of means for bodily moving said holder angularly between a work receiving position and a casting position, means for relatively moving said chuck sections toward each other to secure the work in place when said holder is in work receiving position, means for rotating said holder about its axis when said holder carries the work and is in casting position, and means for directing liner material into the work during the rotation of said holder.

2. In a casting apparatus, the combination with a movable table, of a work holder mounted on said table and bodily movable angularly relative thereto, means dependent upon the movement of said table for moving said holder angularly between a work receiving position and a casting position, means for rotating said holder about its axis when said holder is in casting position, and means for directing liner material into the work during the rotation of said holder.

3. In a casting apparatus, the combination with a work holder and a furnace for heating the work, of means for bodily moving said holder angularly between a substantially vertical position and a substantially horizontal position, means for transferring the work from said furnace to said holder when the latter is in substantially vertical position, means for rotating said holder about its axis when said holder is in substantially horizontal position, and means for directing liner material into the work during the rotation of said holder.

4. In a casting apparatus, the combination with a work holder bodily movable from a substantially horizontal position to a substantially vertical position and also rotatable about its axis, of means for moving said holder from one of said positions to the other, means for inserting the work into said holder when in substantially vertical position, means for rotating said holder about its axis when in substantially horizontal position, and means for directing liner material into the work during the rotation of said holder.

5. In a casting apparatus, the combination with a movable table, of a work holder on said table comprising chuck sections relatively movable toward and away from each other, a furnace on said table for heating the work, means for bodily moving said holder angularly between a substantially vertical position and a substantially horizontal position, means dependent upon the movement of said table for transferring the work from said furnace to said holder when the latter is in substantially vertical position, means for rotating said holder about its axis when said holder is in substantially horizontal position, and means for directing liner material into the work during the rotation of said holder.

6. In a casting apparatus, the combination with a movable table, of a work holder on said table, a furnace on said table for heating the work, means for bodily moving said holder angularly between a substantially vertical position and a substantially horizontal position, a work transfer device on said table for moving the work to said furnace and from said furnace to said holder when the latter is in substantially vertical position, means dependent upon movement of said table for operating said transfer device, means for rotating said holder about its axis when said holder is in substantially horizontal position, and means for directing liner material into the work during the rotation of said holder.

7. In a casting apparatus, the combination with a furnace comprising relatively movable sections, of a work holder, a work transfer device for moving the work from said furnace to said holder, means for moving said transfer device, and means for relatively moving said furnace sections in timed relation to the movement of said transfer device to provide clearance for the movement of the work from said furnace.

8. In a casting apparatus, the combination with a work holder comprising chuck sections relatively movable toward and away from each other, of means for bodily moving said holder angularly between a substantially vertical work receiving position and a substantially horizontal casting position, a work transfer device comprising an arm having a work receiving yoke at its outer end, a lever pivotally connected to the inner end of said arm for longitudinally reciprocating the same, and means for controlling the raising and lowering of said yoke during the longitudinal reciprocation of said arm to deposit the work on one of said chuck sections of said holder when the latter is in substantially vertical position.

9. In a casting apparatus, the combination with a movable table, of a work holder on said table comprising chuck sections relatively movable toward and away from each other, means for bodily moving said holder angularly between a substantially vertical position and a substantially horizontal position, a pouring spout movable between operative and inoperative positions, and means for automatically moving said pouring spout during the angular movement of said holder.

10. In an apparatus for simultaneously casting liners in a pair of brake drum shells each having an annular flange and a radial flange at an edge of said annular flange, the combination with a pair of coaxial chuck sections each having a portion for encircling and engaging the annular flange and a portion for abutting the radial flange of one shell, means for relatively axially moving said chuck sections toward each other with one chuck section in engagement with one shell and the other chuck section in engagement with the other shell to clamp the radial flanges of the shells upon an insert therebetween, means for rotating said chuck sections as a unit about their axes when said chuck sections are in clamping position to thereby simultaneously rotate the shells and insert, and means

for directing liner material against the annular flanges of the shells during the rotation of the shells and insert.

11. In an apparatus for simultaneously casting liners in a pair of brake drum shells, the combination with a work holder comprising relatively axially movable chuck sections each having a portion for abutting one shell, of means for relatively axially moving said chuck sections toward each other with one chuck section abutting one shell and the other chuck section abutting the other shell to clamp the shells upon an insert therebetween, means for rotating said holder about its axis with said chuck sections in clamping position, and means for directing liner material simultaneously into the shells during the rotation of said holder, said last mentioned means comprising a pouring spout having a guide portion formed with a partition wall positioned to register with the insert when said spout is in operative position.

12. In a casting apparatus, the combination with a movable table, of a work holder on said table rotatable about its axis and comprising coaxial chuck sections relatively movable axially toward and away from each other and angularly spaced elements extending between said chuck sections and compelling said chuck sections to rotate in unison and also guiding said chuck sections during their relative axial movement, stationary means engageable with said holder upon movement of said table to turn said holder about its axis when in substantially horizontal position to position the lowermost angularly spaced elements at substantially the same elevation, and other stationary means engageable with said holder upon further movement of said table to turn said holder about its axis when in substantially horizontal position to position the uppermost angularly spaced elements at substantially the same elevation.

13. In a casting apparatus, the combination with a rotatable horizontal table, of a work holder mounted on said table and rotatable about its axis and also angularly movable bodily from a substantially horizontal position to a substantially vertical position, means dependent upon rotation of said table to turn said holder about its axis when said holder is in substantially horizontal position, means dependent upon further rotation of said table to turn said holder about its axis when said holder is in substantially horizontal position, means dependent upon still further rotation of said table to bodily move said holder angularly from substantially horizontal position to substantially vertical position to receive work, means for then returning said holder to substantially horizontal position, means for directing liner material into the work when said holder is in substantially horizontal position, and means for rotating said holder about its axis while liner material is being directed into the work and during a subsequent portion of rotation of said table.

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