Aug. 16, 1932. T. C. KORSMO 1,872,085

DIE CASTING MACHINE

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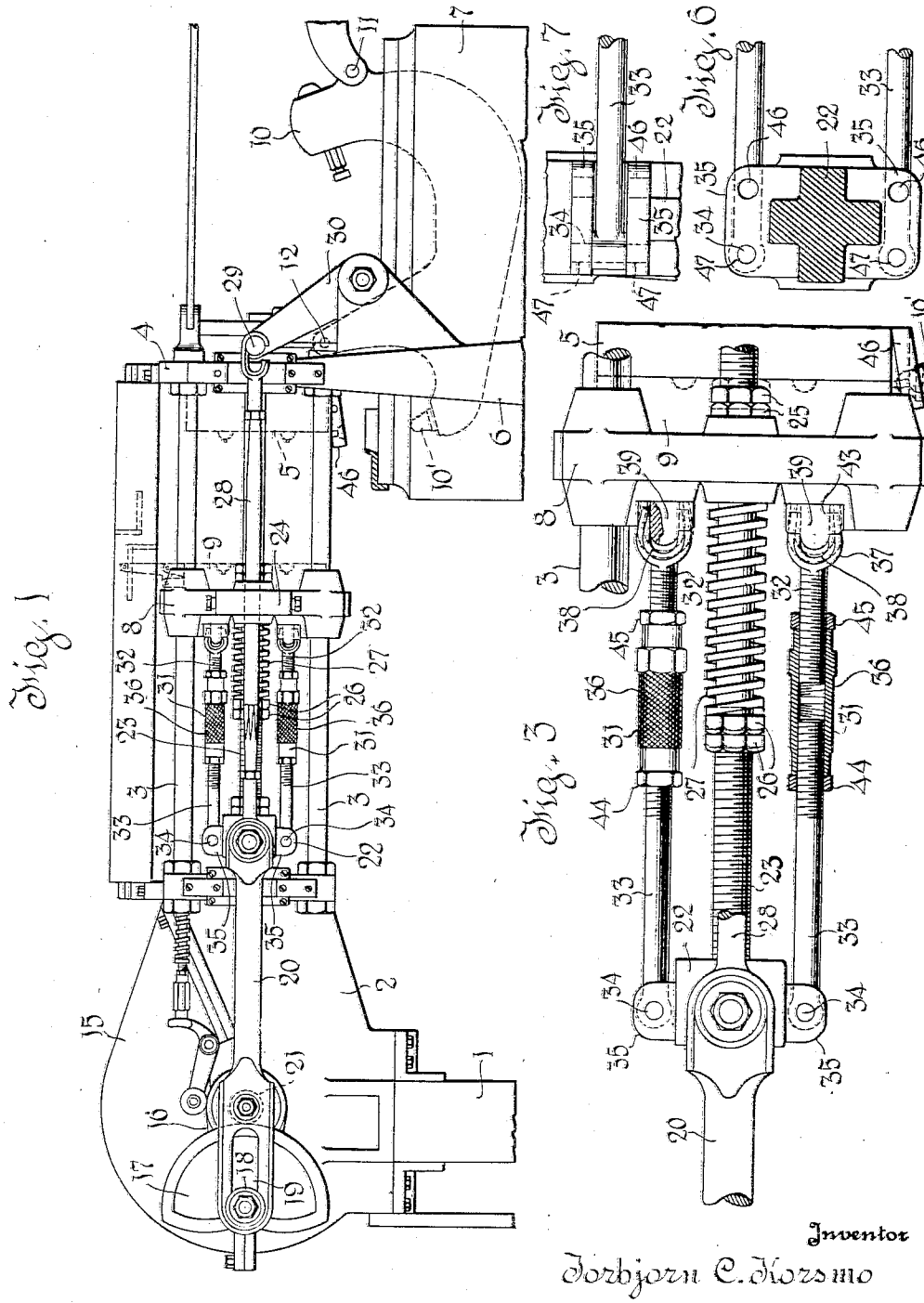


