April 14, 1936. W. I. CARPENTER 2,037,618

MOTOR DRIVEN CASTING MACHINE

Filed May 31, 1934 3 Sheets-Sheet 1

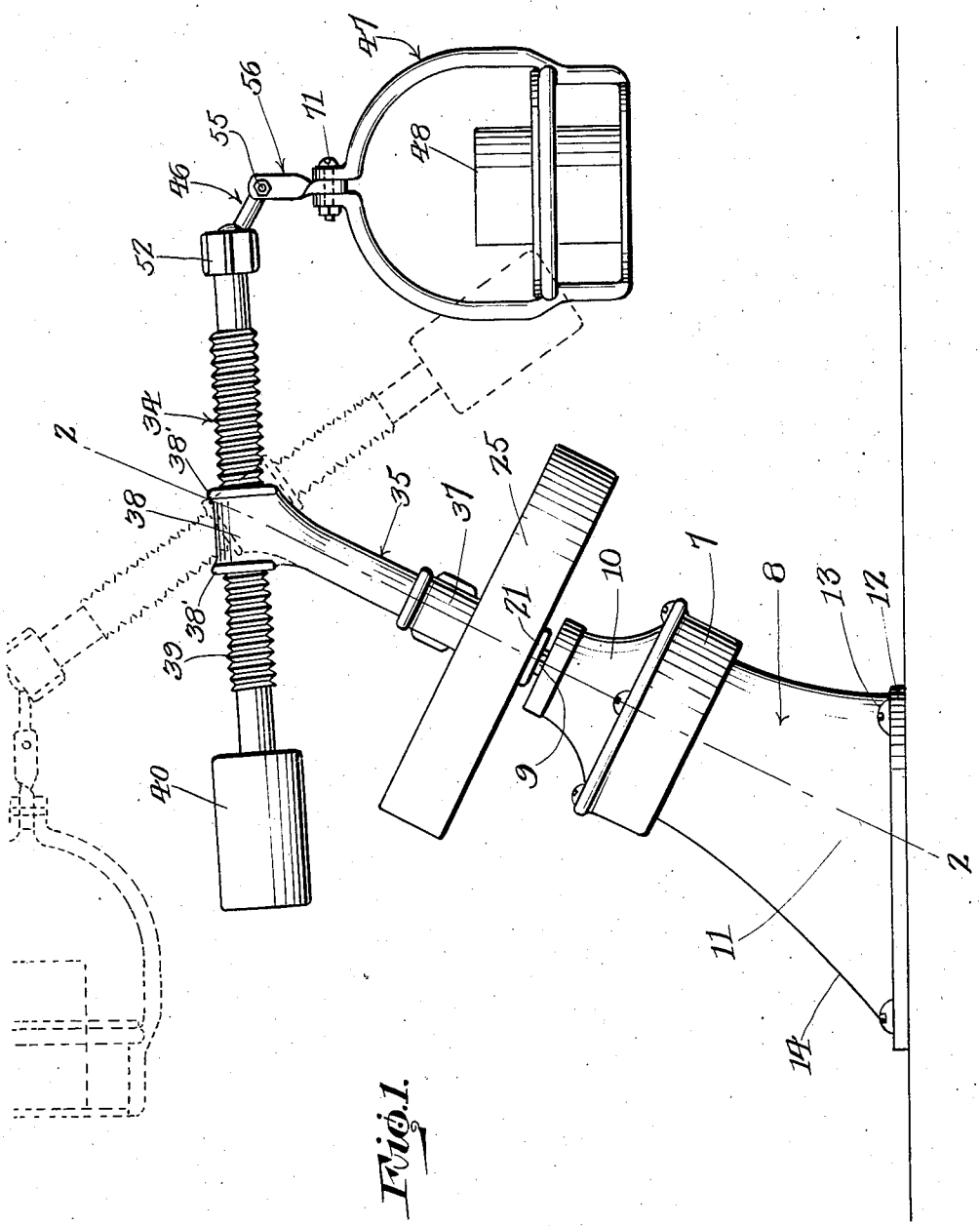


Fig. 1.

Inventor

Webster I. Carpenter

By Geo. P. Kimmel

Attorney

April 14, 1936. W. I. CARPENTER 2,037,618

MOTOR DRIVEN CASTING MACHINE

Filed May 31, 1934 3 Sheets-Sheet 2

Fig. 2.

