No. 887,732. PATENTED MAY 12, 1908.

R. C. ANNAND.

CASTING OF CURVED STEREOTYPE PLATES.

APPLICATION FILED JULY 3, 1907.

5 SHEETS—SHEET 1.

Fig. 1.

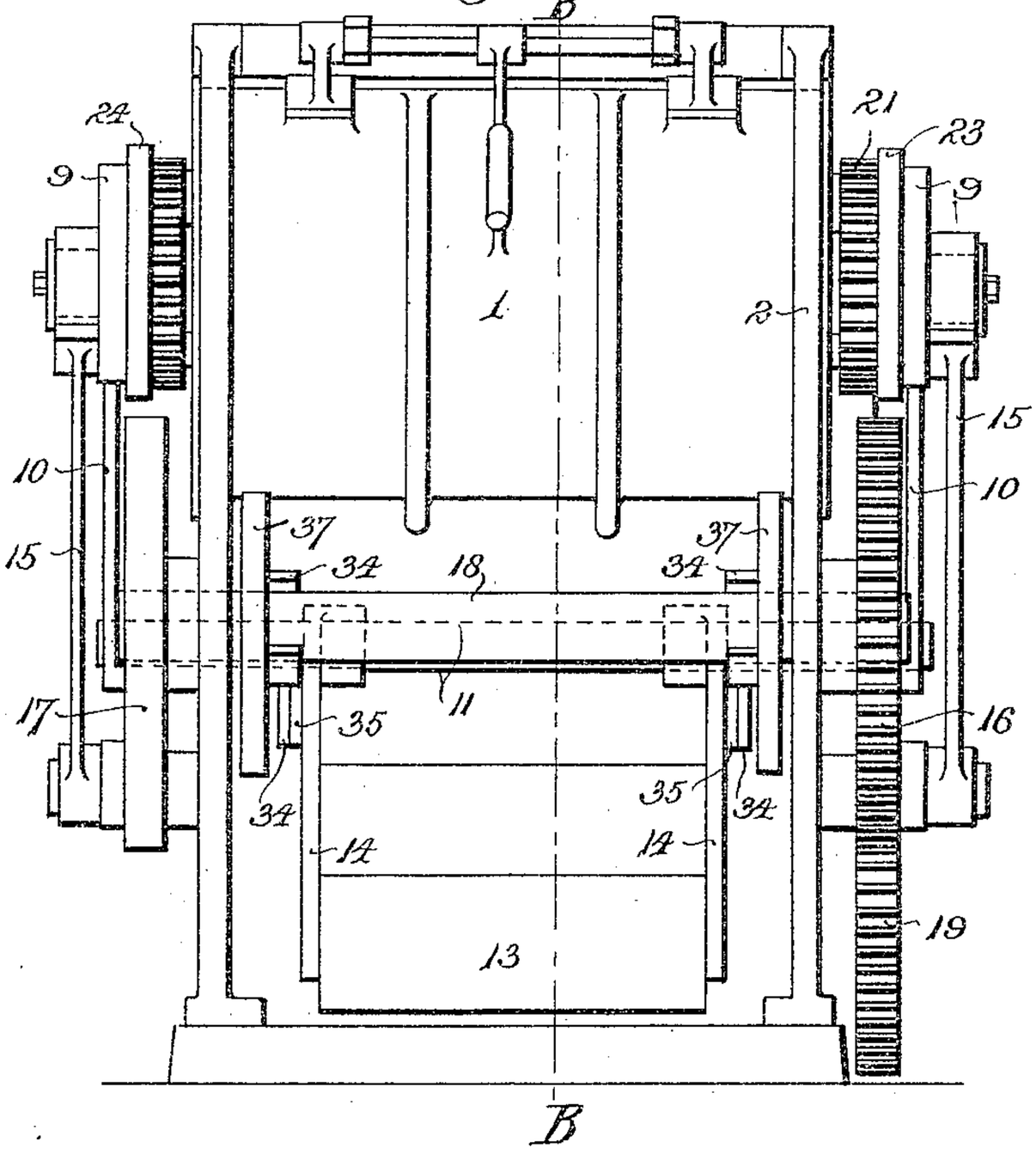
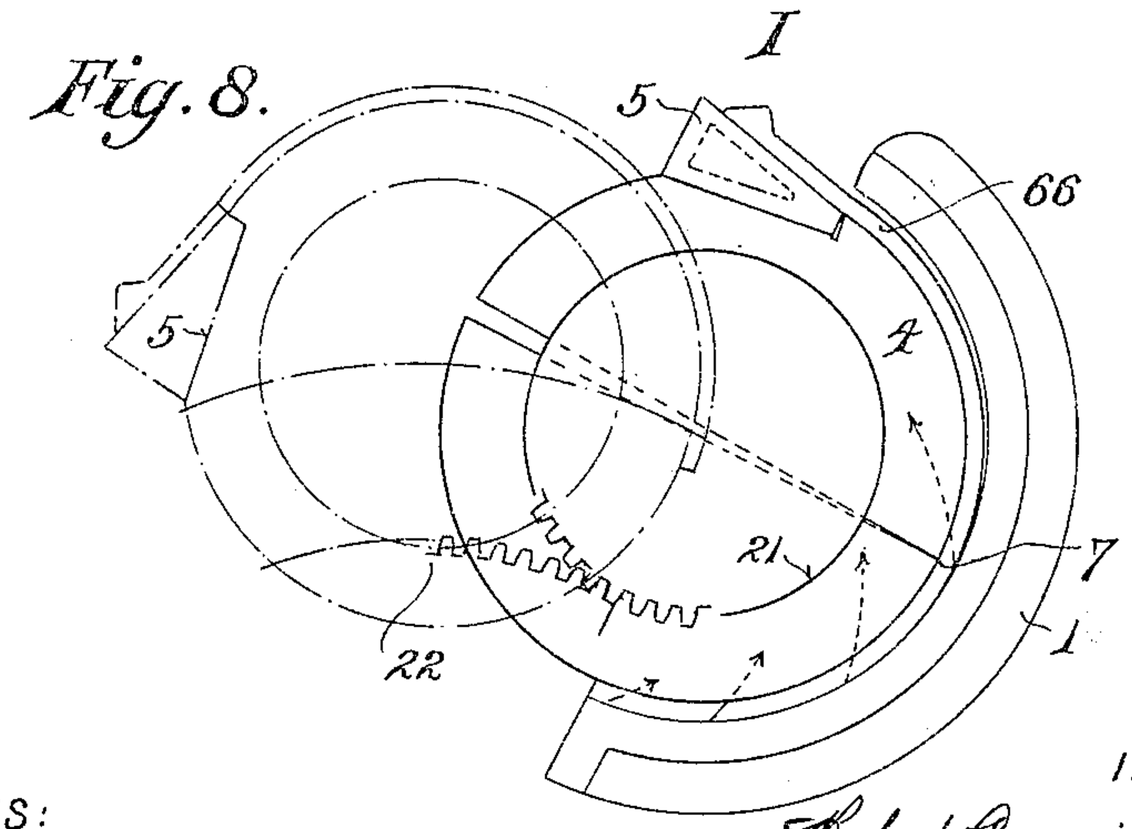


Fig. 8.