Fig. 1

Fig. 3

Fig. 6

Fig. 7

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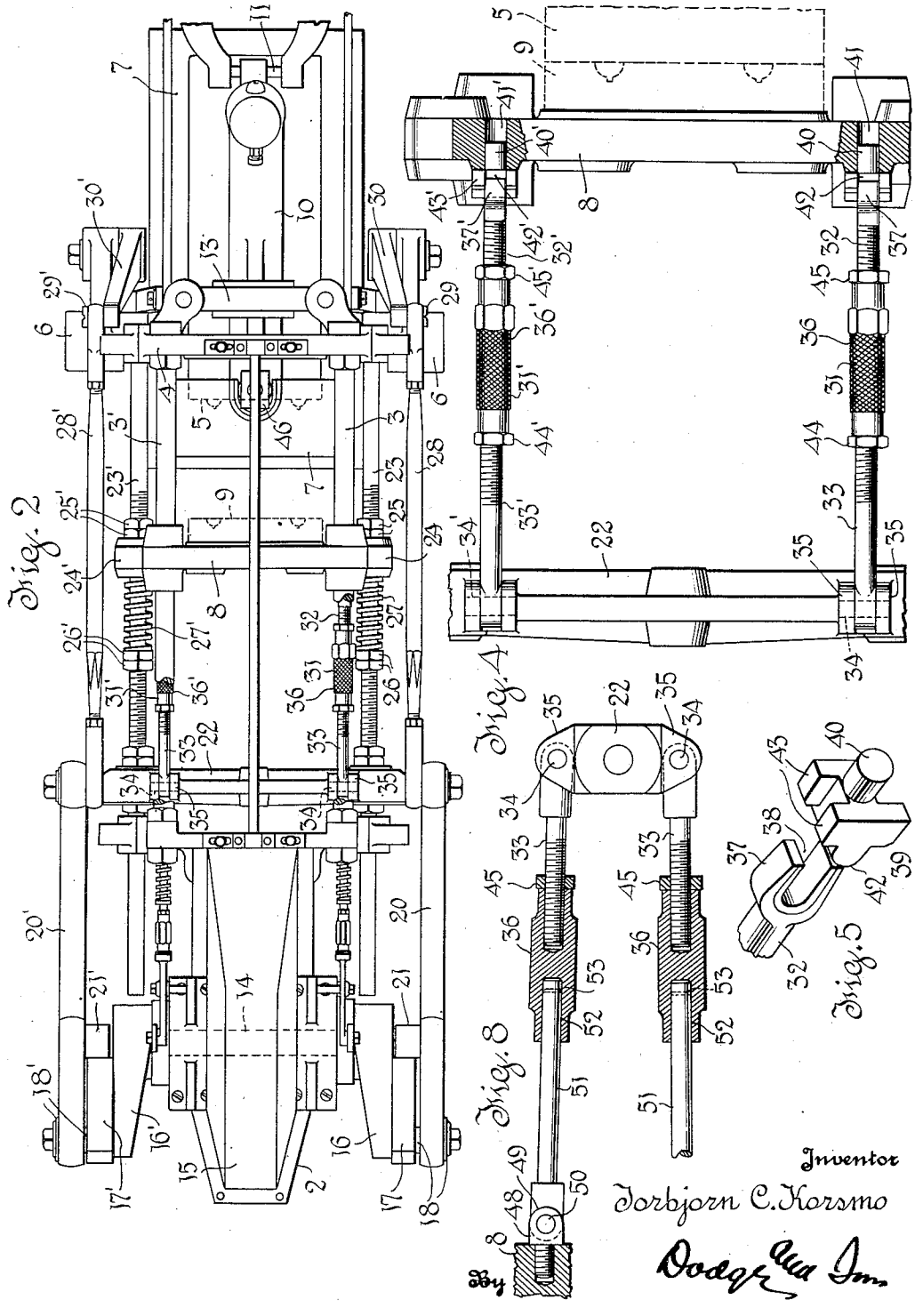


Fig. 2

Fig. 4

Fig. 8

Fig. 5

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UNITED STATES PATENT OFFICE

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DIE CASTING MACHINE

Application filed September 9, 1930. Serial No. 480,728.

The present invention relates to die casting machines, and more particularly to the type of machine wherein the die comprises a plurality of parts, one or more of which are movable for the purpose of ejecting the casting.

The invention is directed to the mechanism by which the movable die part is operated to open and close the die. The particular object in view is to provide means which insure that the die parts are brought tightly together at all points and locked in this condition, when the die is closed. The importance of this in preventing leakage of molten metal from the die cavity and the formation of burrs on the castings will readily be appreciated.

A further object is the provision of die locking means of the type described which are adapted for use with dies of different sizes, including the largest commercial forms now in use.

Since the features of the device herein described are applicable particularly to die casting machines of the type disclosed in my earlier Patents Nos. 1,607,677 of November 23, 1926, and 1,627,784 of May 27, 1927, especial reference is made thereto. The invention, it will be understood however, is in nowise limited to this type of machine.

The accompanying drawings, which disclose a practical embodiment of the invention now in successful commercial use, comprise

Fig. 1, a fragmentary side elevation view of a die casting machine embodying the invention, the machine illustrated being of the type shown in my two earlier patents, supra. In this view, the die is open and therefore the locking device is in its inoperative position;

Fig. 2, a similar, plan view which also shows the parts in the same position;

Fig. 3, a fragmentary side elevation of the die locking device when the die is closed, but not locked, the locked position of the parts, ready for a casting to be "shot", being indicated in dotted lines;

Fig. 4, a similar, plan view of the same;

Fig. 5, a perspective of a detail;

Fig. 6, a side elevation, partly in section, of a modified form of the locking device adapted to take care of large sized dies;

Fig. 7, a plan of the same; and

Fig. 8, a side elevation, partly in section, of a modified form of the locking device.

In order to disclose the invention fully, it is not necessary to illustrate the complete die casting machine; nor to describe in detail the construction and operation of the die charging means and the means for opening and closing the die. However, such reference will be made to these parts and their mode of operation as is essential to a complete understanding of the present invention. Details of construction and operation of the devices referred to are fully set forth in my earlier patents, Nos. 1,607,677 and 1,627,784, supra, to which reference is made for this purpose.

