I. SHÖNBERG.

CASTING APPARATUS.

APPLICATION FILED NOV. 14, 1908.

937,477. **Patented Oct. 19, 1909.**

4 SHEETS—SHEET 1.

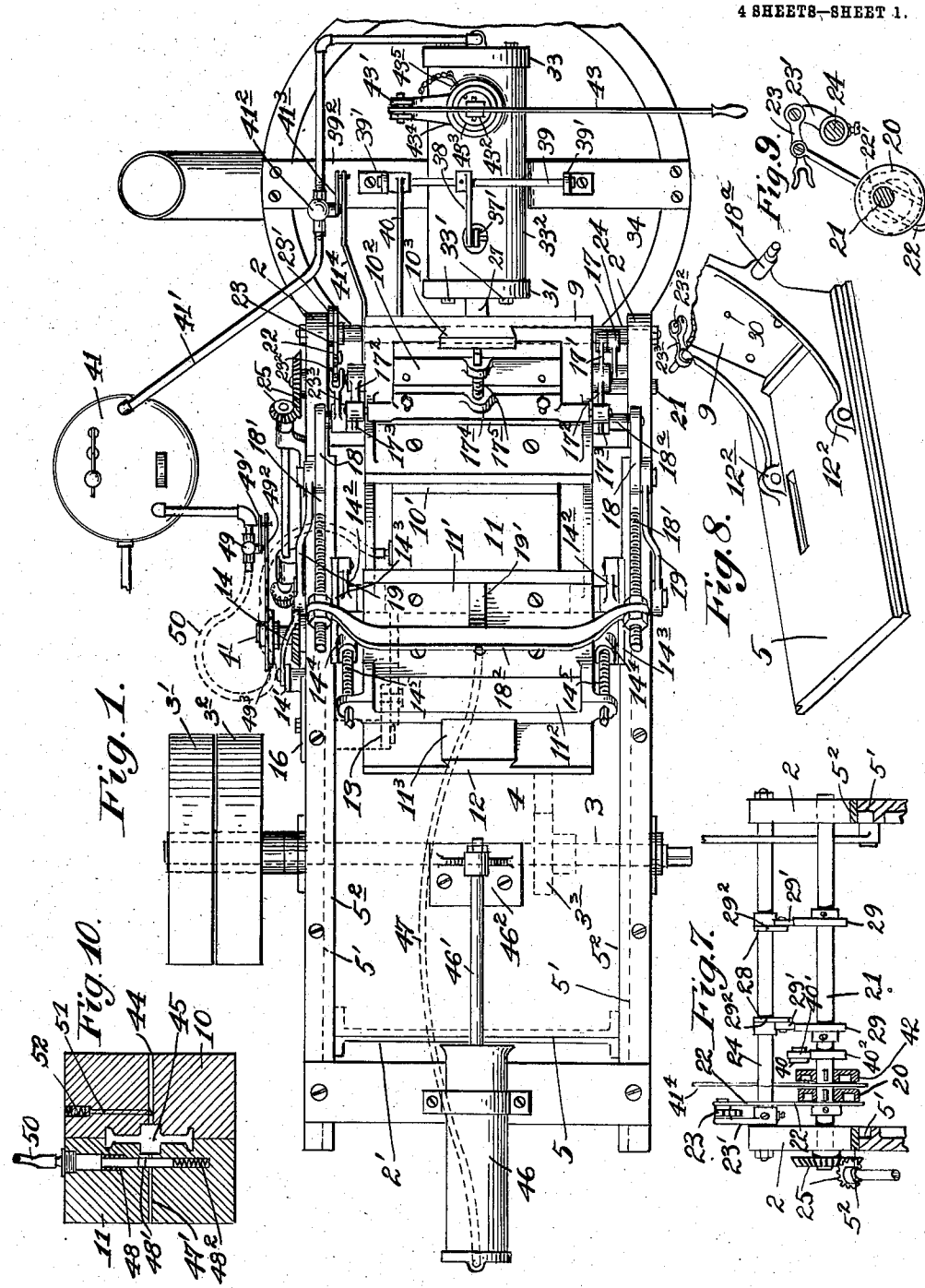

Fig. 1.