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No. 887,732. PATENTED MAY 12, 1908.

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5 SHEETS—SHEET 2.

Fig. 3.

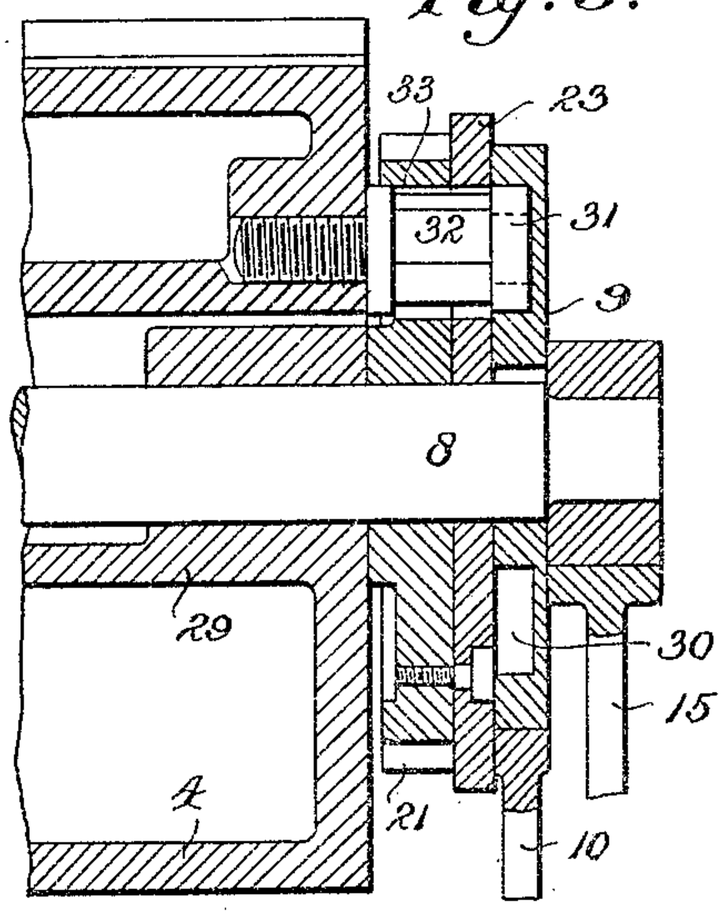


Fig. 4.

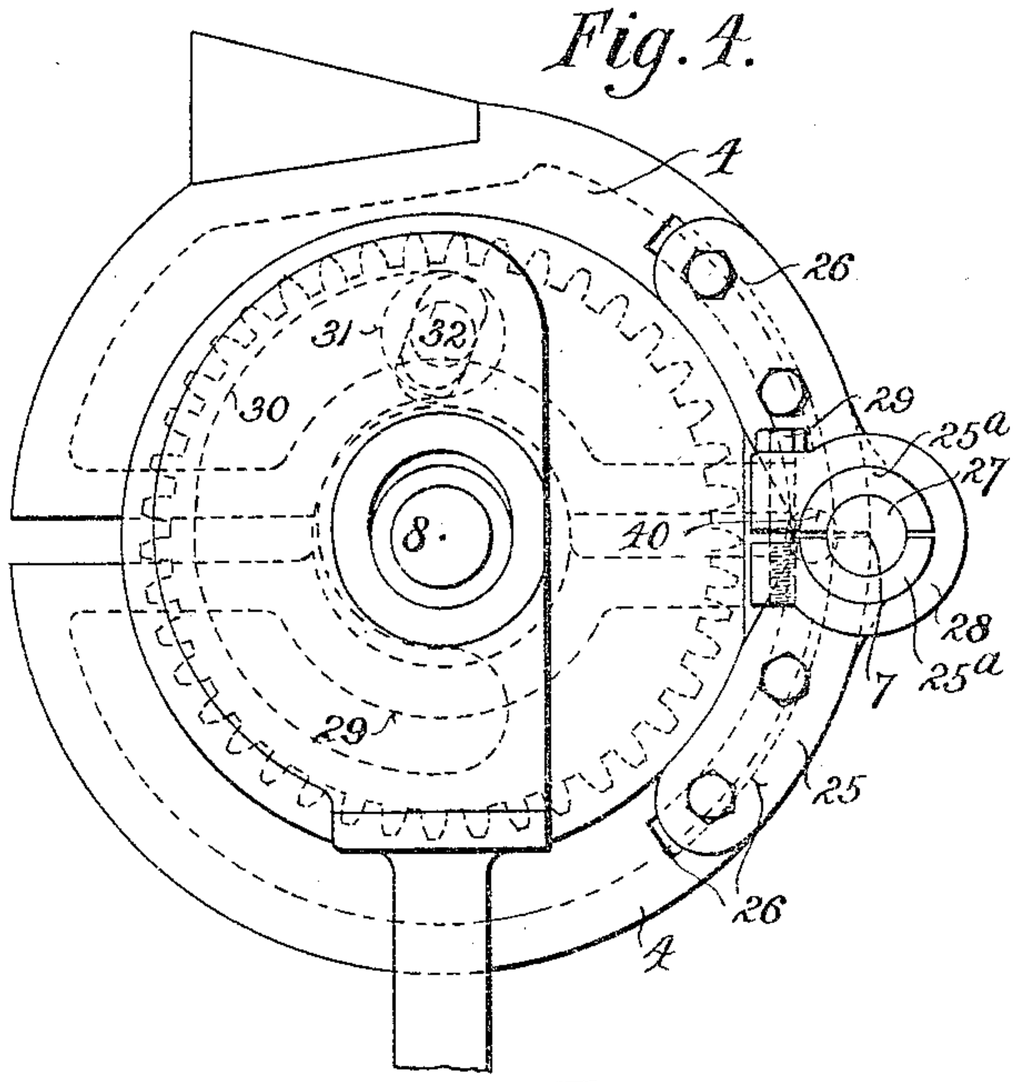


Fig. 5.