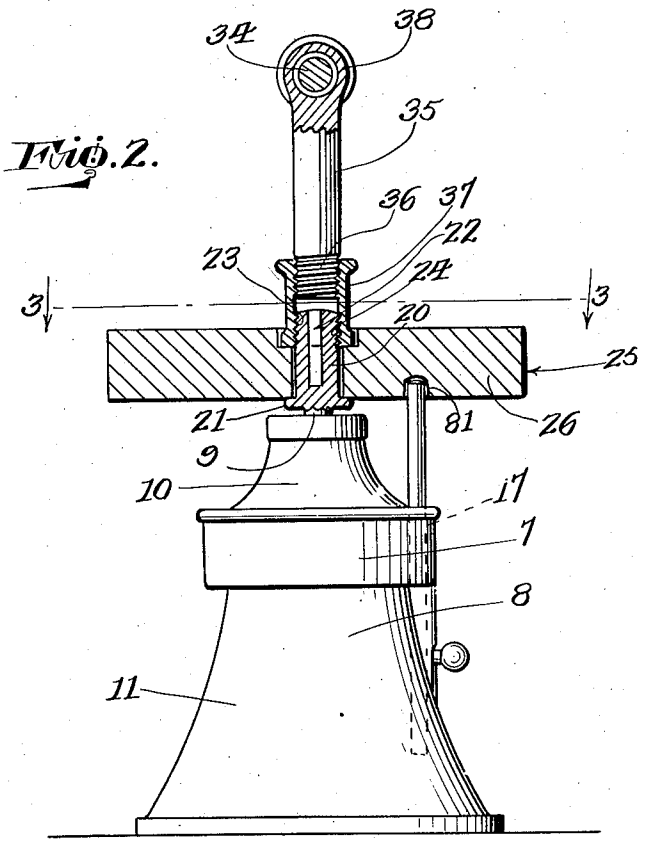


Fig. 3.

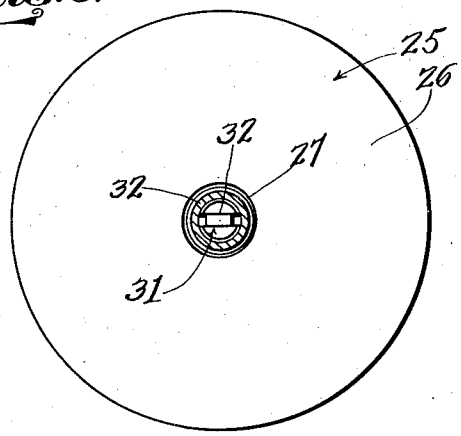
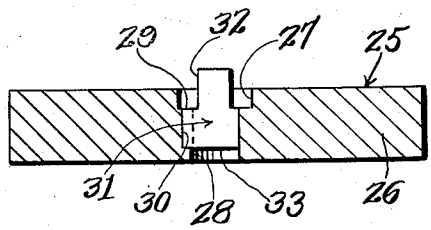


Fig. 4.



Inventor

Webster I. Carpenter

By Geo. P. Kimmel

Attorney

April 14, 1936. W. I. CARPENTER 2,037,618

MOTOR DRIVEN CASTING MACHINE

Filed May 31, 1934 3 Sheets-Sheet 3

Fig. 5.

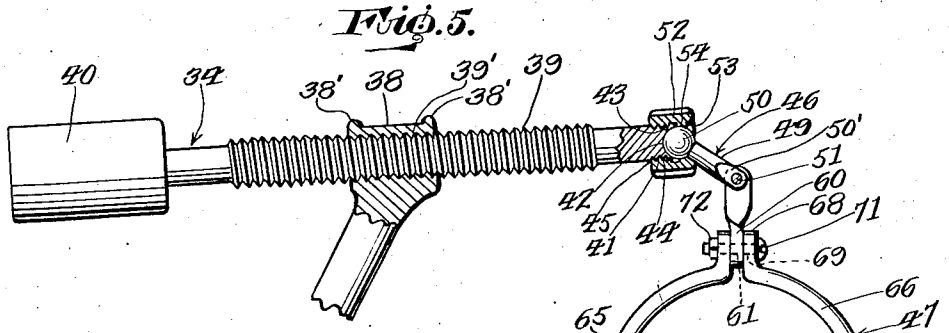


Fig. 6.