Fig. 8.

Fig. 9.

Fig. 7.

Fig. 10.

Witnesses:

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William Surridge

Inventor;

Isaac Shönberg,

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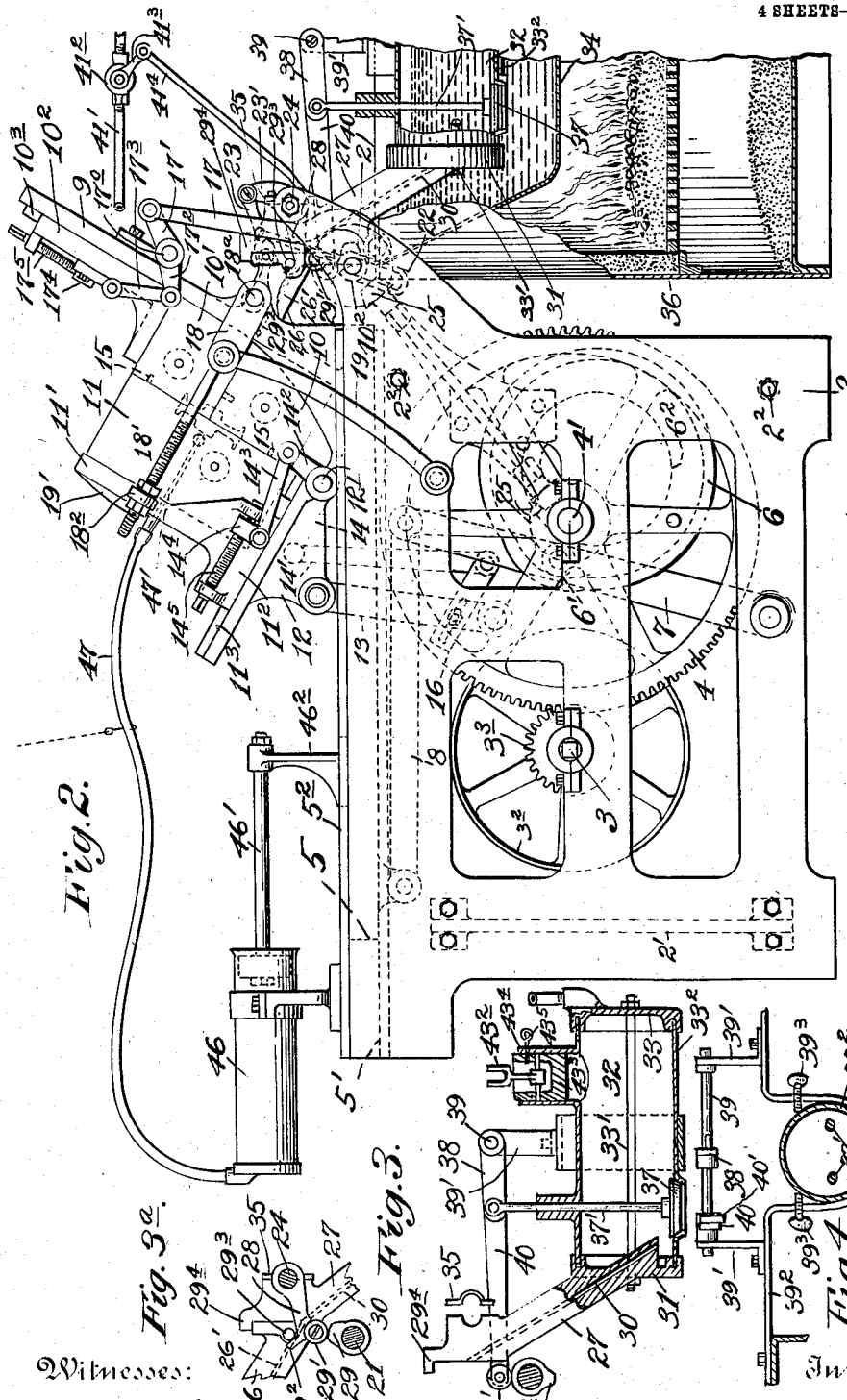

Fig. 2.

Fig. 3a.

Fig. 3.

Fig. 4.