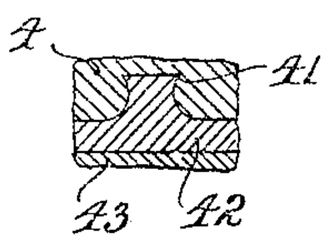
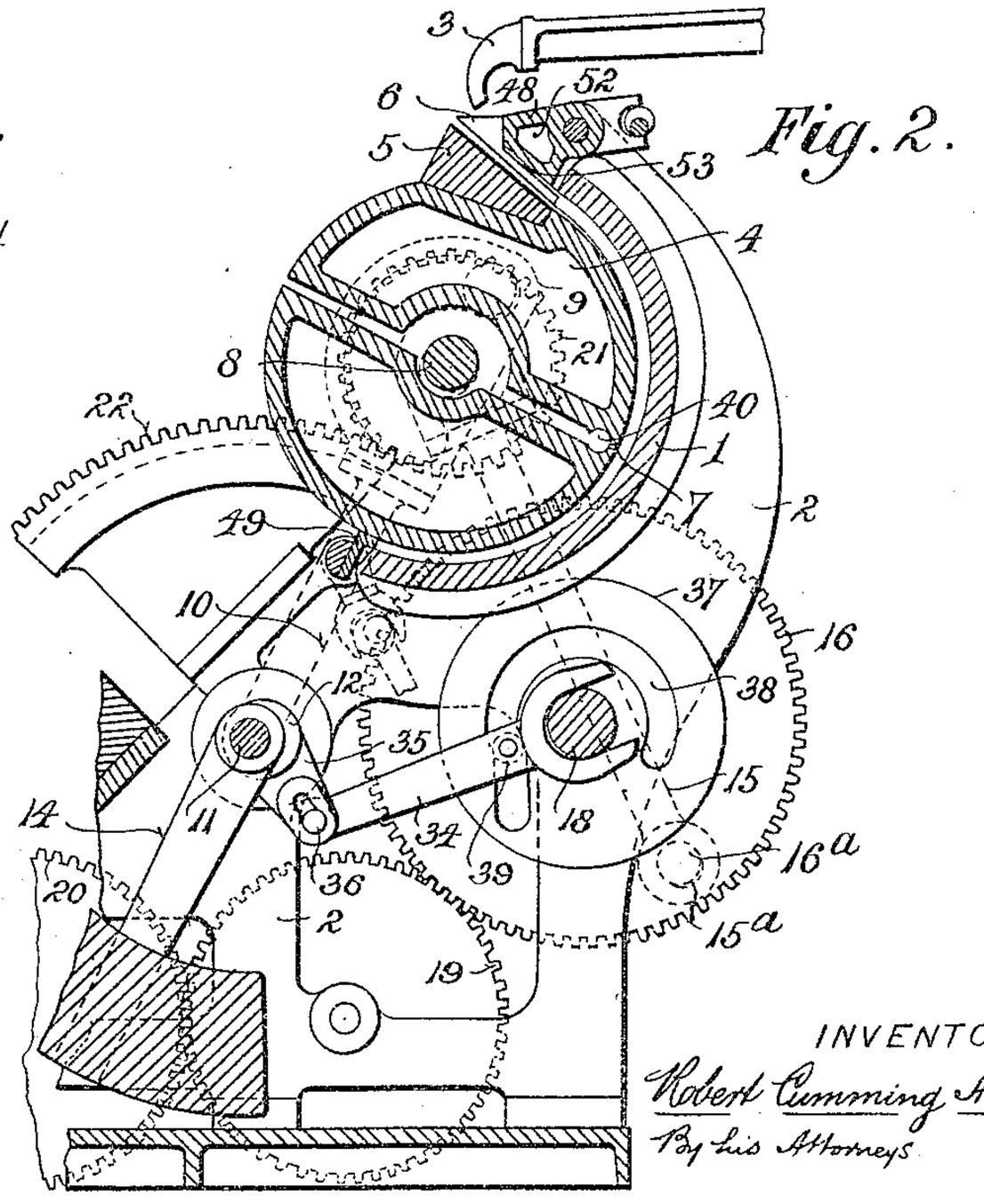


Fig. 2.



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No. 887,732. PATENTED MAY 12, 1908.

R. C. ANNAND.

CASTING OF CURVED STEREOTYPE PLATES.

APPLICATION FILED JULY 3, 1907.

5 SHEETS—SHEET 3.

Fig. 6.

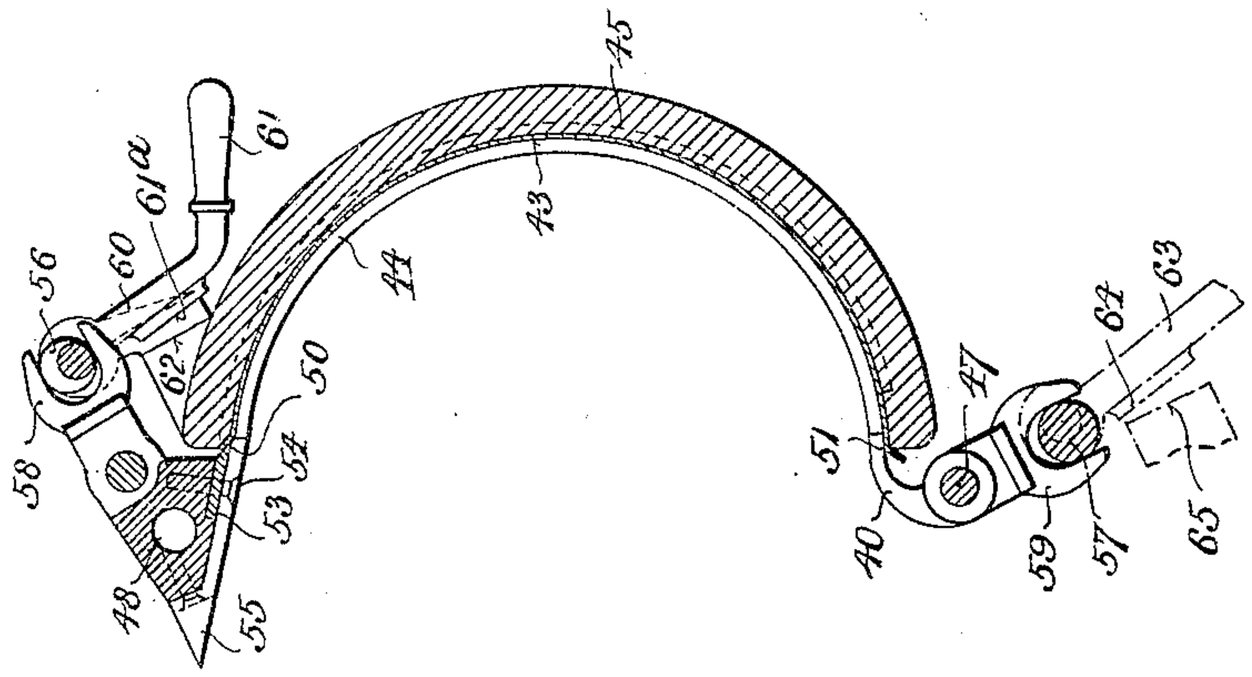
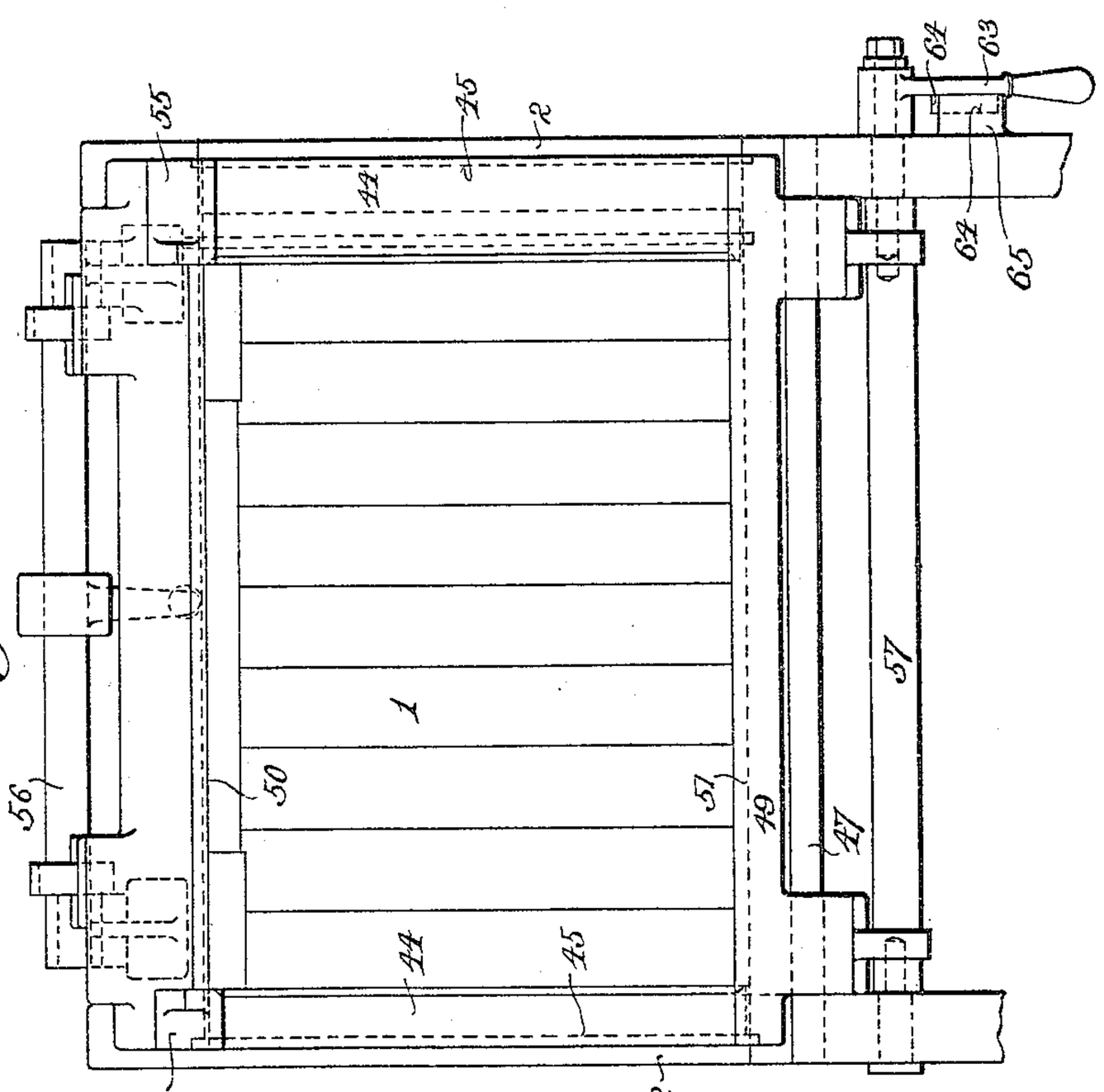