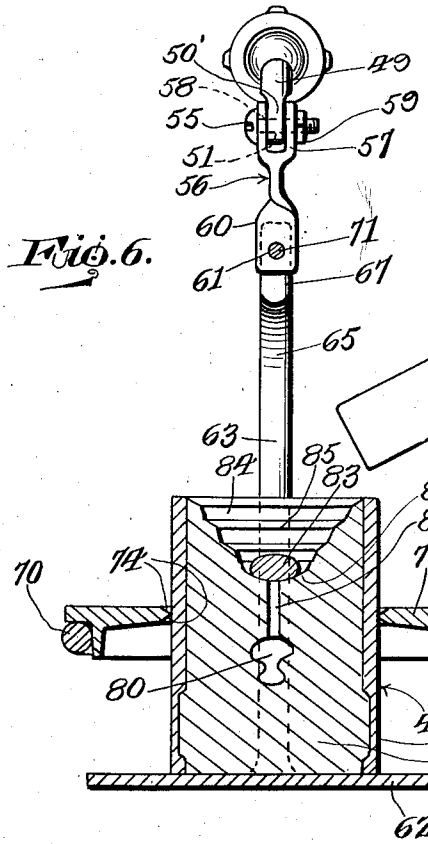
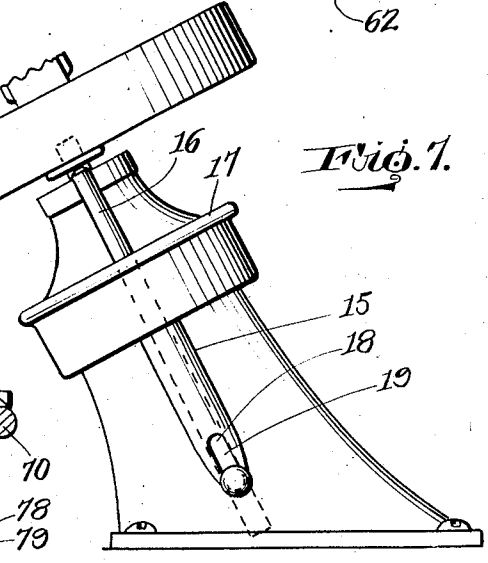


Fig. 7.



Inventor
Webster I. Carpenter

By Geo. P. Kimmel
Attorney

Patented Apr. 14, 1936

2,037,618

UNITED STATES PATENT OFFICE

2,037,618

MOTOR DRIVEN CASTING MACHINE

Webster I. Carpenter, Norfolk, Va.

Application May 31, 1934, Serial No. 728,454

7 Claims. (Cl. 22—65.1)

This invention relates to a centrifugal casting machine designed primarily for use in the making of metallic dental castings, but it is to be understood that a machine, in accordance with this invention may be employed in any connection for which it is found applicable, and has for its object to provide a machine of the class referred to constructed in a manner as hereinafter set forth whereby the applied force thereto will initially create a lifting action upon a casting element carrying a body of molten metal for throwing the latter down into the mold on the first half of the first revolution of the machine and immediately following the throwing of the metal into the mold building up a centrifugal force sufficient to retain the metal in the mold during the second half of said first revolution and during successive revolutions of the machine until the metal has cooled sufficiently to retain shape.

Centrifugal force is a delayed force, it takes time to build it up and for that reason it is not dependable to force the metal in the mold while it is very hot. It is true that centrifugal force is used in some forms of casting machines to force the molten metal into the mold, but it is recognized also that the metal has slightly cooled before the centrifugal force has built up sufficiently to force the metal into the mold, and for this reason it is found that when using a specified size sprue opening to mold that the molten metal, having slightly cooled while waiting for the centrifugal force to build up, does not flow as freely, thereby preventing as much molten metal flowing through the specified sprue opening as would be possible, could the molten metal be forced into the mold immediately while it is very hot, and in a very high state of fluidity. It is further recognized, that molten metal in a very high state of fluidity or while very hot, will adapt to the shape, and crevices of the mold more perfectly, than it is possible to do when it has slightly cooled, yet though, still in a fluid state, is not as mobile as a very hot freely flowing molten metal. It is the primary object of this invention to immediately on the start of the machine to throw a very hot freely flowing molten metal into the mold to attain the advantage as aforesaid.