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4 SHEETS—SHEET 3.

Fig. 5.

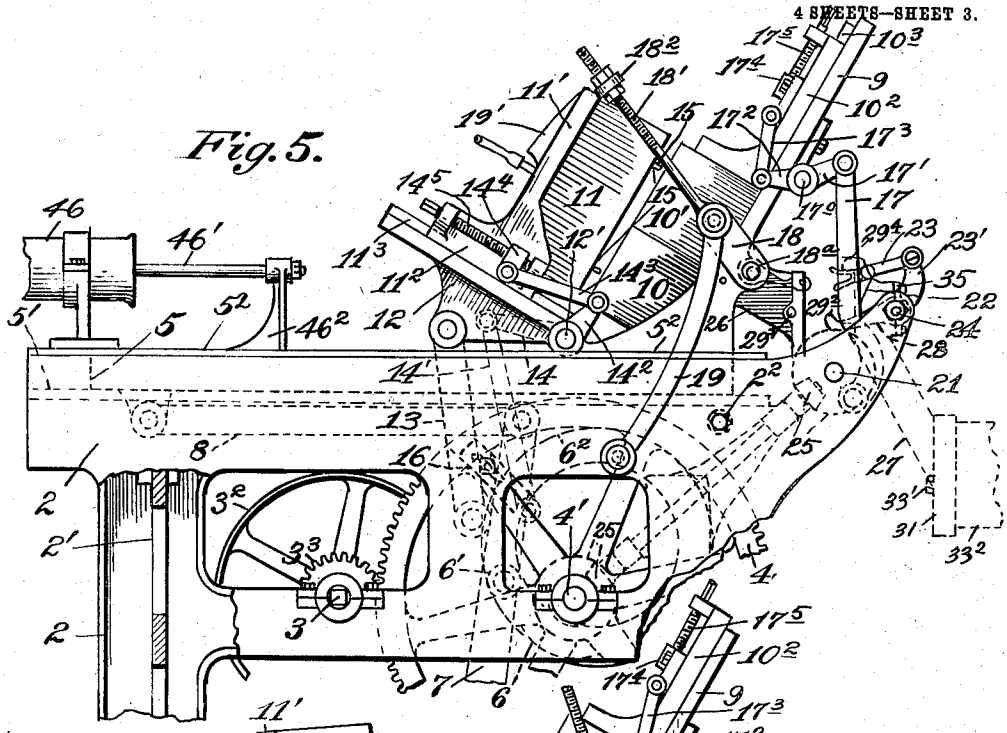
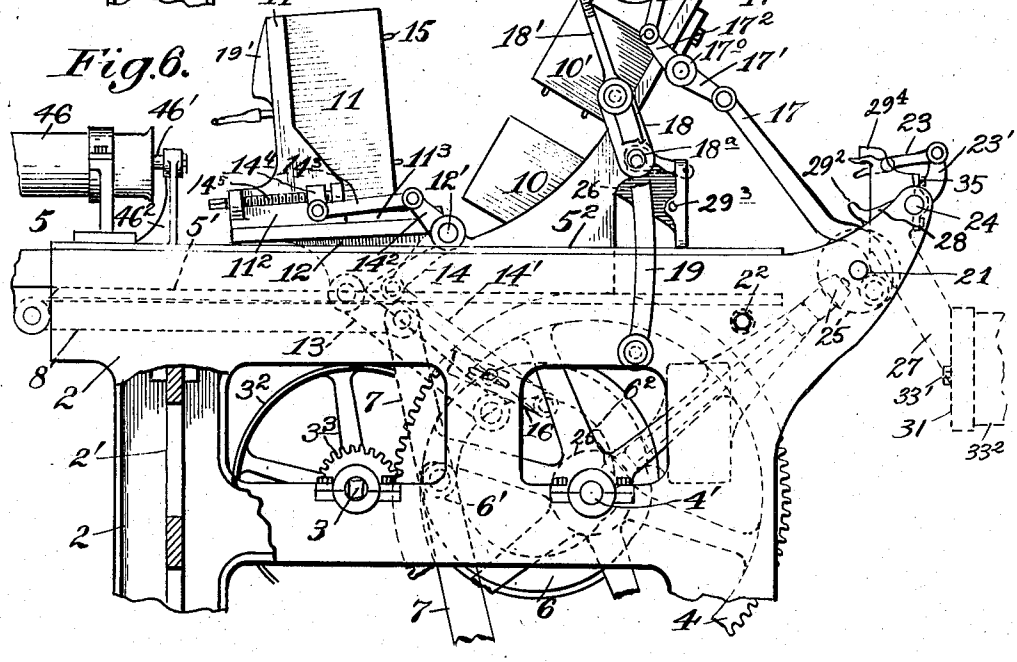


Fig. 6.