Fig. 7.



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No. 887,732. PATENTED MAY 12, 1908.

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CASTING OF CURVED STEREOTYPE PLATES.

APPLICATION FILED JULY 3, 1907.

5 SHEETS—SHEET 4.

Fig. 9.

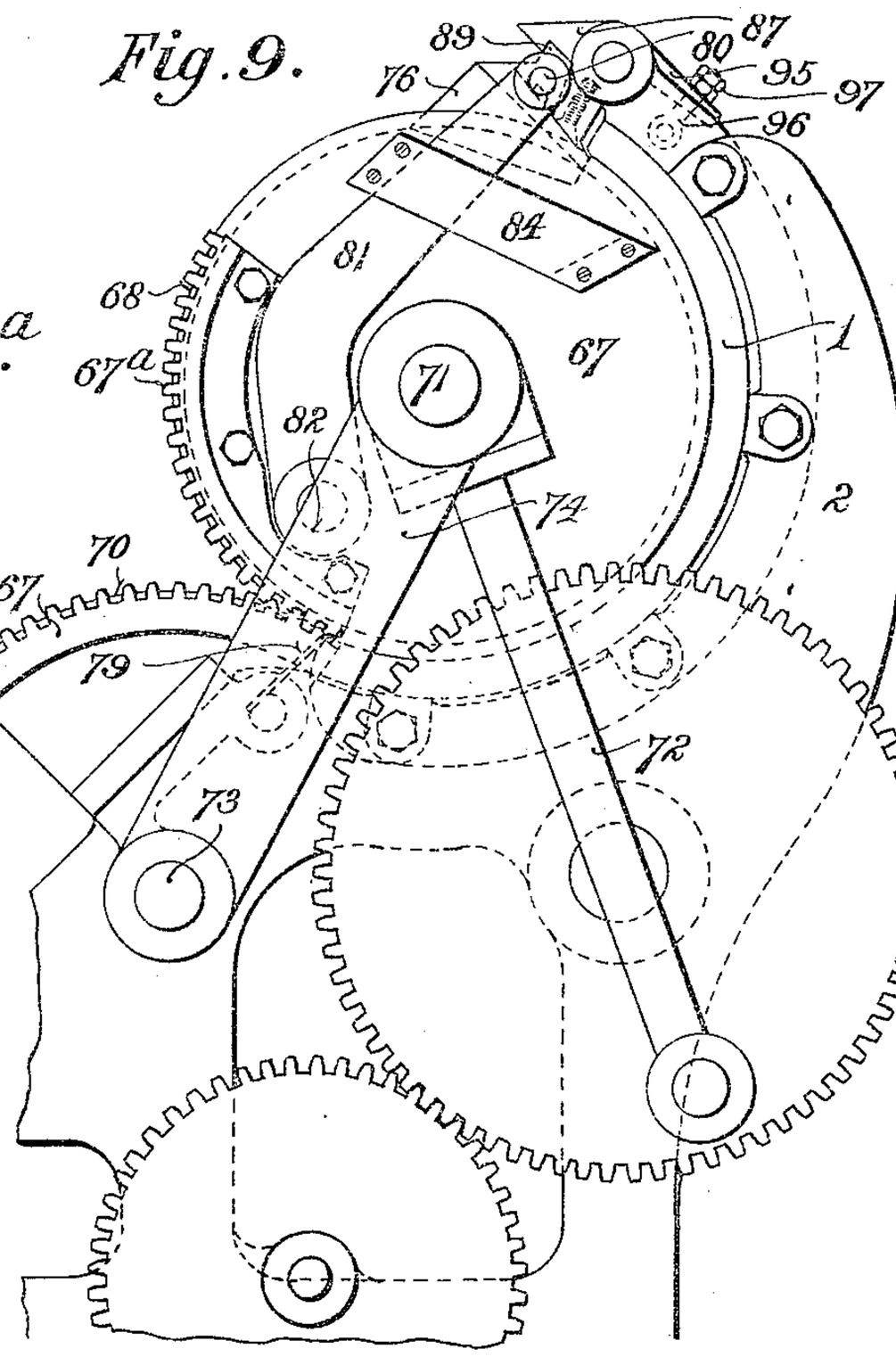
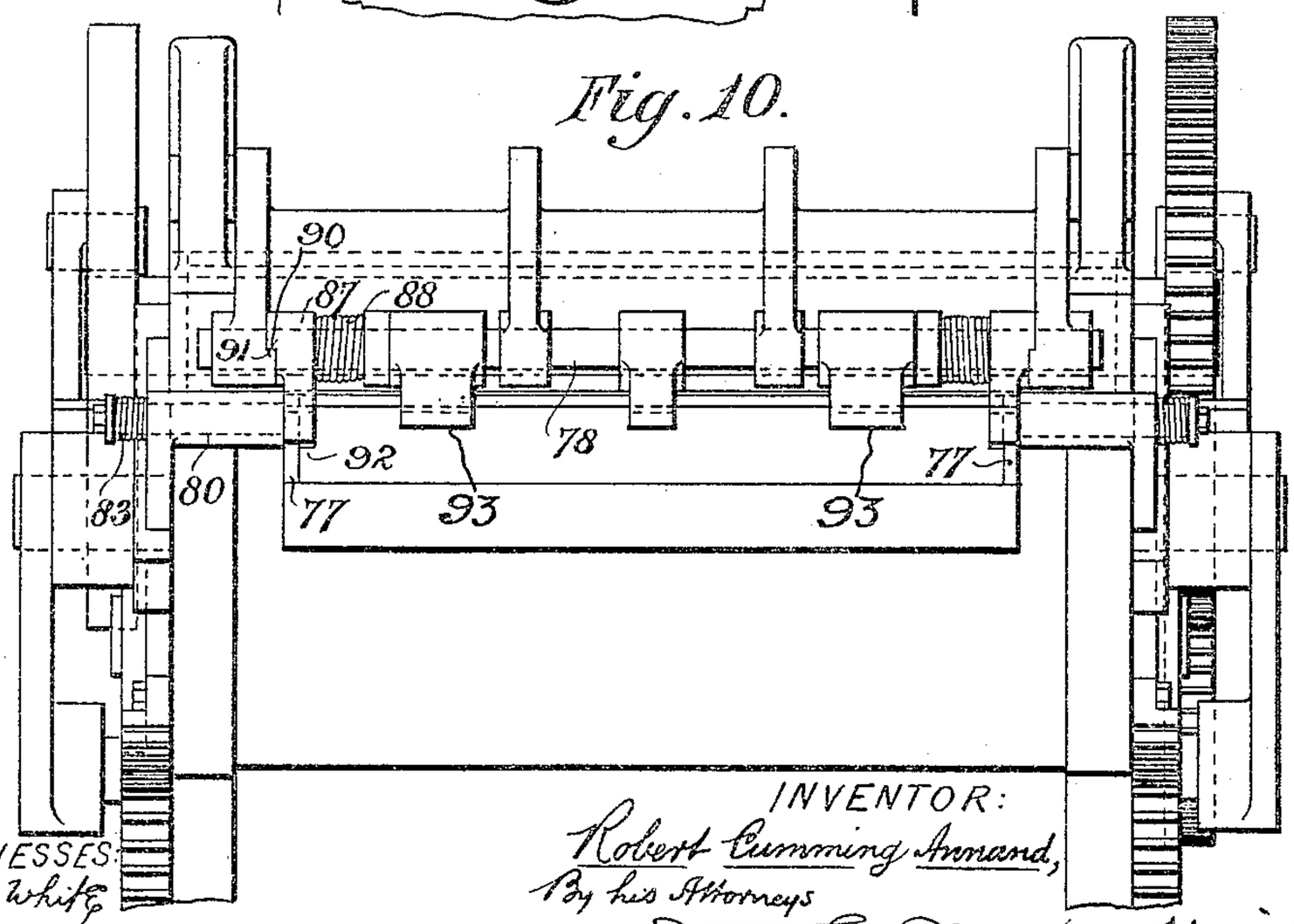