A further object of the invention is to provide a construction of casting machine whereby molten metal will be thrown immediately into a mold on the starting of the machine resulting in more molten metal being forced into the mold through a specified size sprue opening than would be the case should the metal be allowed to slightly cool. This has a practical value to the dentist, or the user of the machine. It means that the one using the machine does not have to use a large number of sprue openings to the mold to accommodate the passage of the molten metal. Why, because the machine acts to throw the molten metal immediately into the mold while the metal is in a very fluid state.

A further object of the invention is to provide a centrifugal casting machine for throwing metal in a very fluid state into a mold, whereby the very hot fluid state metal will adapt itself to all nooks and crannies of the mold, thereby making a casting with sharp detail, that is a perfect casting. It is a well known fact that when the molten metal has seriously cooled, that it does not, in a rather stiffened condition, flow to all nooks and crannies of the mold. Castings, therefore, have no detail, and the edges all are round, without sharp detail.

A further object of the invention is to provide a motor driven centrifugal casting machine with means to prevent a too fast starting thereof, to overcome the throwing of the molten metal from off of the top of the casting element and waste it.

A further object of the invention is to provide a centrifugal casting machine which will permit of the metal, being heated in the end of the casting element, itself. This keeps the said element hot while the metal is being melted. When the metal is melted, the machine is started, the metal does not have to travel through the air from a crucible to the casting element and thereby cool off seriously, but it being already on the top of the casting element, when the machine starts, is thrown immediately into the mold through the sprue opening leading to the latter.

To the above ends essentially, and to others which may hereinafter appear, the invention consists of such parts, and such combination of parts which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a side elevation of the machine and further illustrating in dotted lines one position of the hanger shaft during the operation thereof,

Figure 2 is a section on line 2—2 Figure 1.

Figure 3 is a section on line 3—3, Figure 2,

Figure 4 is a detail section illustrating the coupling means between the operating and motor shaft,

Figure 5 is a fragmentary in side elevation and in section of the upper portion of the machine,

Figure 6 is an elevation partly in section look-

ing towards one end of the hanger shaft, and

Figure 7 is a fragmentary in side elevation of the lower portion of the machine.

The machine includes a windable spring motor of any suitable type, not shown and which will have its power spring housed within the intermediate portion 7 of a base 8. The motor will be of that type including a power transmitting shaft 9 extended upwardly from the top portion 10 of base 8. Preferably the form of spring motor employed will be similar to that disclosed by Patent 1,195,803, August 22, 1916. It is to be understood however that any suitable motor capable of being installed in the base 8 for driving the operating shaft of the machine may form a part of the latter. The base 8 is permanently disposed at an inclination with respect to the support, not shown, upon which it is mounted and anchored to. The lower portion 11 of base 8 is formed with an outwardly directed flat annular flange 12 having apertures for the passage of holdfast devices 13 for the purpose of fixedly securing the base to its support. The portions 7, 10 and 11 of base 8 are disposed at an inclination to flange 12. The top edge of portion 7 of base 8 is disposed at an inclination. The portion 11 of base 8 is flared at its lower part in one direction sidewise, as at 14. The base 8 is tubular. The portion 7 of the base is of uniform diameter. The portion 10 of the base tapers. The portion 11 of the base 8 has a lengthwise offset web 15 which merges into the bottom of portion 7 and which provides a guide channel for a latching rod 16. The purpose of the latter will be hereinafter referred to. The portion 7 has an opening 17. The rod 16 is of a length to extend from the lower part of portion 11 up through opening 17 and beyond the top of portion 7. The rod 16 carries a finger piece 18 which extends outwardly through a slot 19 formed in the web 15. The finger piece 18 facilitates the shifting of rod 16 to and from latching position. The rod 16 is disposed at an inclination similar to that of base 8.

The shaft 9 is of that type capable of being rotated in opposite directions. It is rotated in an anti-clockwise direction manually to wind up the power spring of the motor. It is rotated in a clockwise direction by the power spring of the motor and then functions as a power transmitting shaft. The shaft 9 has its upper end portion 20 of enlarged outer diameter with respect to that portion of shaft 9 from which it extends. The shaft 9 is disposed at an inclination similar to that of base 8. The portion 20 at its inner end is formed with an outwardly directed annular flange 21. The portion 20 is bifurcated and with the furcation, indicated at 22 opening at the outer end thereof. The portion 20 has peripheral threads designated 23, extending from its outer end to a point in proximity to its transverse median.

