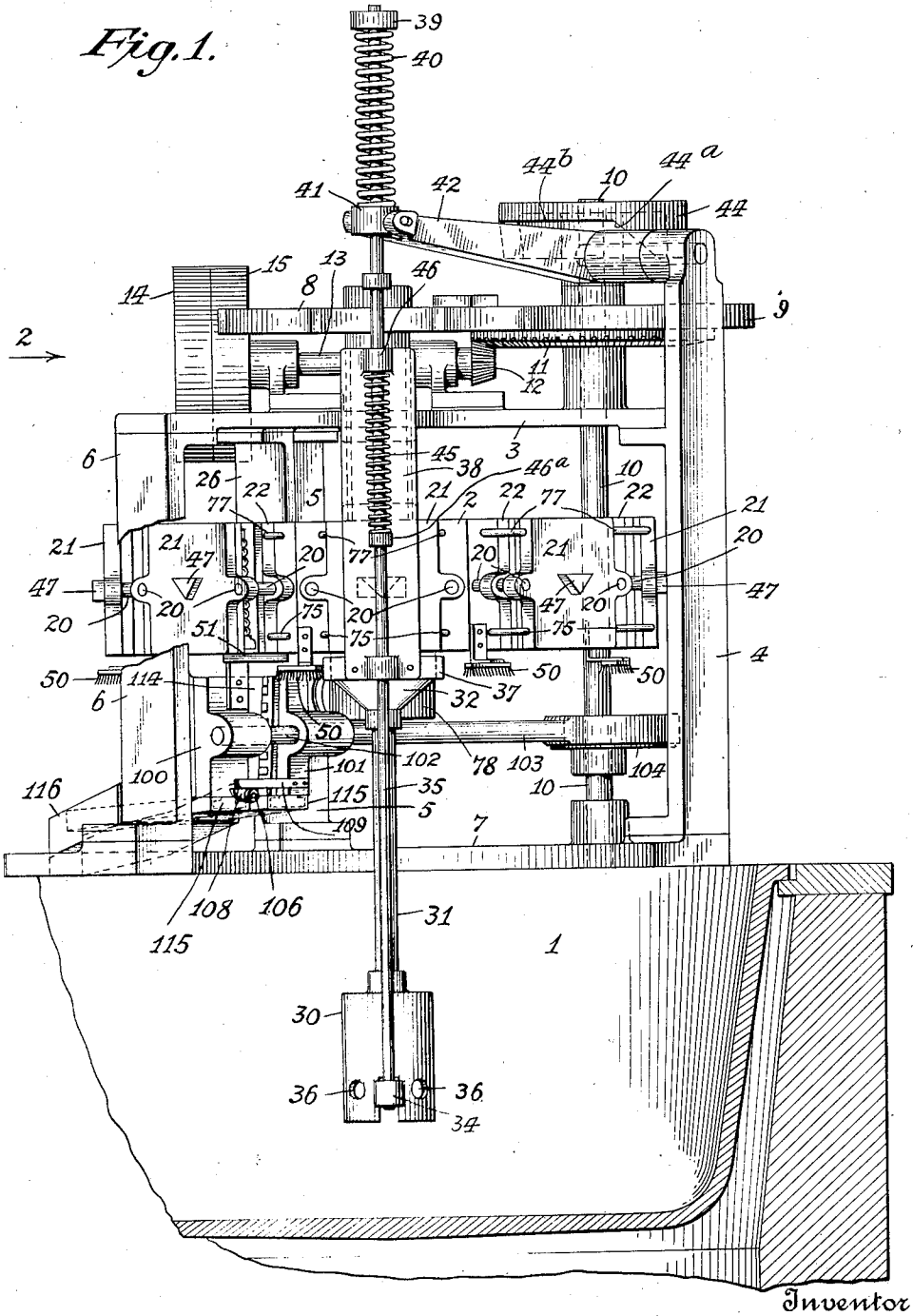
April 14, 1925. 1,533,649

C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

Filed Oct. 21, 1918 9 Sheets-Sheet 1

Fig. 1.



Inventor
Charles E. Hopkins

By his Attorney
Fred Becker

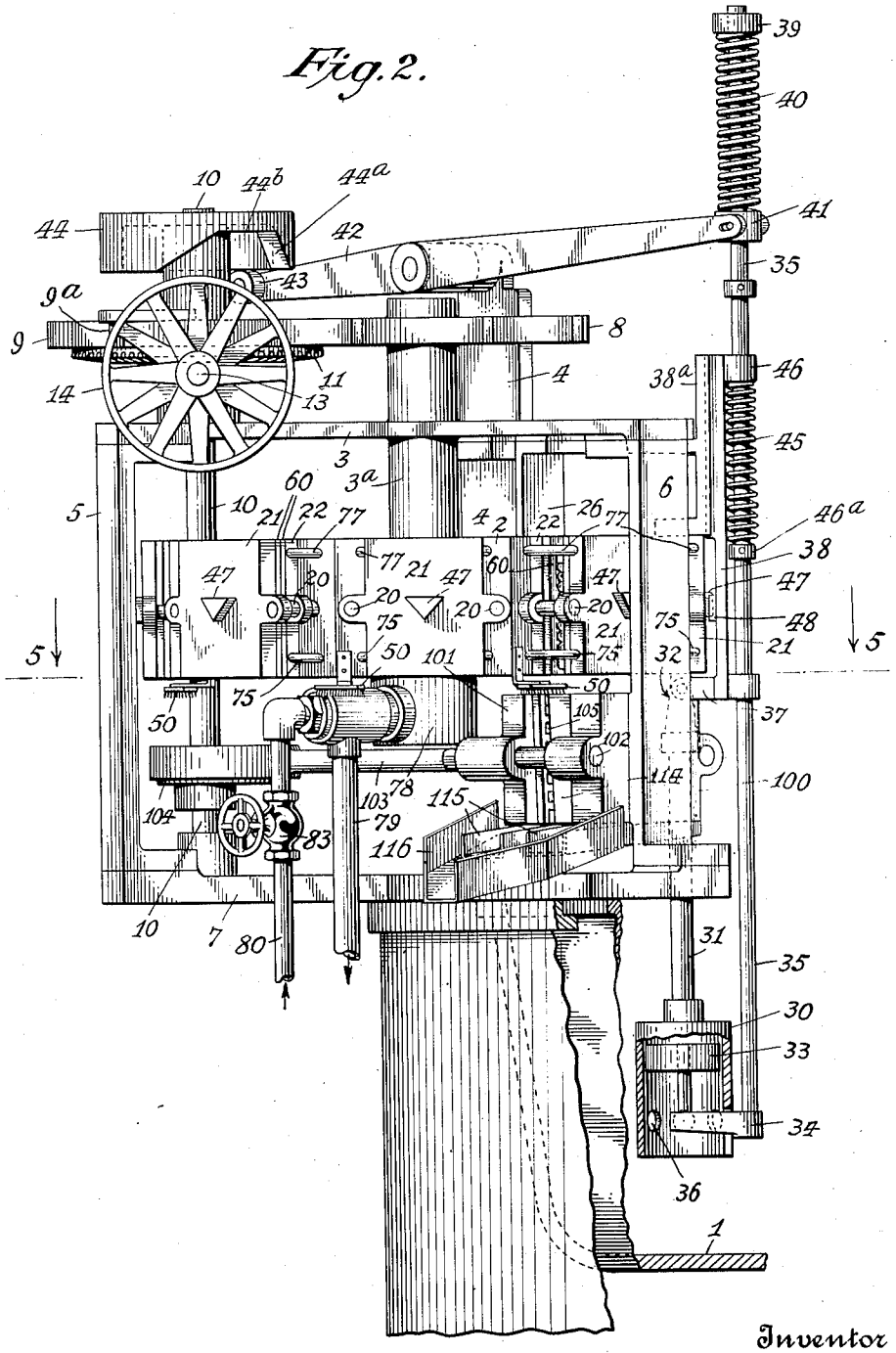
April 14, 1925. 1,533,649

C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

Filed Oct. 21, 1918 9 Sheets-Sheet 2

Fig. 2.