Fig. 9a.

Fig. 10.



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No. 887,732. PATENTED MAY 12, 1908.

R. C. ANNAND.

CASTING OF CURVED STEREOTYPE PLATES.

APPLICATION FILED JULY 3, 1907. 5 SHEETS—SHEET 5.

Fig. 11.a.

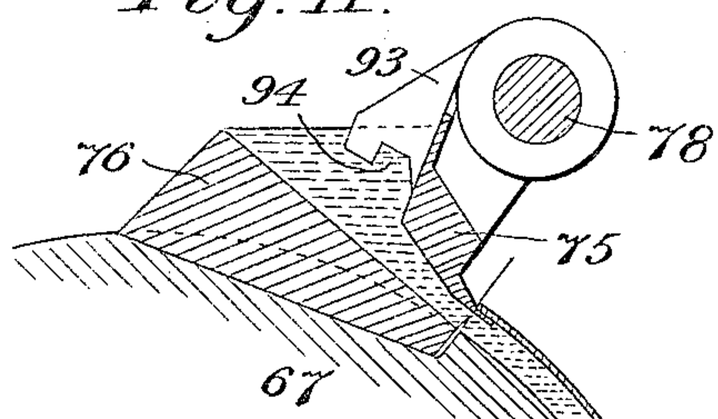
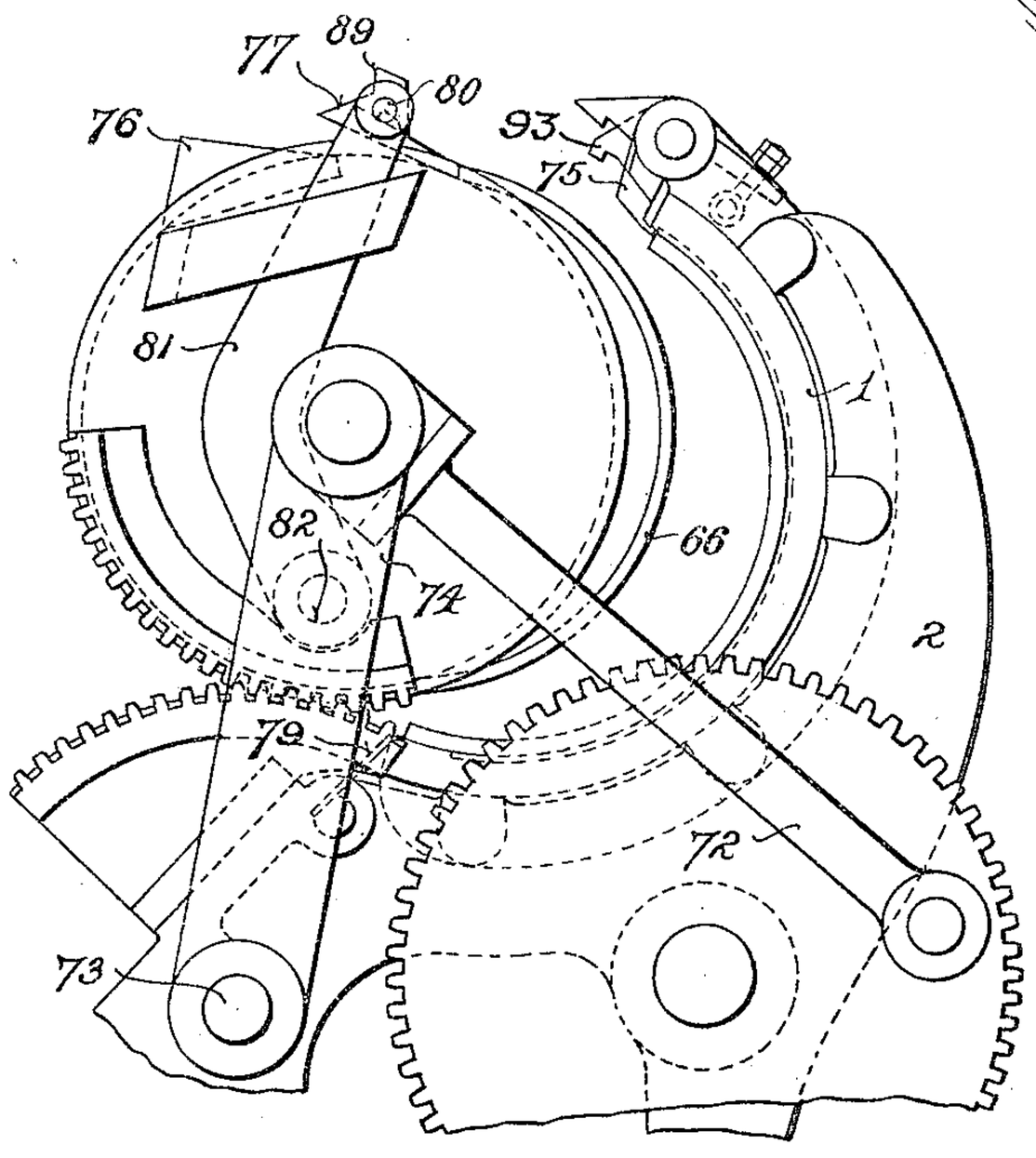