There is associated with shaft 9 a weighting means in the form of a fly wheel 25 consisting of a circular disc 26 of materially greater diameter than the portion 7 of base 8. The disc 26 has an axial bore having its wall of two different diameters. The part of largest diameter is designated 27 and the other at 28. The junction of the two diameters of the wall of the bore forms a seat or shoulder 29. The part 27 is of less length than part 28 and is arranged at the upper portion of the disc. The latter is formed with a groove 30 which extends from seat 29 and terminates at a point adjacent the inner face of the disc. The groove 30 opens at seat 29 and into the part 28 of the bore. The disc 26 is positioned in encompassing relation with respect to portion 20 of shaft 9. The disc 26 is coupled to shaft 9 by a key 31 having its upper portion 32 of reduced width with respect to its lower portion 33. The key 31 is seated upon the base wall of the furcation 22 and has its wider portion 33 extend into groove 30 whereby disc 26 will be coupled with shaft 9 to bodily rotate with the latter. The purpose of reducing the upper portion 32 of key 31 will be hereinafter referred to.

The machine includes a horizontally disposed hanger shaft 34 and an inclined operating shaft 35 acting upon shaft 34 to cause it to travel in an inclined circular path. The shaft 35 is permanently inclined to the vertical. The shaft 34 is disposed at an oblique angle to the shaft 35. The latter has its lower portion peripherally threaded as at 36 for engagement by an internally threaded coupling sleeve 37. The internal threads 24 of the latter also engage with the threads 23, of the portion 20 of shaft 9 whereby the latter is coupled to shaft 35 to provide for the latter extending at the same inclination as that of base 8 and to provide for shafts 9 and 35 operating in unison. The sleeve 37 extends into the part 27 of the wall of the bore of disc 25 and bears against seat 29 whereby the inner end of sleeve 37 will coact with seat 29 and flange 21 for holding disc 26 in a manner to prevent it shifting lengthwise of portion 20 of shaft 9. The reduced upper portion 32 of key 31 functions to provide a clearance for the threads on the inner face of sleeve 37. Formed integral with the upper end of the shaft 35 is an internally threaded sleeve 38 which is disposed at an angle with respect to the axis of shaft 35, and extends from one end to the other at a slight upward inclination with respect to the upper end of shaft 35. The length of sleeve 38 is greater than the diameter of and extends forwardly and rearwardly beyond opposed sides of shaft 35.

The shaft 34 extends through and projects beyond each end of sleeve 38. The shaft 34 is peripherally threaded intermediate its ends, as at 39 for engagement with the threads 39' of sleeve 38. The shaft 34 is adjustable lengthwise of sleeve 38 and has one end portion formed with an integral counterweight 40. The other end portion 41 of shaft 34 has peripheral threads 43 and a concave recess 42 which is formed in the end edge 44 of portion 41. At the inner end of the threads 43 shaft 34 is provided with a peripheral shoulder 45. The shaft 34 extends at the same pitch as that of sleeve 38.

Extended from the end edge 44 of shaft 34 is a suspension member 46 for a carrier or basket 47 for a casting element 48. The member 46 consists of a stem 49 provided at its upper end with a spherical enlargement 50 which seats in the recess 42. The lower end of stem 49 is reduced, as at 50' and formed with an aperture 51. Threadedly engaged with the threads 43 is a retaining collar 52 formed at its outer end with an inwardly arranged annular flange 53 having its rear face 54 curved for seating against the enlargement 50. The latter, recess 42 and the flange 53 coact to provide a universal joint connection between shaft 34 and member 46.

Carried on a pivot 55 disposed at right angles to the axis of shaft 34 is a torsionally twisted hanger 56 for the carrier 47. The upper portion of hanger 56 is in the form of a yoke 57 having its arms formed with aligning openings 58. The

lower end 50' of the stem 49 is positioned between the arms of yoke 57 with the aperture 51 aligning with the openings 58. The pivot 55 extends through aperture 51 and openings 58 and carries a retaining nut 59 therefor. The lower portion of hanger 56 is designated 60 and formed with an opening 61 disposed at right angles to the openings 58.