Inventor
Charles E. Hopkins
By his Attorney
Albert Peeler

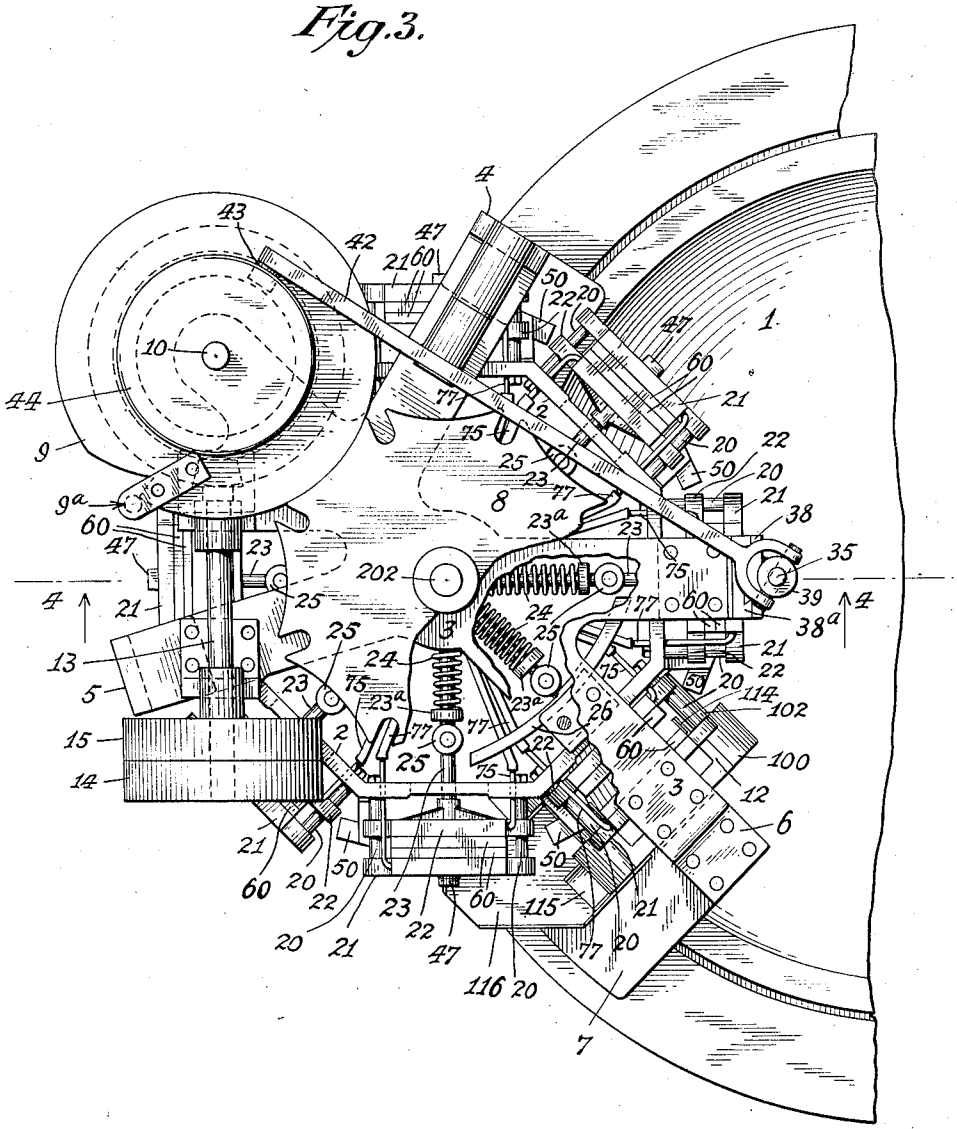
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C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

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Fig. 3.



Inventor
Charles E. Hopkins
By his Attorney
Albert Becker

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C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

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Fig. 4.

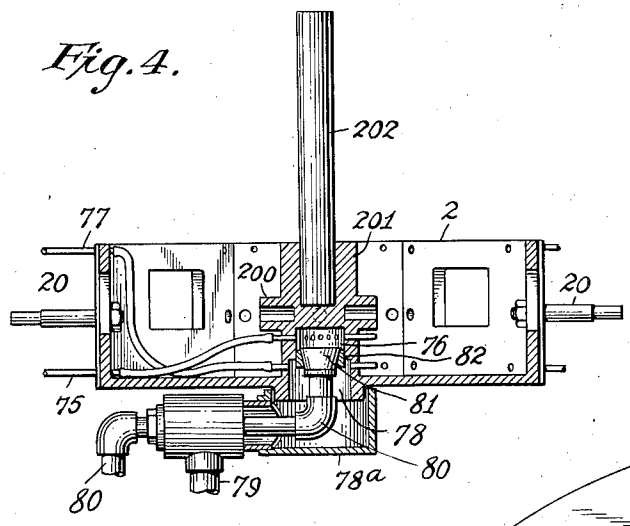
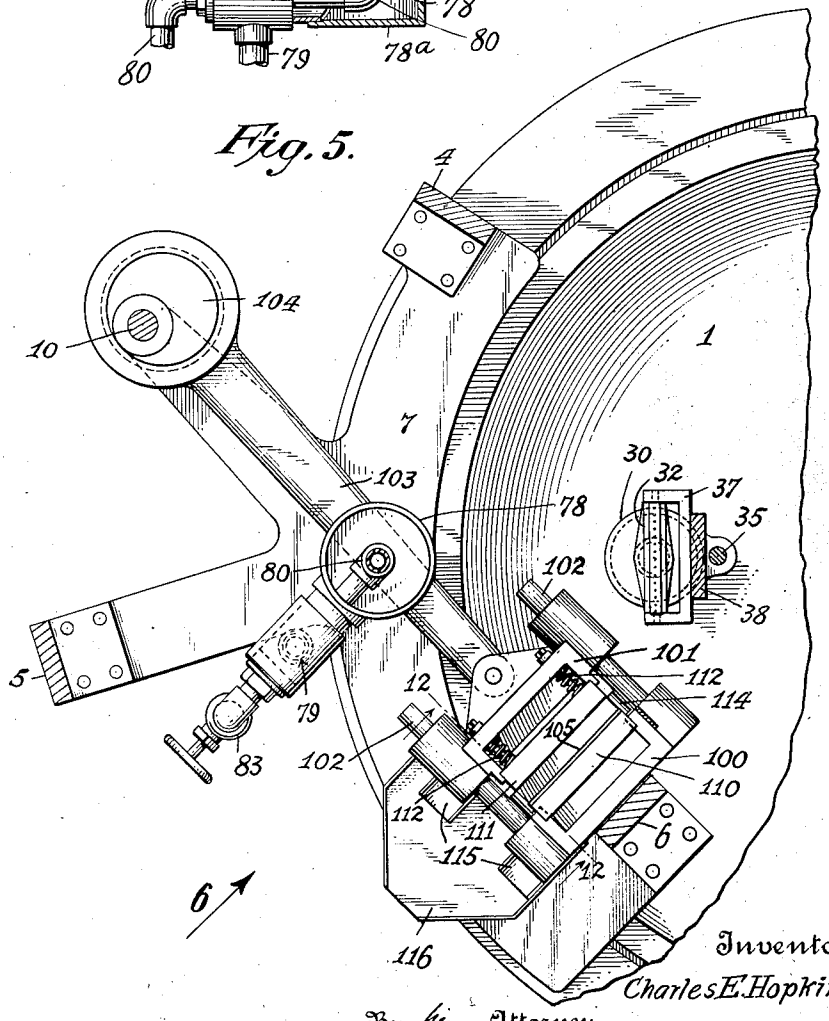


Fig. 5.



Inventor
Charles E. Hopkins
By his Attorney

April 14, 1925. 1,533,649

C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

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Fig. 6.

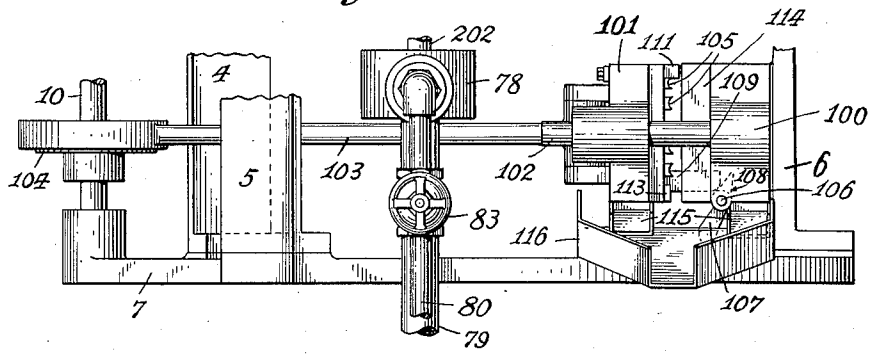


Fig. 7.