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CASTING APPARATUS.

APPLICATION FILED NOV. 14, 1908.

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4 SHEETS—SHEET 4.

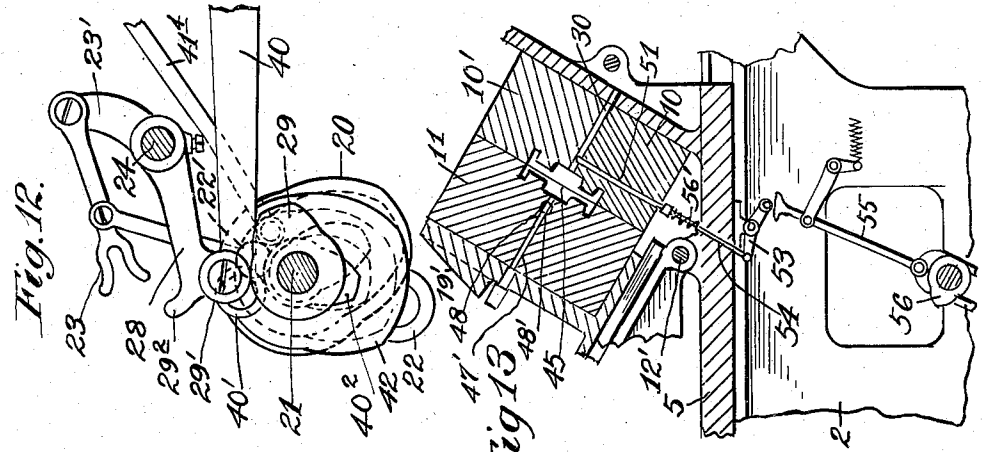

Fig. 12.

Fig 13

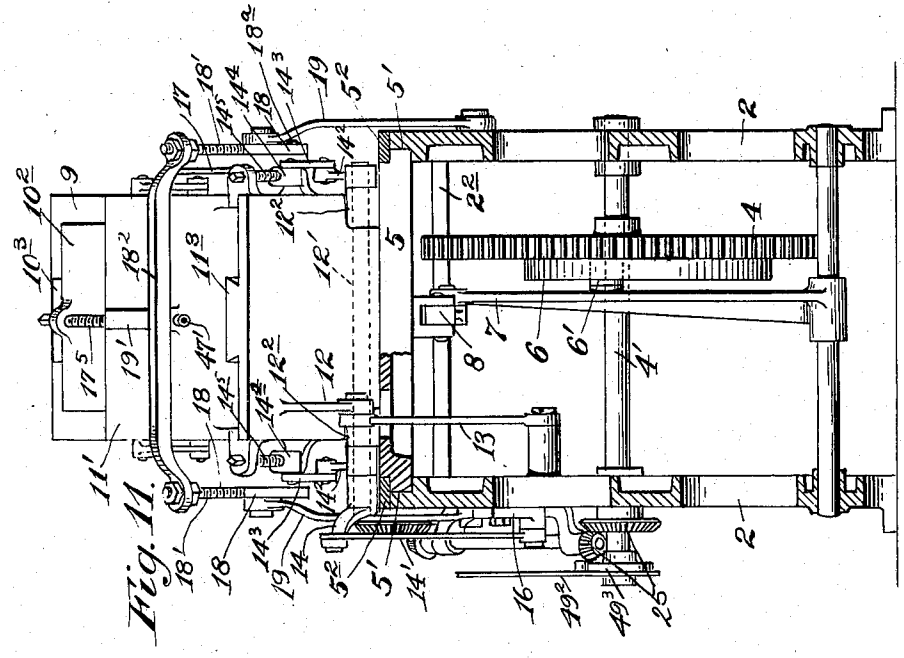

Fig. 11.