Fig. 11.



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UNITED STATES PATENT OFFICE.

ROBERT CUMMING ANNAND, OF SOUTH SHIELDS, ENGLAND.

CASTING OF CURVED STEREOTYPE-PLATES.

No. 887,732. Specification of Letters Patent. Patented May 12, 1908.

Original application filed January 17, 1907, Serial No. 352,695. Divided and this application filed July 3, 1907. Serial No. 382,068.

To all whom it may concern:

Be it known that I, ROBERT CUMMING ANNAND, of South Shields, England, printers' engineer, have invented certain new and useful Improvements in the Casting of Curved Stereotype-Plates, of which the following is a specification.

This invention aims to provide an improved method or process whereby semicircular or curved stereotype plates can be rapidly produced.

More particularly the invention has been devised for application to power driven machinery for automatically casting or automatically casting and finishing such plates, but it may be used in connection with curved stereotype plate casting or casting and finishing apparatus operated partly or entirely by hand.

In the specification of an application for patent filed by me on January 17th. 1907, Serial No. 352,695 I have described and claimed apparatus for the production of semicircular or curved stereotype plates, and in particular machinery for automatically casting and finishing such plates, wherein the plates are stripped from a matrix fixed in a casting back or shell by apparatus so arranged and operated that the plate is bent inwards on the core and stripped thereon from the fixed matrix without injury to the matrix. The present application for patent is divisional of the said original application and claims the method or process of so stripping semicircular or curved stereotype plates from a matrix fixed in a casting shell by bending the plate inwards on a core and separating the core and plate and the matrix.

In apparatus as hitherto used for the production of semicircular stereotype plates it has not been possible to clamp or fasten the matrix to the solid concave part or shell of the casting mold, so that it can remain in this position while the desired number of plates are being cast and removed. The usual practice is to arrange the casting mechanism so that the matrix with the side gages is drawn out of the casting box attached to the newly cast plate and the matrix has to be stripped from the plate and reset in position in the casting back. As this has to be done each time a plate is cast it consumes much valuable time and greatly reduces the output of the machine.

The object of the invention is to overcome this drawback and to provide a method whereby any desired number of semicircular or curved stereotype plates can be cast and stripped in succession from a matrix fixed in a rigid mold or casting shell, without injury to the matrix. This I effect by bending the cast plate inwards on the core to a sufficient extent to enable it to be stripped on the core from the matrix, leaving this fixed in the mold or casting shell. For this purpose the core may be arranged to move into and out of the mold and may be constructed so that it can be collapsed after the plate has been cast, a sufficient connection between the cast plate and the core being provided to cause the plate to partake of the collapsing motion and thus move away from the matrix to enable it to be stripped therefrom with the core when this is moved out of the casting box or shell. Or a non-collapsible core may be employed and means may be provided whereby when the core is moved out of the casting box after the plate has been cast, the plate is at first delayed from following its motion so that clearance is created between the core and casting box to allow of the plate being bent inwards on the core, this bending being effected as the core moves out of the casting shell.

The invention will be illustrated by way of example by the accompanying drawings which show two forms of apparatus constructed to embody the invention and as employed in a machine of the kind as described in the original application S. 352,695, that is to say, wherein the core is arranged to deliver the cast plates direct into a reciprocating boring bed, which travels to a position opposite the casting shell to receive the cast plate from the core and then carries it to finishing and delivery mechanism.

Figure 1 is a side elevation of so much of the machine as is necessary to illustrate the invention. Fig. 2 is a sectional elevation of the mold, core and core operating mechanism on B—B, Fig. 1. Fig. 3 is a longitudinal section of one end of the collapsible core of Fig. 1 and Fig. 4 is an end elevation thereof. Fig. 5 is a detail section showing the way in which the usual rib casting grooves in the core are cut for a purpose explained later. Figs. 6 and 7 are detail views in side elevation and plan of means for clamping the matrix in the casting shell. Fig. 8 is a diagram illustrating the action of the core. Fig. 9 is a similar view to Fig. 2 illustrating a modified method of bending the plate and stripping it

from a fixed matrix while employing a non-collapsible core; Fig. 9[a] is a detail. Fig. 10 is a corresponding plan, and Fig. 11 is a similar view to Fig. 9 showing the plate removed from the mold by the core and plate bent thereon. Fig. 11[a] is a detail sectional view showing the noses 93 and projections 94.

Referring first to Figs. 1 to 8, 1 is a fixed semicircular mold chamber or casting shell bolted in encircling frames 2, 2 at one side of the machine in an inclined position under a metal pouring spout 3. In this casting shell the matrix is clamped so that it will not shift during the casting of the required number of plates, and a collapsible core is arranged to move with a combined swinging and rolling action into and out of the casting shell for the purpose of casting the plates and extracting them from the casting shell. The core is cylindrical and is composed of two hinged segments 4, 4 the upper of which carries the usual lip or wedge shaped complement 5 of the pouring mouthpiece 6, this lip extending across the core and forming the front wall of the mouthpiece. The core segments are hinged together at 7 and are mounted on a shaft 8 which passes through between them and is rigidly attached to the lower segment 4.

The shaft 8 is supported in cams 9, 9 carried by rocking arms 10, 10 centered on a shaft 11 mounted in eccentric bushes 12 working in the frames 2, 2.

13 is a balance weight attached to the shaft 11 by arms 14. To the ends of the core shaft 8 are connected links 15, 15, the other ends of which are connected to crank wheels 16, 17 mounted on a shaft 18 to which an oscillating motion is imparted through gearing 19, 20 in a manner more particularly described in my said original application for patent. The eyes by which the links 15 are connected to the studs 16[a] on the crank wheels 16, 17 are slightly slotted as shown at 15[a] Fig. 2.