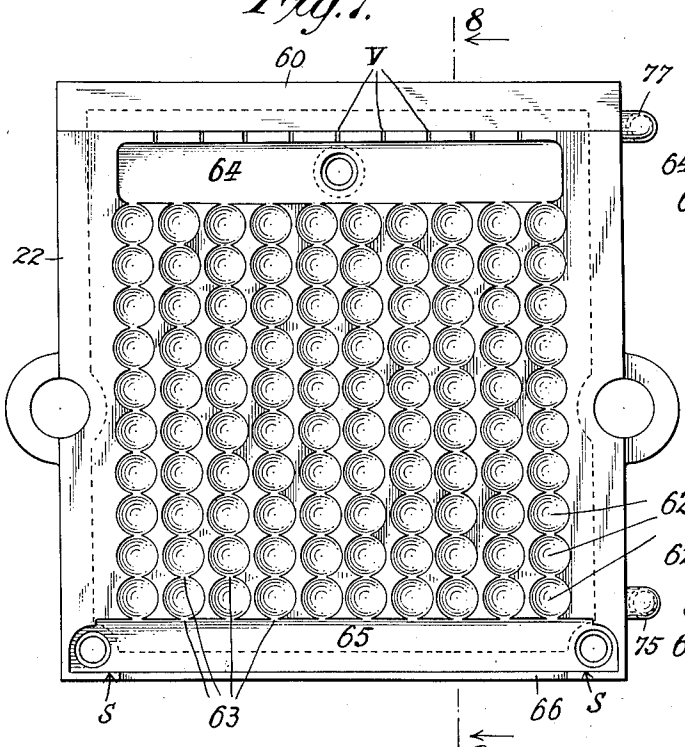
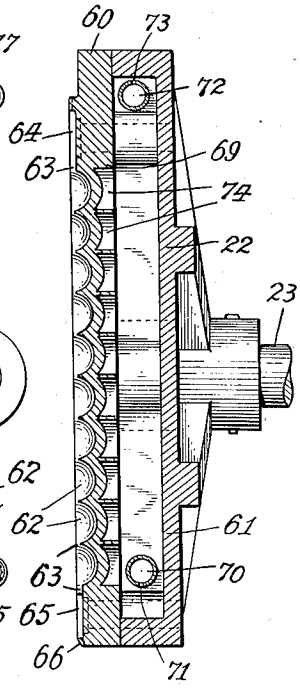
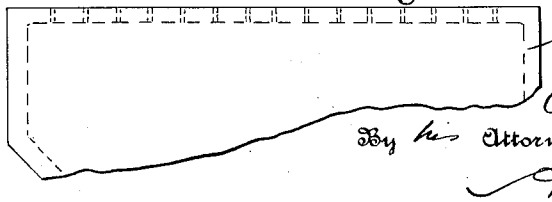


Fig. 8.







Inventor

Charles E. Hopkins

By his Attorney

Arthur Becker

April 14, 1925. 1,533,649

C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

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Fig. 11.

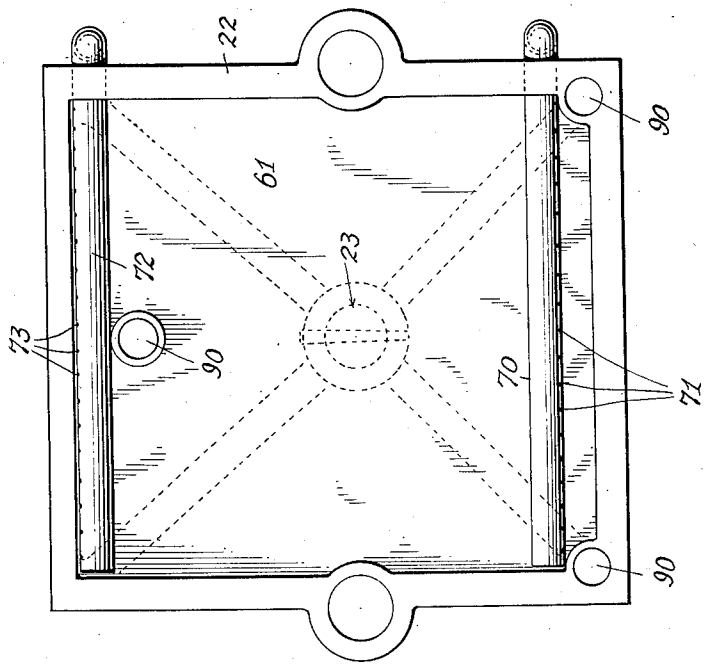
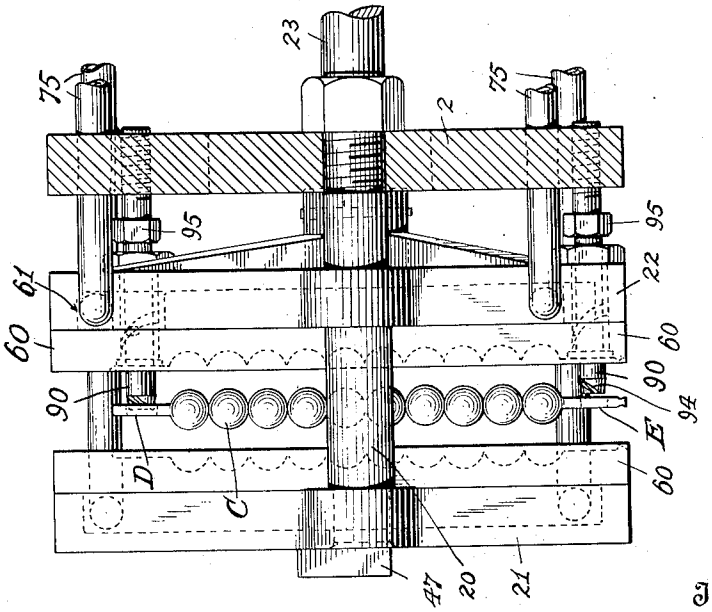


Fig. 9.



Inventor
Charles E. Hopkins
By his Attorney
Arthur Becker

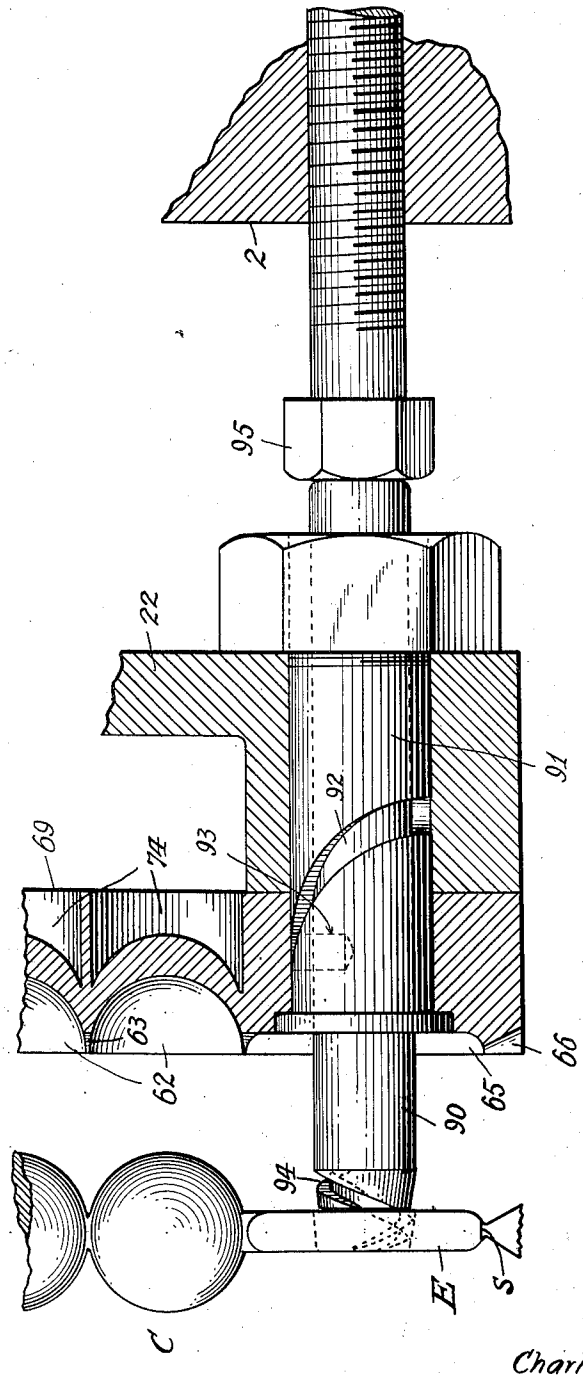
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C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

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Fig. 10.