Witnesses:
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UNITED STATES PATENT OFFICE.

ISAAC SHÖNBERG, OF NEW YORK, N. Y.

CASTING APPARATUS.

937,477. Specification of Letters Patent. Patented Oct. 19, 1909.

Application filed November 14, 1908. Serial No. 462,594.

To all whom it may concern:

Be it known that I, ISAAC SHÖNBERG, of the borough of Brooklyn, city and State of New York, have invented a certain new and useful Improvement in Casting Apparatus, of which the following is a specification.

This invention pertains to mechanism for effecting a sequential operation involving the closing of the separable mold and its approach to the casting spout, the locking of the mold parts or sections together and to the spout, the injection of molten metal into the mold, the separation of the sprue from the casting in the mold cavity and the withdrawal of the filled mold, and finally the separation of the mold sections—this cycle of operations being repeated continuously during the running of the apparatus.

Various features of novelty and utility are embraced in the foregoing apparatus as disclosed in the drawings forming part of this specification and in which—

Figure 1 is a plan view of a casting apparatus in which are embodied my present improvements. Fig. 2 is a side elevation. Fig. 3 is a longitudinal section through the pressure cylinder or chamber located in the melting pot. Fig. 3^a is an enlarged detail of means for locking the mold part to the casting spout during the casting operation. Fig. 4 is a cross section of such cylinder. Figs. 5 and 6 are views similar to Fig. 2, these two figures showing the operative parts in two positions corresponding to a partially open and a fully open condition of the mold. Fig. 7 is partly an elevation, partly a section of the supplemental cam shaft with associated parts. Fig. 8 is a perspective view of the shiftable mold-carrying table or slide of the apparatus, the angle plate for supporting the mold sections being broken away. Fig. 9 is a detail of means for locking together parts of the closed separable mold, this condition of the mold prevailing immediately prior to and during the casting operation. Fig. 10 is a cross section through a mold of a somewhat different construction to that already shown taken on the line of the inlet passage and shows the valve for controlling the exhaustion of the mold cavity and the separation of the sprue from the casting. Fig. 11 is a cross section of the apparatus. Fig. 12 is an enlarged detail of certain cams on the supplemental cam shaft together with associated parts. Fig. 13 is a view of a modified construction for separating the sprue.

Similar characters of reference designate corresponding parts in all figures.

The operative parts of the apparatus are supported on suitable frame work which here comprises side frames 2, 2, a cross frame 2′ and tie bars 2^2. The main driving shaft 3 is journaled in suitable bearings on the side frames and here carries fast and loose pulleys 3′, 3^2, and a driving pinion 3^3 which meshes with a gear 4 secured to a main cam shaft 4′ also journaled in bearings on the side frames.

It may be premised that the mold is mounted on a carrier slide 5 adapted to move along ways 5′ at the top of the frame work the slide being held to its prescribed line of travel by gibs 5^2. A reciprocating motion is imparted to the carrier from a cam 6 on shaft 4′, a cam roll 6′ on cam lever 7 traveling in a groove 6^2 of the cam and the lever being connected by a link 8 with the carrier.

Referring now to the mold and mold mechanism, it should be stated that the particular separable mold embraced in the construction illustrated in all figures except Fig. 10 embodies three parts or sections, one of which is fixed relatively to the carrier while the other two sections are movable relatively to each other and to the first mentioned part.

At one end of the carrier there is provided an angle plate 9 extending above and at an angle to the upper face of the carrier. Secured to the inclined face of this angle piece is the so-called stationary mold section 10 while in juxtaposition to such section along the angle piece is a second section 10′ which is secured to a slide 10^2 mounted on ways 10^3 with which the angle piece is provided. The third mold section designated by 11 is secured to a transverse extension 11′ of a slide 11^2 mounted on ways 11^3 on a swinging support 12, the bearings for the supporting shaft 12′ of which are designated by 12^2, see Fig. 8.