The carrier 47 includes a bottom plate 62 upon which is seated the casting element 48 and a pair of oppositely disposed arms 63, 64 formed with inturned upper portions 65, 66 respectively terminating in vertically disposed parallel spaced portions 67, 68 respectively formed with parallel openings 69. The carrier 47 also includes a support 70 in the form of an annulus which is arranged between and secured to the arms 65, 66 between the transverse medians of said arms and plate 62. The lower portion 60 of hanger 56 is arranged between the portions 67, 68 of the arms of the carrier and has its opening 61 align with the openings 69. Extending through the aligning openings 61, 69 is a pivot bolt 71 carrying a securing nut 72. The support 70 is adapted to have removably mounted therein a balance member 73 in the form of an annulus and which also functions as a retainer for the element 48. The inner edge of member 73 is oppositely beveled as at 74.

The casting element 48 includes a casting ring 78, an investment 79, a molding chamber 80, and a sprue opening 81 leading to chamber 80. One end of investment 79 is formed with an opening 84 having its wall at the base thereof formed with a cavity 82 for receiving the body of metal 83 to be melted. The sprue opening 81 communicates with the cavity 82. The wall of opening 84 is terraced as at 85.

As is well known in all motor driven machines they are open to the objection of too quick starting, now to overcome the objection it is necessary to have the machine in accordance with this invention so constructed to overcome that too quick starting. In connection with this invention it is accomplished by adding weight in the form of the fly wheel 25 and also rigidly fixing the counterbalance 40 to the shaft 38 which gives added weight to the fly wheel 25. It is recognized that when the spring of a spring motor is wound up that the pull force of the spring increases as it is wound up. Consequently when the spring is released, the greater pull is right from the start, therefore, the fly wheel structure absorbs this initial strong pull of the spring and prevents a too fast starting of the machine, which otherwise would throw the molten metal from off of the top of the casting element.

The fly wheel 25 not only acts to absorb the initial strong pull of the motor spring, but also constitutes a momentum for a shaft 9. The wheel 25 is latched from movement by the rod 16 being extended into a socket 86 (Figure 2) formed in the lower face of the disc 26. The fly wheel 25 is disposed in an inclined plane parallel to that of the edge of the upper end of portion of base 8.

The machine permits of the metal being heated in one end of the casting element itself by a blow pipe, and this keeps the said element hot while the metal is being melted. When the metal is melted the machine is started and the molten metal travels immediately into the molding chamber through the sprue opening. The construction of the machine will give a lift action on the starting thereof, before any centrifugal force has had time to build up and such action throws the very hot molten metal immediately down into the molding chamber on the first half turn of the first turn of shaft 34. By this time the centrifugal force has built up sufficiently to retain the molten metal in the molding chamber during the second one half turn of the shaft 34, and for all successive turns of said shaft, until the metal has cooled sufficiently to retain shape. The lifting action attained on the starting of the machine is due to the inclination of the operating shaft.

The arranging of sleeve 38 in the manner as shown prevents the carrier suspended from shaft 34 hitting the support to which base 8 is attached, the blow pipe employed for heating the metal or other objects on the support in proximity to the machine during the revolving of shaft 34 and which would not be the case if the ends 38' of sleeve 38 were parallel to the axis of shaft 35.

The shaft 34 is adjustable lengthwise of the sleeve to balanced position and when so adjusted one end thereof is moved away from and its other end moved towards the center of gravity resulting without the necessity of ajusting the counterbalance lengthwise of said shaft.

When the machine is operated, the shaft 34 sweeps out two conical paths with the apices of the cones adjacent. The axis of the two cones being common to each other and being one and the same as the axis of the shaft 35. Upon initially starting the machine the shaft 34 not only starts to course in a circle but as the shaft 34 travels in a slightly upward direction, the carrier 47 swings outwardly and the shaft 34 tends to lift the carrier 47 until its long axis approaches a point approximately at a right angle to the axis of shaft 34, and therefore the centrifugal force does not whip the carrier up to position as the machine speeds up. During the aforesaid outward and lifting action applied to the carrier 47, the latter is at the same time being carried in a circular path, the axis of which is parallel and one and the same as the axis of shaft 35. As the latter is permanently inclined to the vertical and the shaft 34 disposed at an oblique angle to shaft 34 no two points on the shaft 34 travel in the same path, but each individual point of shaft 34 travels in a circular path, the axis of which is the axis of shaft 35.

The fly wheel not only provides for the retarding function referred to, but also acts to develop a gyroscopic force that steadies the superstructure of the machine should the counterbalance and the carrier be slightly out of balance.