Inventor
Charles E. Hopkins
By his Attorney
Arthur Becken

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C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

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Fig. 12.

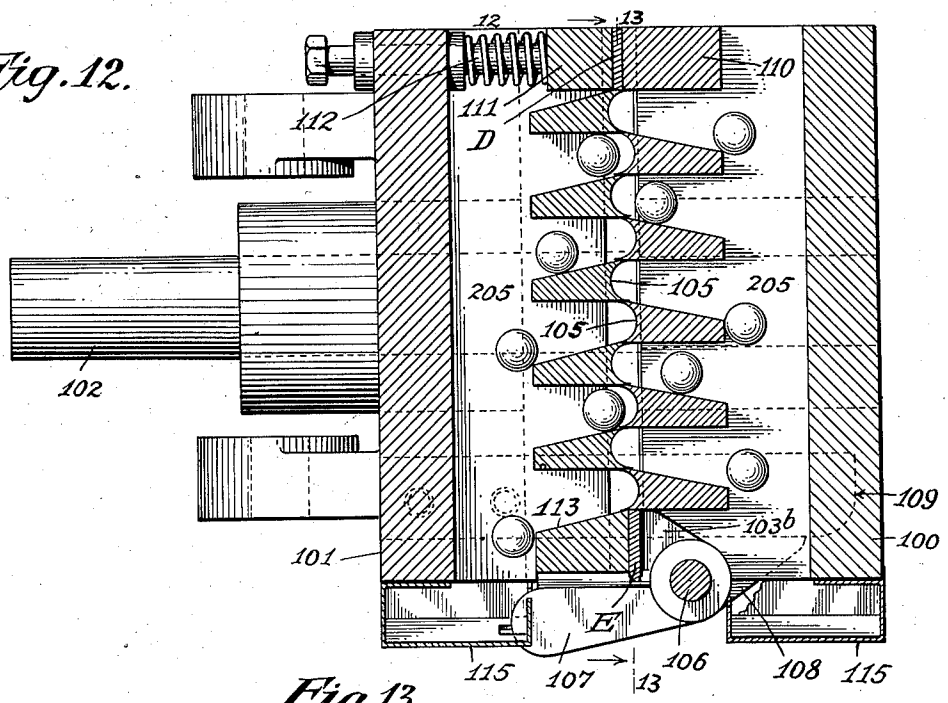
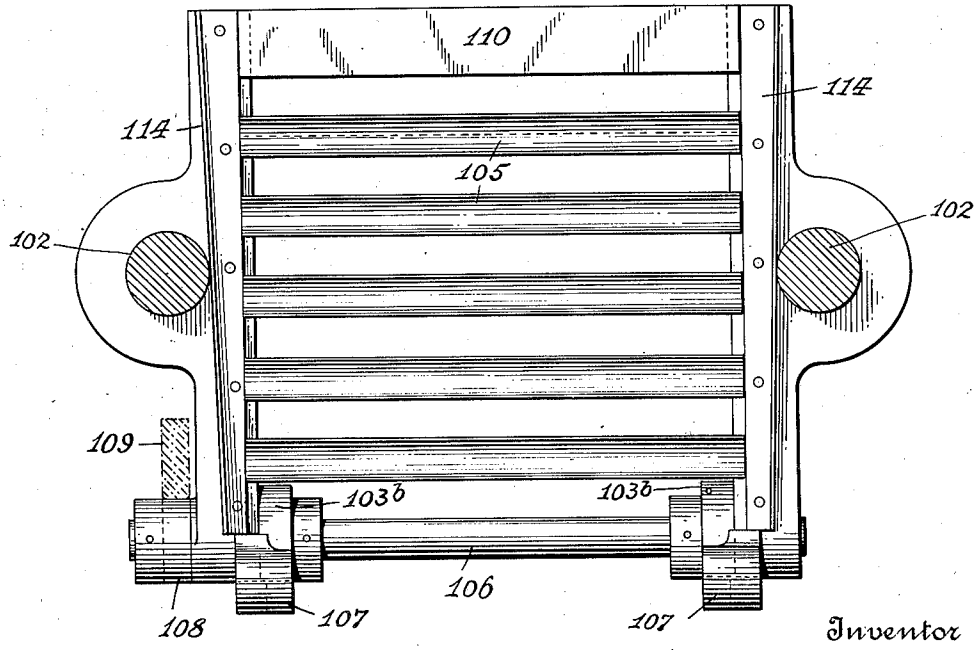


Fig. 13.



Inventor
Charles E. Hopkins
By his Attorney
Arthur Becken

April 14, 1925. 1,533,649

C. E. HOPKINS

CASTING APPARATUS AND PROCESS OF CASTING

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Fig. 14.

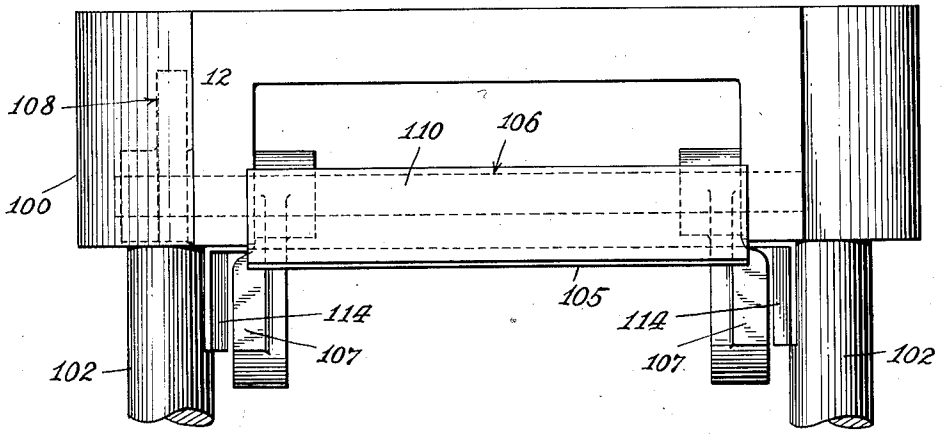
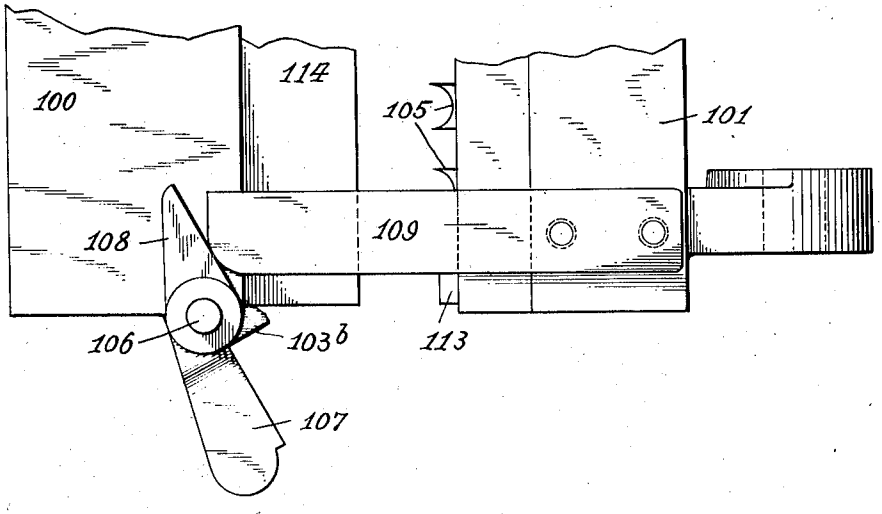


Fig. 15.



Inventor
Charles E. Hopkins
By his Attorney
Arthur Becken

Patented Apr. 14, 1925. 1,533,649

UNITED STATES PATENT OFFICE.

CHARLES E. HOPKINS, OF PLAINFIELD, NEW JERSEY; THE PLAINFIELD TRUST COMPANY, OF PLAINFIELD, NEW JERSEY, ADMINISTRATOR OF ESTATE OF CHARLES E. HOPKINS, DECEASED.

CASTING APPARATUS AND PROCESS OF CASTING.

Application filed October 21, 1918. Serial No. 259,048.