On the ends of the shaft 8 are likewise mounted toothed wheels 21 meshing with toothed segments 22 fixed to the frame of the machine; corresponding circular and segmental guide surfaces 23, 24 may be carried by the toothed wheels and toothed segments respectively to prevent the teeth from engaging too deeply. Thus when the crank wheels 16, 17 oscillate the core is caused to swing into and out of the casting shell 1 about the shaft 11 and at the same time it is rotated on its axis by the rolling of the toothed wheels 21 on the toothed segments 22.

The hinge 7 of the core segments 4, 4 consists at each side of two parts 25, 25 bolted respectively to the upper and lower segments and adjustable circumferentially with respect thereto by being arranged to slide in grooves 26 in the core, in which they are bolted. The adjacent edges of the segments at the hinge joint can thus be set up into contact to compensate for wear. The hinge members 25, 25 have semicircular bearing surfaces 25[a], 25[a], encircling a hinge pin 27. To hold the whole together a split collar 28 is used, the pressure of which is adjusted by a screw 29. The core shaft 8 is rigidly fastened in bosses 29 of the lower core segment 4.

The cams 9 are made with a slot 30 (Figs. 3 and 4) forming a path for a roller 31 which revolves freely on a stud 32 projecting through a slot 33 in the spur wheel 21 and guide 23, this slot being struck from the hinge center. An identical arrangement of cam mechanism is provided at the other end of the core.

The eccentric bushes 12 receive an oscillating motion in their bearings so as to give the center of the shaft 11 and hence the arms 10, 10 and cams 9, 9 a back and forth movement in a direction the average of which is along the line of centers of the shafts 11 and 8. This is effected by a forked link 34 at each side connected to slotted arms 35 of the bushes 12 by a stud 36, the links 34 receiving their motion from cams 37 oscillating with the shaft 18 and actuating the links 34 by cam grooves 38 and rollers 39.

Registering grooves 40, 40 are formed in the core segments near the hinge joint to receive asbestos or like packing so that if any molten metal should leak past the joint it will be stopped by the packing and not interfere with the working of the segments.

The core segments are further formed with the usual parallel grooves into which the metal runs to form the ribs on the concave face of the cast plate, but these grooves are curved and slightly undercut as shown at 41, (Fig. 5), where 4 indicates the core, 42 the plate and 43 the matrix. This undercutting provides sufficient connection between the cast plate and the core to enable the plate to bend inwards with the collapsing core and to roll out therewith while still allowing it to be stripped off the core by the succeeding mechanism of the said original application for patent.

The method of fixing the matrix in the casting shell 1 is shown in Figs. 6 and 7. 44, 44 are loose side gages disposed in the shell 1, and arranged to overlap the margins of the matrix 43. They are inserted in the casting shell 1 by a semicircular feather 45 with which they are each formed, these feathers engaging in grooves in the shell and preventing the side gages from slipping out when released. Any desired number of similar grooves may be provided in the shell to allow the gages to be set for plates of different widths.

Portions of the main frames 2, 2 are seen in Fig. 7 and through these are passed spindles 46, 47 on which are centered grippers 48, 49 to hold the straight edges of the matrix 43

which is thus gripped against the shell 1 at 50, 51 along its straight edges, and between the side gages 44 and the shell at its curved edges. Gripper 49 also serves as a stopper bar, completely filling the gap between the shell 1 and the core when this is in casting position, and together with the side gages forming a metal tight box only open at the top. The gripper 48 is a casting having a channel 52 for circulating cooling water in the known way, and fitted with a steel gripping bar 53 running the full length of the shell 1 and fixed to the gripper 48 at each end by screws 54. Also screwed to the gripper 48 are the end pieces 55 of the pouring mouthpiece, which is completed by the lip 5 before referred to. This latter abuts against the end pieces 55 when the core is in the casting position and closes the top of the pouring space 6 at the front while the pieces 55 close it at the ends. The end pieces 55 likewise abut against the ends of the side gages 44 and lock these in position, causing them to grip the matrix. The grippers 48, 49 are locked in position to grip the matrix and lock the side gages by means of eccentrics 56, 57 working in forks 58, 59 attached to the respective grippers. Eccentric 56 is held by brackets 60 carried by the shell 1 and is operated by a handle 61 having a face 61[a] formed to abut against a face 62 on the shell. By throwing the handle over, the eccentric rocks the fork and gripper into or out of its locking position and the faces 61[a] 62 are so arranged that when the gripper is turned to gripping position the handle abuts against 62 and locks the gripper in position. The gripper 49 is opened and locked in the same way by the eccentric 57 mounted in the frames 2, 2 and operated by a handle 63 with a facing 64 coacting with a facing 65 on the frame.

The operation is as follows:—Assuming the core to be expanded in casting position in the mold and the molten metal to have been delivered to the mold through the spout 3 by the mechanism more particularly described in my said original application for patent. In the casting position of the parts the center of the circular roller path 30 of the cam 9 is further away from the center of curvature of the toothed segment 22 than is the center of shaft 8. On starting the machine the shaft 18 and crank wheels 16, 17 commence their upward oscillation and the motion is first communicated to the eccentric bushes 12 through the cams 37 and links 34. The bushes 12 are thus caused to draw down the shaft 11, arms 10, cams 9, rollers 31 and top core segment 4 until the upper portion of the plate 66 (Fig. 8) is bent free from the matrix as far as the hinge point. This is shown at position I, Fig. 8. The roller path 30 is now concentric with the core shaft 8 and the center of curvature of shaft 11 coincides with that of the toothed segment 22, so that the mechanism is in a suitable position for the core to roll away out of the casting shell. Meanwhile the studs 16[a] have moved from one end to the other of the slotted eyes 15[a], and they now proceed, in the continued upwards oscillation of the crank wheels 16, 17 to drive the core away out of the mold by means of the links 15 and the toothed wheels and segments 21, 22. As the core rolls out of the casting shell, the lower half of the plate leaves the matrix at various circumferential points in paths and directions indicated by the arrows in Fig. 8. The velocities of these points are proportionate to the lengths of these paths and the action is such that if for any cause the plate should tend to adhere to the matrix a tension is set up in the latter from the bottom upwards, thus keeping it taut in the region where such a strain is desirable at the time.

In the continued upward oscillation of the crank wheels 16, 17 the core rolls away through the position II (Fig. 8) and at the end of the forward stroke of the links 15 it delivers the plate into a boring shell as described more particularly in my said original application for patent. In the backward oscillation of the crank wheels 16, 17 the core rolls back into the casting shell 1 and shortly before it completes its return roll into the casting shell the straight portion of the cam grooves 38 rocks the links 34 and shaft 11 so that the cams 9 lift the top core segment 4 into casting position.

Referring now to the modification shown in Figs. 9 to 11, 1 is the inclined casting shell bolted in the frames 2, 2 and wherein the matrix is clamped. 67 is a cylindrical core, to which are fixed at each end the toothed segments 67[a] and circular guides 68 running on the toothed segments and segmental guides 69, 70 on the main frames 2, 2 as before. The core is mounted on a shaft 71 connected to links 72, 72 corresponding to the links 15 of the first arrangement and driven in the same way by the oscillating crank wheels 16, 17 except that the eyes by which these links are attached to the studs 16[a] are not slotted. Further, in this modification the shaft 73 (corresponding to shaft 11 of the previous arrangement) about which the core swings, is fixed in the side frames 2. The core shaft 71 is connected by levers 74, 74 to the central shaft 73, which is counterweighted as before. By this means the core can be rolled into and out of the casting shell 1 in a manner similar to that before described.