The separation of the mold sections involves in the present instance an initial movement of section 11 at substantially a right angle to the meeting plane of the section with sections 10 and 10′ after which section 11 is swung to a position indicated in

Fig. 6. During this swinging movement, section 10′ is moved upward along ways 10^3. In order to obtain these opening (and reverse or closing) movements the motion of the main slide or carrier 5 is in the present instance utilized to actuate controlling links fulcrumed to stationary parts on the frame work and to the respective moving parts. That is to say, support 12 is connected by a link 13 with the frame work while an arm 14^4 fast to shaft 12′ is connected by link 14′ to the frame work, a pair of side arms 14^2, 14^2 rigid with the shaft being connected by links 14^3 to carrier 11^2. This latter connection in order to permit of the insertion of molds of various sizes is an adjustable one, here comprising on each side a nut 14^4 to which the link 14^3 on that side is connected, each nut being threaded on a corresponding adjusting screw 14^5 rotatively mounted on the slide. Links 13 and 14′ are of such length and so related that during the first portion of the backward movement of carrier 5 an initial movement of mold section 11 results, as aforesaid, to properly draw from the casting and to free the usual dowel pins 15. This may be more readily attained by making the fixed fulcrum support of link 14′ adjustable as by mounting such support on a slotted arm 16 adapted to be secured to the frame work in various positions. Similarly slide 10^2 is moved to and fro by a link 17 fulcrumed at one end to the framework and at the opposite end to an arm 17′ of a shaft 17^0 journaled on the plate 9, arms 17^2, 17^2 of this shaft being connected by links 17^3, 17^3 to nuts 17^4, 17^4 on adjusting screws 17^5, 17^5 for a reason already explained. Means are also shown for locking the mold sections together when the mold is in its casting position, see Fig. 2, the locking mechanism here comprising a pair of side arms 18, 18 loosely mounted upon the eccentric ends of a shaft 18^a, mounted in bearings in the angle plate 9. Each side arm 18 is provided with a threaded extension 18′ whereby a cross bar or bail 18^2 may be adjustably secured to the extensions in such a position as to cause the cross bar to swing to place back of mold section 11 and away therefrom during the reciprocation of carrier 5, this actuation of the cross bar being under the control of links 19, 19 one at each side. A rib 19′ on the upright part 11′ of slide 11^2 forms a seat for the cross bar the latter being drawn firmly against its seat by a partial turning of shaft 18^a just prior to the injection of molten metal. This locking motion of the shaft is here effected by a cam 20 on supplemental cam shaft 21, a slotted link 22 having a cam roll 22′ and being connected to a forked lever 23, preferably adjustably mounted as for instance by pivoting the same to an arm 23′ adjustably secured to a fixed shaft 24. Forked lever 23 is held in such a position that when the mold carrier moves backward to its casting position, a pin 23^2 on arm 23^3 extending from shaft 18^a enters the fork of the arm whereupon cam 20 rocks arm 23 and turns shaft 18^a just prior to the casting operation. The eccentric ends of the shaft cause the slight drawing inward on cross bar 18^2 thus clamping section 11 tightly to the other sections. Supplemental cam shaft 21 may be driven by a bevel gear connection 25 from shaft 4′.

While I have shown and described a three-part mold, obviously a two-part one may be used, parts 10 and 10′ being combined into one section as in Fig. 10, fast to angle plate 9, in which event slide 10^2 and its operating parts are omitted.

It will be understood that when the mold carrier is in its extreme position to the right, see Fig. 2, it is in its casting position, ready for the injection of metal. In this position of the parts an inclined extension 26 which contains the passageway 26′ leading to the mold is in juxtaposition to casting spout 27 the extension being preferably firmly held against the end face of the spout during the casting operation by some means, such, for instance as that shown in which locking levers 28 (one only being shown) loose on fixed shaft 24 are shifted to a position by cams 29, 29 (on supplemental cam shaft 21) which contact with respective rollers 29′, 29′ on the levers, such that an inclined extension 29^2 on each lever impinges against a corresponding roller or pin 29^3 on extension 26, the outward thrust being taken by a shoulder 29^4 on the spout. The parts are thus held securely together until the continued rotation of cams 29, 29 frees the levers leaving the mold, etc., free to be withdrawn.