To all whom it may concern:

Be it known that I, CHARLES E. HOPKINS, a citizen of the United States, and a resident of Plainfield, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Casting Apparatus and Processes of Casting, of which the following is a specification.

The present invention relates generally to casting apparatus and the process of producing simultaneously a plurality of castings.

It has for its main object the rapid production, in great quantities, of small objects, such as bullets, and also the further object of providing simple and automatic means irrespective of the size of the object to be produced for making castings in rapid succession.

One feature of the invention resides in a method for producing in web form, by casting, a plurality of objects in which the web so produced is discharged from the mold and clamped into position for the purpose of breaking it up or severing it mechanically, into individual castings, this being accomplished, preferably, by forming the casting or web, at both ends, with overcast portions to afford a medium that may be clamped to hold the casting while the web is being operated upon to sever the individual castings or objects, the overcast and the castings, after severance, being directed into separate channels for the purposes of collecting the individual castings into a suitable container and returning the overcast portions to the melting pot.

Another feature of the invention resides in means whereby the casting produced by the mold may be removed from both mold members, preferably by the action of opening the mold itself after which it is discharged into a separating device that properly aligns and supports the casting and subsequently breaks it up and separates the overcast from the casting itself. In connection with this feature of the invention there is provided in the mold an ejecting means which, in the present instance, takes the form of a plurality of rods or members that project into the mold chamber and become embedded in the casting. Upon the opening of the mold these members move first with one mold member to separate the casting from the other mold member after which the first mold member continues its movement independently of the ejecting means so as to separate the casting from the first mold member, said casting remaining suspended on the ejecting means in the open mold. Suitable means are provided for releasing the ejecting means from the cast, the freeing of the casting, in this instance, being effected by imparting a rotating motion to the ejecting members, said motion being preferably produced by the mere opening of the mold itself during the latter part of the opening movement. As here shown, the ejecting members are provided with threaded portions that preferably become embedded in the overcast portions that are located both at the top and bottom of the casting produced by the mold so that after the cast has been separated from the walls of the mold, a partial rotation of the ejecting members will unscrew them from the threaded members formed in the casting and will permit the latter to drop into the breaking-up device.

The invention further comprises an automatic molding apparatus in which means for delivering a charge of molten metal is located at the casting point in connection with which is used a mold consisting of a plurality of members relatively movable with respect to each other to open and close the molds, said members being movable, at intervals, into and out of position with respect to the casting point to receive a charge of molten metal. In the more particular form of the invention herein disclosed, a plurality of molds, that are brought in succession to the casting point are used, this operation being effected by means that operate, preferably, intermittently; and the casting produced is carried around until just before it reaches casting position again when the mold is opened and the casting discharged.

Another feature of the invention resides in means for cooling the casting molds in transit consisting here of a centrally disposed water supply or distributing chamber coincident with the axis of rotation of a supporting member or turret that carries molds together with suitable connections

between the water jackets of the casting molds and the distributing chamber.

Other features of invention will appear as the specification proceeds.

In the accompanying drawings there is disclosed a concrete and preferred embodiment of the invention, in which—

Figure 1 is a front elevation of the casting apparatus with part of the frame-work broken away and a part of the melting pot shown in section, the pump being shown in the elevated position occupied by it during the introduction of a charge of metal into a casting mold.

Figure 2 is a view in elevation, looking in the direction of the arrow 2 of Fig. 1, with the parts occupying the same position as in Fig. 1 and with a portion of the melting pot in section.

Figure 3 is a top plan view of the parts shown in Figs. 1 and 2 with portions broken away and in section.

Figure 4 is a vertical section through the turret and water distributing means taken on the line 4—4 of Fig. 3, the molds and other parts being omitted.

Figure 5 is a horizontal sectional view substantially on the line 5—5 of Fig. 2.

Figure 6 is a view looking in the direction of arrow 6 of Fig. 5, the melting pot and pump being omitted.

Figure 7 is a face view of the interior of the movable mold member showing the relation of the pump nozzle to the mold, the latter being in its lower position.

Figure 8 is a sectional view on the line 8—8 of Fig. 7 showing also the nozzle in end elevation and located as in Fig. 7.

Figure 9 is an assembled view of the members composing the mold showing the mold in position on the turret, the turret being in section and the mold members in their open position with a casting suspended by the ejecting means.

Figure 10 is a sectional view of the lower portion of the movable mold member together with a portion of the casting in position on the ejecting means showing more particularly the mechanism for causing the ejecting means to disengage the casting.

Figure 11 is a view in elevation of one of the water jackets of the mold, the face plate constituting the mold being omitted.

Figure 12 is a vertical sectional view of the breaking up device taken on the line 12—12 of Fig. 5 showing the parts in their closed position with a casting clamped and broken.

Figure 13 is a sectional view on the line 13—13 of Fig. 12 showing the stationary breaking member in elevation.

Figure 14 is a top plan view of the parts shown in Fig. 13.

Figure 15 is a fractional view in elevation of the lower part of one side of the breaking device, showing particularly the means for actuating the positioning fingers for supporting the casting.

1 indicates a melting pot of any suitable construction on the upper part of which there is a bed plate 7 carrying three upright legs 4, 5 and 6 united at the top by a spider 3. Rotatably mounted in a bearing 3^a, carried by said spider, is a rotatable member or turret 2, in this instance provided with eight faces. This turret carries a plurality of molds and is actuated by suitable means for intermittently advancing the molds in succession to and from a casting point denoted by a pump nozzle 32 and to and from a breaking device which extends over the melting pot and is located, with respect to the direction of rotation of the rotatable member or turret, in advance of the casting point. Any suitable means may be used for effecting an intermittent rotation of the turret taking, in the present instance, the form of a Geneva stop motion and consisting of a slotted disk 8, mounted on the turret, with which engages a pin 9^a on a disk 9 mounted on a shaft 10 carried by a bearing on bed plate 7 and spider 3. Suitable means for rotating shaft 10 are provided consisting, in the present instance, of a power shaft 13 disposed horizontally in bearings carried by spider 3 and having fast and loose pulleys 14 and 15. Motion is transmitted from this power shaft 13 to shaft 10 by means of a bevel pinion 12 meshing with a bevel gear 11, so that with each revolution of the vertical shaft 10, turret 2 is moved one step.

The molds are mounted exteriorly of the turret by means of horizontally disposed arms 20 that project from the faces of the turret. Each mold consists preferably of a stationary and of a movable member, 21 and 22, the movable member being disposed between the stationary member and the face of the turret. Suitable means are provided for automatically opening and closing the molds which are so arranged that, when each mold reaches the casting position, the members thereof are closed with respect to each other to receive and retain a charge of molten metal and this closed position is maintained while they are advancing and until they reach the breaking device when the mold is again automatically opened. In the embodiment herein shown, the means for opening and closing the molds take the following form. A movable mold member 22 is slidably mounted on arms 20 and each carries an actuating rod 23 that extends through and slides in, the face of turret 2 and in bearings 200 radially disposed on a hub 201. This hub 201 is, in the present instance, formed integrally with the turret structure 2, as best seen in Fig. 4, and is mounted on a shaft 202 which, in turn, is mounted in

bearings of spider 3. Carried by rod 23 is an anti-friction roller 25 adapted to engage with a cam 26 fixed on the frame-work in such a position that, as each mold reaches the breaking device, the mold members will be open. The cam is of such length that it will not extend up to the casting point where the mold is in casting position so that the members of said mold may be again closed before receiving the charge of metal. Fixed to rod 23 is a collar 23^a between which and bearing 200 is a compression spring 24 normally urging the members of the mold into closed position, the action of said spring being overcome by engagement of roller 25 with cam 26, as described. So far as the general arrangement of the parts is concerned, the particular mold structure is immaterial and the nature of the casting made is likewise immaterial. However, the mold structure embodies in itself new and valuable features of construction as will appear.