What I claim is:—

1. In a centrifugal casting machine, an upstanding rotatable operating shaft permanently inclined to the vertical, a revoluble hanger shaft having a fixed counterbalance at one end and universally suspended from its other end a casting element arranged to carry a body of molten metal, said hanger shaft being connected intermediate its ends to, operated from and permanently disposed at an oblique angle to said operating shaft whereby on the start of each rotation of said operating shaft a lifting action will be imparted to the hanger shaft to immediately throw the molten metal into the casting element and on continuation of the rotation of the operating shaft centrifugal force will be built up to maintain the metal within said element.

2. In a centrifugal casting machine, an upstanding rotatable operating shaft permanently inclined to the vertical, a revoluble hanger shaft

having a fixed counterbalance at one end and universally suspended from its other end a casting element arranged to carry a body of molten metal, said hanger shaft being connected intermediate its ends to, operated from and being permanently disposed at an oblique angle to said operating shaft whereby on the start of each rotation of said operating shaft a lifting action will be imparted to the hanger shaft to immediately throw the molten metal into the casting element and on continuation of the rotation of the operating shaft centrifugal force will be built up to maintain the metal within said element, a motor driven shaft permanently inclined to the vertical and having its axis corresponding to the axis of said operating shaft, and means for connecting said operating and driven shafts in endwise opposed relation.

3. In a centrifugal casting machine, an upstanding rotatable operating shaft permanently inclined to the vertical, a revoluble hanger shaft having universally suspended from one end thereof a casting element arranged to carry a body of molten metal, said hanger shaft being connected intermediate its ends to, operated from and being permanently disposed at an oblique angle to said operating shaft whereby on the start of each rotation of said operating shaft a lifting action will be imparted to the hanger shaft to immediately throw the molten metal into the casting element and on continuation of the rotation of the operating shaft centrifugal force will be built up to maintain the metal within said element, a motor driven shaft permanently inclined to the vertical and having its axis corresponding to the axis of said operating shaft, means for connecting said operating and driving shafts in endwise opposed relation, a combined absorbing and momentum means of disc-like form connected to, bodily moving with and disposed concentrically to the axis of said driven shaft for retarding quick starting of said operating shaft, and a coupling connecting the operating shaft to the driven shaft including means to prevent the disc shifting lengthwise of the driven shaft, said coupling means disposed concentrically to the axes of said shafts.

4. In a centrifugal casting machine, a revoluble hanger shaft provided with a fixed counterweight at one end, a suspension means for a casting element carrier formed of an inner and an outer section pivotally connected together, said shaft at its other end and said inner section having coacting parts forming a ball and socket joint, means for pivotally connecting the outer end of said outer section to said carrier, an operating shaft permanently inclined to the vertical for revolving the hanger shaft, and means for connecting said hanger shaft to the upper end of said operating shaft at an oblique angle.

5. In a centrifugal casting machine, a suspended carrier for a casting element arranged to support a body of molten metal at its top, and a bodily rotatable structure including an operating shaft and a hanger shaft connected upon the upper end of the operating shaft, means for suspending the carrier from said hanger shaft, the said operating shaft being permanently disposed at an inclination to the vertical and said hanger shaft being permanently disposed at an oblique angle to the operating shaft to provide during each rotation of the operating shaft for the hanger shaft applying a lifting action on the carrier to immediately throw the molten metal into the casting element and for applying centrifugal force to the said carrier immediately following the lifting action to maintain the metal within said element.

6. In a centrifugal casting machine a rotatable operating shaft permanently inclined to the vertical, a revoluble hanger shaft operated from said operating shaft, means for suspending a casting element from the hanger shaft, and means at the upper end of the operating shaft for connecting the hanger shaft intermediate its ends to and for permanently maintaining the hanger shaft at an oblique angle to said operating shaft.

7. In a centrifugal casting machine a weighted rotatable operating shaft permanently inclined to the vertical, a revoluble hanger shaft operated from said operating shaft and having a fixed counterweight at one end and a recess at its other end, a suspension formed of an inner and an outer section pivotally connected together at one end, said inner section being formed with a globular enlargement at its other end arranged in said recess, means for loosely connecting the enlargement to the hanger shaft in extended relation thereto, means at the other end of the outer section of the suspension and disposed at right angles to the pivot between said sections of the suspension for pivotally connecting a casting element carrier to said suspension, and means at the upper end of the operating shaft for connecting the hanger shaft intermediate its ends to the operating shaft and for permanently maintaining the hanger shaft at an oblique angle to said operating shaft.

WEBSTER I. CARPENTER.