The mouthpiece of the mold is made up of a plate 75 carried by the casting shell 1 and extending the full width of the core, a corresponding wedge shaped lip 76 fixed to the core and end pieces 77 adapted to slide on the core as explained later. The plate 75

serves as the gripper to hold the matrix at its top edge. It is mounted on the shaft or stay 78 so that it can be turned thereon for inserting and clamping the matrix and retained in its released or clamping positions by any suitable means. The bottom edge of the matrix is similarly clamped by the pivoted gripper bar 79 and the means for clamping the matrix are otherwise similar to those in Figs. 6 and 7.

The sliding end pieces 77 are attached by their spigots 80 to arms 81 centered on the core at 82, and coiled springs 83 on spigots 80 tend to keep the end pieces 77 pressed against the core when the mold is being closed, so that the several parts of the mouthpiece come together in their proper relative positions. The arms 81 are guided and limited in their motions by the guides 84. The core also carries a fixed stopper bar 85 (see detail view Fig. 9[a]) adapted to close the bottom of the casting space; the bar is formed with a projecting feather 86. This feather projects into the lower edge of the cast plate so as to hold it on the core during the rolling out, but not so much as to prevent the plate being wrenched clear when it is being stripped off the core. 87, 87 are catches mounted on the stay 78 and kept pressed downwards by coiled springs 88 into position to engage projections 89 on the sliding end pieces 77 so as to hold these in position when the mold core is in casting position and retain them during the initial portion of the outward rolling motion of the core until they are automatically released by the action of the arms 81. To prevent the spring 88 forcing the catches 87 too far round, these latter have shoulders 90 which abut against shoulders 91 on the bosses which carry the stay 78.

The sliding end pieces 77 are formed with inwardly projecting edges 92, so that, when the metal is poured, corresponding shoulders or recesses are cast in the plate at these points, these abutting against the ledges 92 to permit bending of the plate as about to be explained.

The operation is as follows:—The plate having been cast as described and the machine started, the core begins to roll out of the casting shell 1 under the action of the links 72, spur wheels 67 and racks 69, the projections 89 being still held by the catches 87 so that the end pieces 77 do not follow the rolling motion of the core, which begins to roll out under them, thus creating clearance between the core and matrix. The motion of the center 82 in this initial rolling has a downward direction such that the arms 81 draw the end pieces 77 down parallel with the engaging faces of the catches 87 carrying with them the cast plate by means of the projecting ledges 92 which at the same time serve as an abutment for the cast plate. As the rigidly fixed stopper bar 85 rolls with the core the result of these combined motions is that the straight edges of the plate are bent inwards on the core away from the matrix during the initial portion of the rolling, the end pieces 77 stripping the upper portion of the plate from the matrix and the stopper bar 85 stripping the lower portion of the plate therefrom, moving it off in a direction at approximately right angles to a tangent to the circumference of the mold. The catches 87 serve to keep up the described relative motion of the core and end pieces 77 till the plate has been stripped from the matrix, when the projections 89 move beyond the control of the catches 87. By this time the inner ends of the guides 84 have come against the arms 81 and the arms 81 are driven with the core, so that the core rolls away with the plate as indicated in Fig. 11.

At the end of its outward rolling motion, the core will deliver the cast plate to succeeding boring and finishing mechanism as before mentioned and will then roll back into casting position with the projections 89 engaged by the catches 87.

To relieve the catches 87 from the first strain of freeing the core from the plate, recessed noses 93 rigidly connected to the fixed stay 78 may be provided and arranged to project into the part of the casting space where the head piece is formed, so that projections 94 are cast in the head piece (see Fig. 11[a]). These projections not being so high as the projection, 89, will be quite clear of the noses 93 before the plate begins to move away, the control, after the first strain is over, being taken by the catches 87.

As a rule the projections 87 will be well clear of the catches 89 before the guides 84 begin to drive, so that both ends of the core will be able to move away at the same time so as to keep the plate parallel, but for finer adjustment instead of the stops 90, 91 the catches 87 may be provided with a slotted extension 95 through which an eyebolt 96 carried by a stud in the shell of the mold would pass, the adjustment being provided by lock nuts 97 against which the extension 95 would press.

In carrying the present invention into effect the core or its segments should be made hollow and cooled by a circulation of water or other medium or by expanding compressed air and gas therein, and the casting back or other part of the machine may also be similarly cooled.

It will be evident that the method of stripping a semicircular or curved stereotype plate from a fixed matrix by bending the plate inwards on a collapsible core, or upon a non-collapsible core suitably manipulated with respect to the plate and mold to permit such bending may be applied not only to ma-

chines for automatically casting or automatically casting and finishing curved stereotype plates, but also to machines in which such plates are cast or cast and finished partly or entirely by hand. It will also be evident that many other forms of mechanism for effecting the bending of the plate on the core and stripping it from a fixed matrix can be devised by those skilled in the art, and various other means for collapsing the core and bending and stripping the plate thereon will suggest themselves.

When a collapsible core is employed it may consist of more than two segments if desired.

What I claim and desire to secure by Letters Patent is:—

1. In the casting of curved stereotype plates, the process of stripping the plate which consists in bending the plate inward and relatively moving the plate and matrix.

2. In the casting of curved stereotype plates, the process of stripping the plate which consists in bending the plate inward on the core, and separating the core and plate and the matrix.

3. In a process of casting curved stereotype plates, stripping the cast plate from a matrix fixed in the mold by bending the plate inwards on the core and moving the core with the cast plate thereon out of the mold to strip the plate from the fixed matrix.

4. In a process of casting curved stereotype plates, stripping the cast plate from a matrix fixed in the mold, by collapsing the core to provide clearance between the plate and matrix, bending the plate inwards on the core, and moving the core with the cast plate thereon out of the mold to strip the plate from the fixed matrix.

5. In a process of casting curved stereotype plates, stripping the cast plate from a matrix fixed in the mold, by bending the plate inwards on the core and rolling the core with the cast plate thereon out of the mold to strip the plate from the fixed matrix.

6. In a process of casting curved stereotype plates, stripping the cast plate from a matrix fixed in the mold by collapsing the core to provide clearance between the plate and matrix, bending the plate inwards on the core and rolling the core with the cast plate thereon out of the mold to strip the plate from the fixed matrix.

7. In a process of casting curved stereotype plates comprising stripping the cast plate from a matrix fixed in the mold by bending the plate inwards on the core and rolling the core and plate out of the mold, delaying the plate from following the initial portion of the rolling of the core bending it inwards thereon and rolling the core and plate out of the mold.

8. In the casting of curved stereotype plates, the process which consists in casting a plate which is approximately semicircular, and stripping the plate by bending it inward and relatively moving the plate and matrix.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

ROBERT CUMMING ANNAND.

Witnesses:

JEAN MITCHELL,

ROBERT MILTON SPEARPOINT.