The means for delivering a charge of molten metal here consist of a pump constructed in the following manner. The pump cylinder indicated by 30, is open at its lower end and is suspended within a melting pot by means of a tube 31 terminating at its upper end in a mouth piece or nozzle 32, of such shape as to properly coact with the under surface of the mold into which the metal is to be introduced. The nozzle 32 is provided with a series of small aligned perforations or outlets, as shown in Fig. 5, and is carried by a yoke 37 attached to a sliding member 38 movable in guides 38^a attached to spider 3. Mounted on the slide 38 is a collar or bushing 46 through which extends a rod 35 on the lower end of which is an arm 34 carrying a pump piston 33. 46^a indicates a collar, fast on rod 35 and between which and collar 46 of slide 38 is a spring 45. Carried at the upper end of rod 35 is a stop collar 39 between which and a movable collar 41 is a heavy compression spring 40. The movable collar 41 is connected to rock arm 42 pivotally supported on the frame-work, as shown, and actuated by means of cam roller 43 engaging with cam 44 carried on shaft 10. On rotation of cam 44, roller 43 will engage an inclined face 44^a. This will act to raise rod 35 and, through spring 45, will also cause slide 38 to move in guide ways 38^a so that pump cylinder 30 and pump piston 33 will be raised in unison until the nozzle 32 comes in engagement with the lower part of a mold in casting position. It will be understood that at this time, piston 33 is at the lower end of cylinder 30 and that metal has flowed in through the openings 36 filling the pump chamber. When the nozzle 32 engages the mold in the manner described, the slide 38 can no longer move upward and, consequently, the upward movement of collar 41 will lift rod 35 as fast as the outflowing metal in the pump chamber will permit it to be lifted, the spring 45 being compressed during this action. The movement of collar 41 is, however, greater than the movement of piston 33 and spring 40 will consequently also be compressed. Cam roller 43 has, by this time, reached the high point of cam 44 thereby continuing to hold spring 40 under compression and as fast as the metal in pump cylinder 30 escapes through nozzle 32, the expansion of spring 40, and consequent raising of rod 35, will continue to move pump piston 33 upward to complete the charge of metal. During expansion of spring 40 to admit of continued movement of piston 33, spring 45 will by its action on collar 46 of slide 38, keep the nozzle in intimate contact with the bottom of the mold. Continued rotation of cam 44 eventually releases lever 42, the weight of the pump structure, as a whole, causing the parts to descend to their original position, the lowermost position of the pump part being limited by the lower point 44^b of cam 44. By the arrangement of springs 45 and 40, the molten metal may be held under practically uniform compression during the charge notwithstanding any leakage that may take place around the plunger or nozzle and regardless of any variations in the quantity of metal required to make a cast. By the time the pump structure is released by rotation of cam 44, a congealing action of the metal between pump nozzle 32 and the narrow opening in the mold may have taken place, thus preventing the descent of the pump structure by gravity. To overcome such a condition, there is provided on the outer surface of each mold and centrally disposed thereof a V-shape projection 47. The relation of the mold to the pump structure when in casting position is such that the V-shape member 47 will be in alignment with a V-shape recess 48 formed upon slide 38. It will be understood that upon elevation of slide 38, the V-shape recess 48 will serve to align the mold properly and to lock it in such position. Upon completion of the cast, rotation of turret 2 will cause 47 and 48 to act as cam members to force the pump structure down, thereby breaking any adhesion that might exist between pump nozzle 32 and the lower end of the mold. To clean the top surface of nozzle 32, there is attached to each mold and located with respect to the direction of rotation of turret 2 in advance of said mold, a brush 50 that wipes over the top surface of nozzle 32 before each casting operation. To clean the intake at the bottom of each mold, there is provided a brush or pad 51 attached to a face member 100 of the breaking device. This pad 51 is so disposed that is will wipe along the lower

end of each mold after the casting has been discharged and just before the mold closes and again moves into casting position (see Fig. 1).

The mold structure may, of course, vary widely in form and be used for the purpose of casting various products but, in the present instance, it embodies valuable features in itself and is more particularly adapted to casting a plurality of small objects such as bullets in web form. Each of the members, 21 and 22, of each mold consists here of a casting face plate 60 and a hollow supporting back 61 forming a water jacket for each mold member. Each face plate has a series of depressions of such shape as will produce the desired casting, the particular shape here being semi-globular. These depressions 62 are arranged in vertical rows so that when the mold is closed, a plurality of chambers are produced one above the other, there being a passage way 63 that connects adjacent chambers of the vertical rows. At the top, the entire series of vertical rows are connected to a riser chamber 64 and, at the bottom, said vertical rows are connected with a receiving chamber 65. Metal is forced into a V-shape inlet slot 66 at the lower end of the mold facing, thence into receiving chamber 65 and up through the small openings or passage-ways 63 into the globular recesses 62, the metal rising from chamber to chamber through the small openings 63 and finally filling the riser chamber 64, the air escaping through vents V. It will be observed that riser chamber 64 and receiving chamber 65 are in this instance shallower than the casting chamber proper; and, furthermore, that the connecting passages 63 are located at a point remote from the cooling surface of the mold. The result is that the walls of the casting chamber are at a lower temperature than a vertical column of liquid passing up through openings 63 and that the metal in the casting chamber will solidify gradually from the surface of the casting inwardly and that the central liquid column, as well as the metal contained in the riser and in the receiving chambers, will be the last to solidify. As the casting faces of the bullet depressions are kept at a much lower temperature than the molten metal, the contacting surfaces of the molten metal therein will congeal instantly. The remainder of the molten metal, however, remains in a liquid form within its congealed walls and thus, as the filling operation progresses the molten metal is free to flow through the small openings 63 and bullet depressions to the riser chamber.

Inasmuch as the molten metal during the casting operation is continuously passing through the several strings of bullet depressions, the thin walls separating these depressions are heated to a considerably higher degree than is the remainder of the mold surface and, due to the continuous upward flow of hot metal through these passages, the metal therein will be the last part of the casting to congeal; and on the complete filling of the cast chamber, the hot metal in the string will act as a feeder from the riser chamber 64 to all the bullets in each string or vertical row thereby supplying fluid metal to the interior of the casting during the cooling and solidifying process for the purpose of overcoming face shrinkage of the bullets.

Any suitable means may be employed for circulating water through the water backs of the molds and in the present instance these means take the following form.

76 indicates a receiving chamber formed in hub 201; and 78 is a waste chamber separated from the receiving chamber by a partition 82. Suitable inlet and outlet water pipes are connected to the distributing and waste chambers, the intake pipe 80 having a flaring mouth 81 and extending through partition 82 which forms a cone bearing for the flaring mouth of the pipe. 79 is a waste pipe connected with the waste chamber. It will be understood that the inlet pipe 80 and the cap 78[a], the latter of which forms the bottom of waste chamber 78, are stationary and that cone-bearing 82 and the flaring mouth of pipe 80 form a joint around the center of which turret 2 rotates, the cone-bearing turning with the turret and the pressure of the water in the receiving chamber being sufficient to form a water tight joint between the flaring mouth of pipe 80 and cone-bearing 82. Extending from the distributing chamber are a plurality of water connections 75 that communicate with intake pipes 70 in the water back located near the bottom thereof and having perforations 71 pointing in a downward direction. The waste chamber 78 is connected, by means of a plurality of waste pipes 77, with outlet pipes 72 located at the top of the water back and which have perforations 73 pointing in an upward direction. By this construction, the cold water enters uniformly across the bottom of the water back of the mold, rising as it is heated and escaping through perforations 73 in the outlet pipe and thence passing to waste chamber 78. Means, such as a valve 83, seated in the supply pipe 80 is provided for regulating the flow of water and thereby the temperature of the mold casting chambers. Similar valves may be used in connection with each mold supply or outlet pipe, if desired. For the purpose of securing a uniform cooling on the casting face of the mold for the depressions, the back of each casting face plate 69 is formed with depressions having convex bottoms 74 opposite to, and corresponding with, the semi-globular concavities 62

on the face thereof. As it is desirable to retard the cooling and solidifying of the riser D of the casting so that it may act as a feeder, as previously described, the face of plate 60 is made thick at the point where the riser chamber 64 is located thereby making the casting surface of said riser chamber more remote from the cooling surface of the mold. The accomplishment of this object is further facilitated by the fact that when the water reaches the part where riser chamber 64 is located, it has become more or less heated and its chilling action will, consequently, not be so great.