Casting spout 27 has the usual upwardly inclined passageway 30 therethrough, it being here formed integral with one head 31 of a pressure chamber 32 having an opposed head 33 and tie bars 33′ clamping the two heads rigidly to the shell 33^2. Pressure chamber 32 is suspended within a suitable melting pot 34 it being here clamped to the aforesaid fixed shaft or frame tie bar 24 by a cap 35. Some convenient and desired source of heat 36 will be used. Pressure chamber 32 is provided with a valve 37 for permitting the inflow of metal from the melting pot and for shutting off the metal in the pressure chamber therefrom, the stem 37′ of this valve being here connected to an arm 38 extending from a rock shaft 39 journaled in uprights 39′ secured to a cross-bar 39^2 attached to a fixed portion of the apparatus, this cross bar being here shown as passing under the pressure chamber and steadied or centered thereon by screws 39^3.

A rock arm 40 extending from shaft 39 carries at its end a roll 40′ adapted to engage with a cam 40^2 carried on shaft 21 by which valve 37 is operated in proper timing.

In order to subject the metal in the pressure chamber to a pressure suitable for its forcible injection into the mold, I may use compressed air. A pressure tank 41 thereof is indicated, a pipe 41′ leading from the tank to the pressure chamber 32 and being provided with a valve 41^2 to whose stem is affixed an arm 41^3 to which motion is transmitted through link 41^4 by a suitable cam 42 to give a properly timed valve operation.

In those instances in which it is desired to effect a hand or manual operation of the apparatus, an injection pressure on the metal in the pressure chamber may be obtained by depressing a hand lever 43 fulcrumed at one end to a support 43′ and connected by a fork 43^2 to a piston 43^3 working in a cylindrical extension 43^4 of the pressure chamber shell 33^2. When not so used piston 43^3 may be fixed in position by a locking pin 43^5.

Reverting to the mold it should be stated that the passage through extension 26 opens out through angle piece 9 in the parting plane of mold sections 10 and 10′, such passageway being continued through these sections or the single section of Fig. 10 by opening 44 into the mold cavity 45.

A further feature of the present apparatus involves exhaustion of air from the mold cavity prior to the metal injection thereinto. For this purpose I may use a vacuum cylinder 46 mounted on the framework and having therein a piston whose rod 46′ is affixed to a standard 46^2 secured to carrier 5. A flexible pipe 47 leads from cylinder 46 to and connects with a passageway 47′ in mold section 11 communicating therethrough with the mold cavity. A shut-off valve is shown as mounted in mold section 11, this valve comprising a part 48 provided with a port 48′ and a returning spring 48^2. When carrier 5 moves forward a vacuum is formed in the vacuum space between the piston and valve part 48, until the mold reaches its casting position whereupon a valve 49 is actuated through valve stem arm 49′, rod 49^2 and cam 49^3 on cam shaft 4′ and pressure from tank 41 admitted through conduit 50 to the top of valve part 48. Port 48′ is thus alined with passageway 47′, air exhausts from the mold cavity and the passageway is subsequently closed by the continued movement of the valve part. When the mold returns to its open position cam 49^3 reactuates valve 49 to shut off the pressure from the tank, the parts being made sufficiently loose to permit the air thus inclosed between valves 48 and 49 to leak out and allow spring 48^2 to return valve 48 to its original position.

Figs. 10 and 13 illustrate that feature of the present invention in accordance with which the operation of the apparatus involves a step in which the sprue is separated. A sprue cutter in the nature of a valve 51, see Figs. 10 and 13, is located to cross the passage way leading from the casting spout to the mold cavity, it being here mounted in that part of the mold in contact with angle plate 9 and moving in a line transverse to the axis of such passage way. According to the device of Fig. 10, valve 51 is forced to position across the path of metal flow by a spring 52. During the casting operation and when the metal is forcibly injected, the pressure to which the molten metal is subjected is effective in moving the valve back against the pressure of its returning spring leaving the flow of metal unobstructed. When, however, the pressure on the metal is released, the pressure of the spring exerts itself to force the valve to a position in which the metal in the mold cavity is divided from the metal in the pressure chamber it being contemplated that the parts shall be maintained hot enough to render the metal on the chamber side of valve 51 sufficiently fluid to flow back toward the pressure chamber. Instead of relying on the pressure of the molten metal to open the valve it may be operated mechanically as in Fig. 13 in which a lever 53 mounted on the mold carrier is connected to stem 54 of valve 51 and is so related to a push rod 55 operated by a cam 56 that the valve may be moved outward at the proper time against the pressure of a returning spring 56′.