The ejecting means for the casting C is, in the present instance, constructed as follows. A plurality of ejecting members, here shown as three rods 90, are located in openings that extend through the movable mold member; and, when the mold is closed project into the casting chamber of the molds and into contact with the face of the stationary member of the mold. In the present instance, one rod is arranged at the top of the mold extending through the riser chamber 64 and is centrally disposed of the mold, there being also two lower rods extending into the recciving chamber 65 one of which is located at each end. That portion of each rod that extends into the closed casting chamber is formed with a threaded portion,—in this instance, substantially a one-half turn screw-thread 94. The other ends of said rods extend longitudinally through sleeves 91 occupying a fixed position in openings of the mold; and each of said sleeves has a cam slot 92 extending partially around its circumference. Each rod is provided with an operating pin 93 engaging slot 92 in said sleeve. It will be understood that when a casting is made, the ejecting members become embedded in the casting,—in the present instance, in the overcast portions D and E formed in the riser and receiving chamber; and that an internal thread is cast in said overcast portions due to the presence of thread 94 in the members 90. When the movable member 22 of the mold is moved away from the stationary member 21, by engagement of the roller 25 with cam 26, the ejecting members 90 will follow the movement of the movable member and will separate the casting from the molding face of the stationary member 21. After movable member 22 has receded a certain distance, carrying ejectors 90 with it, the ends of said ejectors will come against fixed stops 95 carried by the face of the turret, thereby arresting further movement of said ejectors with the movable member of the mold. Upon continued movement of the movable member 22 in the same direction, the cast will be separated from the mold face of said movable member and the casting will be suspended on the ejecting means.

When the right hand movement of ejectors 90 ceases, by reason of contact with stop 95, cam slot 92 will impart sufficient rotation to members 90 to cause the threaded ends of said members to disengage from the internal threads formed in the casting, the parts being so arranged that the lower member 90 will disengage slightly in advance of the upper member that is located in the rising chamber so that the cast, in its final position in the mold, remains suspended at one point,—at the top. Upon complete disengagement of the ejectors from the casting, the latter will drop into the breaking device to be presently described. It will be seen that, in the present instance, the opening movement of the mold automatically causes separation of the casting from both mold members and subsequently causes the ejecting means to become disengaged from the cast, thereby allowing the latter to drop by gravity. The receiving chamber 65, as shown in Fig. 7, is made longer than the remainder of the casting so that the receiving slug E formed therein is of sufficient length to admit of positioning the lower ejecting rods 90 beyond the side edges of the casting proper for the purpose of permitting the casting to drop freely from the mold after the ejecting means have been freed from riser D and slug E. In order, however, to obtain smooth bottom surfaces on the slug E for the purpose of subsequently positioning the casting in the breaking or separating device, the inlet slot at 66 is made shorter than the width of the mold chamber, thereby producing smooth bottom portions S, one at each side of receiving slug E.

Means are provided for breaking up or separating the web casting produced in the mold, such means taking, in this instance, the following form. As here shown, the breaking or separating device consists principally of means for clamping the web of castings and for severing the web between adjacent bullets that form part of the same vertical string and also for severing the riser D and slug E from the casting proper. The severing means here comprise shearing members that are mounted on opposed jaws movable toward and from each other. In the particular construction disclosed, 100 indicates the fixed jaw attached to the inside face of upright 6, the co-acting movable jaw 101 being slidingly mounted on a part of arms 102 projecting from fixed jaw 100. Any suitable mechanism may be used for reciprocating the movable jaw, there being, in this instance, on shaft 10 an eccentric 104 connected by means of links 103 to a movable jaw 101. The timing of the operation of these parts is such that, when a mold reaches a position in line with the breaking or separating device, jaw 101 is closed after

the casting has dropped from the superposed mold. Mounted in bearings at the bottom of fixed jaw 100 is a rock shaft 106, carrying a pair of supporting fingers 107. On the end of this rock shaft is an operating member or lever 108. On the movable jaw is a bar 109 that engages lever 108, during the closing movement of the jaws, to tilt the supporting fingers 107 into horizontal position to receive the casting dropping from the mold above the breaking device. At the top of the fixed jaw is a clamping surface 110; and on the movable jaw is a bar 111 oppositely disposed to, and normally urged by a spring 112 toward, surface 110 by reason of the fact that said bar is slidingly mounted in the movable jaw. Each jaw is further provided with a series of severing members, here shown as concave shearing or cross-cutting bars 105. Each of these cutting bars is of a width equal to the diameter of the cast bullet and the bars are so spaced that, when the jaws are in closed position, said jaws will shear each other. Near the bottom of the breaking device, there is also a bar 113 that co-operates when the device is closed to clamp the casting against lugs 103^b carried on rock shaft 106. It will also be understood that when a casting is released from the mold, it will drop between the open jaws of the breaking device and will fall upon supporting fingers 107. When the jaws are in this position, the spring-pressed bar 111 is forward of the normal plane of the connecting edge of members 105 and, as the movable jaw approaches the fixed jaw to close on the casting, bar 111 will first engage with riser D at the top, and in advance of members 105, and will tend to clamp said riser against surface 110; and, as the jaws of shearing members 105 will sever or break up the casting bar 113 carried by the movable jaw engaging with lugs 103^b on rock shaft 106, should the casting drop into an uneven position on supporting fingers 107, it will be evident that, during the closing movement of the jaws, members 105, as well as member 103^b, will act as positioning means to gradually move the casting into proper position during the cutting operation.

In addition to the foregoing, guide plates 114 are provided on the fixed jaw for the purpose of adjusting the cast laterally of the jaw, said plates 114 being in effect inclined surfaces for guiding the cast into proper registry laterally, as shown in Fig. 13. The cutting bars 105 are formed with inclined faces, the surfaces at the top serving to direct the bullets severed from the web into a trough or channel so that they may be disposed of quickly and carried out of the turrets by the time the jaws are again open. It will be understood that upon opening of said jaws, bars 110 and 111, as well as bars 113 and projection 103^b, release riser E and slug D and that both of these will drop down into the melting pot through the center of the breaking device, fingers 107, having meanwhile, been carried back to admit of this. The cutting bars 105 really constitute, in addition to severing means, inclined shelves or runways that open into vertical passages 205 in the breaking device and connect with chutes or guides 115 which, in turn, empty into a trough or hopper 116 from whence the bullets may be directed to any suitable receptacle or otherwise collected.

I claim:

1. Casting apparatus comprising: means for delivering molten material at a casting point, a rotatable supporting member, a plurality of casting molds carried thereby each composed of a plurality of members movable relatively to each other to open and close the mold, means for intermittently moving said supporting member to successively bring said molds to and from the casting point so that the molds successively receive a charge of molten material, means for opening each mold after it has received a charge of material and for closing it before it receives another charge, and means for separating the casting from both members of each mold.

2. Casting apparatus comprising: a nozzle for delivering a charge of molten material at a casting point, a plurality of casting molds each having an inlet at its lower end, means for moving said molds successively into and out of position above said nozzle, and means for moving the nozzle toward and away from the inlet of a mold in casting position.

3. Casting apparatus comprising: a nozzle for delivering a charge of molten material at a casting point, a plurality of casting molds each having an inlet at its lower end, automatic means for moving said molds successively into and out of position above said nozzle, and means for moving said nozzle in timed relation with the movement of the molds toward and away from the inlet of a mold in casting postion.

4. Casting apparatus comprising: a nozzle for delivery of molten material at a casting point, a rotatable supporting member, a plurality of molds each having an inlet at its lower end carried by said supporting member above the plane of the nozzle, means for automatically moving said supporting member to successively bring said molds to and from the casting point at such intervals that each mold receives a charge of molten material, and means for moving said nozzle in timed relation with the movement of the supporting member toward and away from the inlet of a mold in casting position.

5. Casting apparatus comprising: a nozzle for delivery of molten material at a casting

point, a rotatable supporting member, a plurality of molds each having an inlet at its lower end carried by said supporting member above the plane of the nozzle, means for automatically and intermittently moving said supporting member to successively bring said molds to and from the casting point at such intervals that each mold receives a charge of molten material, and means for moving said nozzle in timed relation with the movement of the supporting member toward and away from the inlet of a mold in casting position.

6. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means carried by the mold and embedded in the casting, means for causing the ejecting means to separate the casting from both mold members and permitting it to drop from the mold, and means located below the mold for receiving and disintergrating the casting.

7. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means carried by the mold and embedded in the casting, means for causing the ejecting means to separate the casting from both mold members, and means for freeing the ejecting means from the casting.

8. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means carried by the mold and embedded in the casting, and means actuated by opening of the mold for causing the ejecting means to separate the casting from both mold members and for thereafter freeing said ejecting means from said casting.

9. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means carried by the mold and embedded in the casting, means for causing the ejecting means to separate the casting from both mold members upon opening the mold and for holding it suspended, means for freeing the ejecting means from the casting permitting it to drop from the mold, and means located below the mold for receiving and disintegrating the casting.

10. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable for producing a cast and an overcast, means for opening and closing the mold, ejecting means carried by the mold and embedded in the overcast, means for causing the ejecting means to separate the cast and overcast from both mold members upon opening the mold and for holding it suspended, means for freeing the ejecting means from the overcast, thereby permitting the cast and overcast to drop from the mold, and means located below the mold for receiving and separating the cast and overcast.

11. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable for producing a cast and an overcast, means for opening and closing the mold, ejecting means carried by the mold and embedded in the overcast, means for causing the ejecting means to separate the cast and overcast from both mold members upon the opening of the mold, and means for freeing the ejecting means from the overcast.

12. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable for producing a cast and an overcast, means for opening and closing the mold, ejecting means carried by the mold and embedded in the overcast, means for causing the ejecting means to separate the cast and overcast from both mold members upon opening of the mold, means for freeing the ejecting means from the overcast, and means for separating the cast and overcast.

13. Casting apparatus comprising: a melting pot, automatic means for delivering a charge of molten material from the pot at a casting point, a plurality of molds above said melting pot each for producing a cast and an overcast, means for automatically and successively bringing the molds into and out of casting position above the pot, means for separating the cast and overcast produced by each mold, and means for returning the overcast to the melting pot.

14. Casting apparatus comprising: a melting pot, automatic means for delivering a charge of molten material from the pot at a casting point, a rotatable supporting member, a plurality of molds carried by said member above said melting pot each producing a cast and an overcast, means for rotating the supporting member to successively bring the molds into casting position above the pot, a separating device located over the melting pot, under the plane of the orbit of the molds and in advance, with respect to the direction of rotation of the supporting member, of the casting point, means for delivering the cast and overcast to the separating device; and means for directing the overcast back to the melting pot.

15. Casting apparatus comprising: a melting pot, a mold for producing a cast and an overcast, means for supplying a charge of molten material to the mold, means for separating the overcast and cast produced by the mold, and means for returning the overcast to the melting pot.

16. Casting apparatus comprising: a mold

consisting of a plurality of members relatively movable, means for opening and closing the mold, automatic means for separating the casting from both mold members and for supporting it when freed from said members, and means for thereafter releasing said casting.

17. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means carried by the mold and embedded in the casting, means for causing said ejecting means to separate the casting from both mold members when opening the mold, and means for disengaging said ejecting means from the casting.

18. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means carried by the mold and embedded in the casting, said ejecting means including a plurality of members one of which is located centrally of the upper end of the casting, and the others of which are located at the lower end of the casting, means for causing said ejecting means to separate the casting from both mold members when opening the mold, and means for disengaging the lower ejecting members and thereafter the upper ejecting member from the casting.

19. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means carried by the mold and embedded in the casting, means actuated upon the opening of the mold for causing said ejecting means to move in a straight line to separate the casting from one mold member, and means actuated upon a still further opening of the mold for causing the ejecting members to separate the casting from the other mold members and to be rotated to free them from the casting.

20. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means having a threaded portion projecting into the mold and embedded in the casting, and means for turning said ejecting means to free it from the casting.

21. Casting apparatus comprising: a mold consisting of a plurality of members relatively movable, means for opening and closing the mold, ejecting means having a threaded portion projecting into the mold and embedded in the casting, means actuated upon the opening of the mold for causing said ejecting means to separate the casting from the mold, and means for turning said ejecting means to free it from the casting.

22. The method of simultaneously producing a plurality of individual castings which consists in casting a plurality of them in connected web form and with an overcast portion at each end of the web, then supporting the web by clamping the overcast portions, and then disintegrating the web.

23. The method of simultaneously producing a plurality of individual castings which consists in casting a plurality of them in connected web form and with an overcast portion at each end of the web, then supporting the web by clamping the overcast portions, then disintegrating the web, and then separately discharging the individual castings and overcast.

24. Casting apparatus comprising: a mold having exterior cooling surfaces and a plurality of connected chambers, the connection between adjacent chambers being more remote than the walls of the chambers from the cooling surface of the mold.

25. Casting apparatus comprising: a rotatable member, a plurality of molds carried thereby having water jackets, a centrally disposed water distributing chamber, and means for supplying water from said distributing chamber to said water jackets.

26. Casting apparatus comprising: a rotatable member having centrally disposed water distributing and waste chambers, stationary water inlet and outlet connection therefrom, a plurality of molds carried by said member having water jackets, and connections from the distributing and waste chambers to said water jackets.

27. Casting apparatus comprising: a mold for producing a cast with overcast portions at both ends, means for separating the cast and overcast from the mold, means for clamping the overcast portions, and means for breaking up the cast.

28. Casting apparatus comprising: a mold for producing a cast with overcast portions at both ends, means for separating the cast and overcast from the mold, means for clamping the overcast portions, means for breaking up the cast, and means for directing the cast and overcast into separate channels.

29. Casting apparatus comprising: a mold for producing a plurality of individual castings in web form, means for separating said web from the mold, and means for mechanically breaking up the web into individaul castings.

30. Casting apparatus comprising: a mold having a casting chamber including a plurality of connected and vertically arranged recesses and an inlet at its lower end, and means for filling said chamber through said inlet.

31. Casting apparatus comprising: a mold having a casting chamber composed of a plurality of mold recesses together with a riser recess at the top and receiving recess at the bottom, all of said recesses being con-

nected, and means for introducing molten material into the receiving recess.

32. Casting apparatus comprising: a mold having a casting chamber composed of a plurality of depressions arranged in vertical connected rows together with top and bottom horizontal depressions uniting said vertical rows, and means for introducing molten material into the chamber from the bottom thereof.

33. Casting apparatus comprising: a plurality of molds, a nozzle for introducing molten material into the molds, means for successively advancing the molds to a casting position over the nozzle, a brush, and means for causing said brush to engage and wipe the face of the nozzle between each casting operation.

34. Casting apparatus comprising: a plurality of molds, a nozzle for introducing molten material into the molds, means for successively advancing the molds into a casting position above the nozzle, and a brush located between each pair of adjacent molds and movable therewith to engage and wipe the face of the nozzle between each casting operation.

35. Casting apparatus comprising: a plurality of molds, a rotatable member carrying said molds, a nozzle located beneath the orbit of said molds for introducing a charge of molten material into said molds as they successively pass over said nozzle, and a brush mounted in a fixed position beneath the molds and in advance of the nozzle to engage with and wipe the inlet of each mold as it is advanced toward the nozzle.

36. Casting apparatus comprising: a mold having a casting chamber composed of a plurality of mold recesses together with a riser recess at the top and a receiving recess at the bottom, all of said recesses being connected, and means for introducing molten material into the receiving recess.

37. The method of simultaneously producing a plurality of individual castings which consists in casting a plurality of them in a mold in connected web form and with an overcast portion at each end of the web, then discharging the web from the mold, then supporting the web by clamping the overcast portion, and then disintegrating the web.

38. The method of simultaneously producing a plurality of individual castings which consists in casting a plurality of them in a mold in connected web form and with an overcast portion at each end of the web, then discharging the web from the mold, then supporting the web by clamping the overcast portion, then disintegrating the web, and then separately discharging the individual castings and overcast.

39. Casting mechanism comprising: a plurality of mold sections for producing a cast and an overcast, means for opening and closing said mold sections, a casting carrying member adapted to be cast into the overcast, and means for automatically releasing said member from the overcast.

40. Casting mechanism comprising: a mold consisting of a plurality of molding members and a casting carrying member, other than a molding member, adapted to be cast into the casting, means for moving the molding members, one with relation to the other, and means for releasing the casting carrying member from the casting.

41. The method of producing and releasing a casting which consists in producing a casting composed of a cast and an overcast and in imbedding a casting carrying member in the overcast during the casting operation, then in releasing the member from the overcast, and then in severing the overcast from the cast.

42. Casting mechanism including: a plurality of mold sections for producing a cast and an overcast, means for opening and closing the mold sections, a casting receiving device, a casting carrying member adapted to be cast into the overcast, means for moving said casting carrying member to transport the casting to the receiving means, and means for automatically releasing said member from the overcast.

43. Casting mechanism including: a mold consisting of a plurality of molding members and a casting carrying member, other than a molding member, adapted to be cast into the casting, means for opening and closing the mold, a casting receiving device, means for moving the casting carrying member to transport the casting to the receiving means, and means for releasing the casting carrying member from the casting.

Signed at Plainfield, in the county of Union and State of New Jersey, this 16 day of October 1918.

CHARLES E. HOPKINS.