The operation of the foregoing apparatus may be described in general terms as follows: Assuming the mold to be in its casting position, as in Fig. 2, the rotation of driving shaft 3 opens valve 49 admitting pressure fluid to the top of valve part 48. Mold cavity is thus exhausted, and valve 41^2 being thereafter operated, molten metal is forcibly injected into the mold cavity. Pressure on the metal being released valve 51 is actuated cutting off the sprue which operation is followed by the backward movement of mold carrier 5. Prior to this backward movement the descent of arms 28 unlocks extension 26 from the casting spout while the actuation of forked arm 23 turns shaft 18^a releasing the mold from the grip of cross bar 18^2. During the backward movement of the mold carrier, links 19 raise cross bar 18^2, and the initial operation of links 13 and 14′ brings mold section 11 to the position indicated in Fig. 5. The continued operation of these links and link 17 results in substantially the position of the apparatus indicated in Fig. 6 when the casting may be removed. Mold carrier now moves forward, air is exhausted from cylinder 46,

valve 37 is opened to admit a further supply from the melting pot into pressure chamber 32 and the closed and locked mold ultimately assumes its casting position to be followed by a repetition as aforesaid.

Having described my invention, I claim:

1. The combination of a shiftable mold carrier, a supporting frame work, a sectional mold on the carrier, a fixed casting spout, mechanism for causing the mold carrier to approach and to recede from the casting spout, a melting pot, a pressure chamber and means connecting mold sections on the carrier with the framework whereby the movement of the mold carrier causes the relative movement of the mold sections.

2. The combination in a casting apparatus, of a supporting frame work a shiftable mold carrier a swinging support on the carrier for a mold section and a link connecting said swinging support with said supporting frame work for swinging said support to and fro during the to and fro movement of the carrier.

3. The combination, in a casting apparatus of a shiftable mold carrier, a swinging support on the carrier, a mold section slidably mounted on said support, and means for causing a substantially parallel motion of said mold section during the initial opening movement thereof.

4. In a casting apparatus, the combination of a shiftable mold carrier, a supporting frame work, and mold section supporting-slides on said carrier linked to said frame work for the purpose specified.

5. In a casting apparatus, the combination of a supporting frame work, a mold carrier, a vacuum cylinder and piston supported one on said carrier and one on said frame work, a pressure cylinder, a melting pot, a source of pressure fluid, and valve mechanism for controlling the exhaustion of the mold cavity and the entrance of pressure fluid to said pressure chamber.

6. In a casting apparatus, the combination of a shiftable mold carrier, a sectional mold thereon, a frame work to which sections of the mold are linked whereby the movement of the mold carrier causes the relative movement of the mold sections, a casting spout, and means for locking the mold sections together and the mold to the casting spout during the casting operation.

7. In a casting apparatus, the combination of a shiftable mold carrier, a sectional mold adapted to be opened and closed during the movements of the carrier, a mold section locking bar on said carrier adapted to swing to its locking position upon the closing of the mold, a shaft upon which said bar is eccentrically mounted, and a cam for turning said shaft when the bar is in its locking position.

8. In a casting apparatus, the combination of a shiftable mold carrier, a supporting frame work and mold section supporting slides on said carrier adjustably linked to said frame work for the purpose specified.

9. In a casting apparatus, the combination of a separable mold a casting spout, a pressure chamber, a melting pot, a sprue cutter adapted to move across the passage way leading from the casting spout to the mold in a line transverse to the axis of such passage way and be actuated in one direction by pressure in the pressure chamber, and means for forcing said sprue cutter in the opposite direction.

In witness whereof I have signed this specification in the presence of two subscribing witnesses.

ISAAC SHÖNBERG.

Witnesses:

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CELIA R. DEUTSCH.