The machine, as shown in the drawings, includes a frame member 1, carrying a gear housing 2. The ends of a series of guide rods 3, 3, 3′, 3′ are secured in the right hand wall of housing 2 and their opposite ends find support in hot plate 4. The hot plate, which carries the stationary die part 5, is supported on top of a second frame member 6. Both members 1 and 6 are mounted on the bed of the machine (not shown) as is also the combined melting pot and furnace 7 appearing at the right in Figs. 1 and 2. Attached to die carriage 8, which is slidably mounted on guide rods 3, 3, 3′, 3′, is the movable die part 9.

The usual goose neck or pressure chamber 10, having an outlet nozzle 10′, is shown pivotally mounted on the frame at 11. The forward end of the goose neck is pivotally supported at 12 in a vertically movable yoke 13, whereby the goose neck may be swung up and down about its fixed pivot 11. As it appears in Figs. 1 and 2, the goose neck is submerged in the molten metal in melting pot 7, whereby it may receive a quantity of the metal preparatory to charging the die.

The mechanism for opening and closing the die and for raising the goose neck into die charging position will now be described. A drive shaft 14 is journaled at its ends in the sides of housing 2. A cover 15 is provided for the housing and conceals the gearing for driving shaft 14. The die operating

parts about to be described being duplicated on either side of the machine, only the forward set will be referred to in detail. The corresponding parts at the rear are indicated by primed numbers.

A crank 16 fixed to the front end of shaft 14 has a cam 17 secured fast thereto. This cam carries a roller 18 engaging a slot 19 in the end of connecting rod 20. A roller 21 mounted for rotation on the inner face of connecting rod 20 engages at all times with the edge of cam 17.

At their opposite ends, the two connecting rods 20, 20′ are joined together by a cross member 22. This cross member is fixedly secured on die carriage pusher rods 23, 23′ intermediate their ends, the rods being extended on either side of the cross member to pass through suitable guideways provided for this purpose in hot plate 4 and the end of housing 2 (see Fig. 2). Split bearings 24, 24′ on die carriage 8 slidably support the carriage on pusher rods 23, 23′ for a purpose explained later.

On each side of die carriage 8, pusher rod 23 is threaded to receive a pair of nuts 25 to the right and a pair of nuts 26 to the left of the die carriage. A spring 27 located between nuts 26 and the die carriage serves to urge the carriage towards the right and against nuts 25.

Also pivotally connected at one end to cross member 22 is an elevator pusher rod 28. The right hand end of this rod has a pin-and-slot connection at 29 with the upper arm of a bell crank 30. The other arm of the bell crank and the corresponding arm of the rear bell crank 30′ serve, when the machine is operating, to effect the necessary raising or lowering of yoke 13 to actuate the goose neck 10.

No claim is made herein to the mechanisms so far described, since these are fully covered by my prior Patents Nos. 1,607,677 and 1,627,784, supra, and No. 1,590,246 of June 29, 1926, and No. 1,631,686 of June 7, 1927. Reference may be had to these for further details.

Referring particularly now to Figs. 1 and 2, it will be seen that interposed between cross member 22 and movable die carriage 8 is a set of four turn-buckle type, struts or braces 31, 31, 31′, 31′, one pair at the front edge of the die carriage, and the other at the rear edge. These struts are identical in construction, and each extends to a corner of the die carriage 8. At the opposite end, the strut is pivotally connected with cross member 22. As will appear presently, the purpose of these struts is to assist in forcing die carriage 8 to the right, when the die is closed, so as to insure full contact between the faces of die parts 5 and 9, and to positively lock the die parts in this position until the casting has been "shot" and "frozen".

The details of construction of struts 31, 31, 31′, 31′ appear clearly in Figs. 3 and 4. Each strut, which is in the nature of a turn-buckle assembly to permit adjustment for different sized dies, is made up of a short rod 32 and a longer rod 33. Rod 33 is pivotally mounted by means of a pin 34 between a pair of perforated lugs 35 formed on cross member 22. The opposite end of rod 33 is threaded into a cylindrical adjusting member 36. Into the other end of member 36, rod 32 is threaded. The threads in the ends of adjusting member 36 are disposed reversely, as also are the corresponding threads on rods 32, 33. Hence, rotation of member 36 will serve to draw rods 32 and 33 together, or to spread them apart, depending upon the direction of rotation.

The right end of rod 32 is in the form of a U-shaped fork 37, the slot 38 of which receives the central portion of a stud member 39 on the die carriage. This is shown in Figs. 3 and 4 with the parts assembled. The details are clearer in Fig. 5, wherein the same parts are shown disassembled. Stud 39 may be mounted in any suitable manner on die carriage 8. As shown, it is provided with a cylindrical portion 40 having a force fit with a corresponding opening 41 in the die carriage. Since fork 37 is intended to slide back and forth on the central portion 42 of stud 39, the length of the arms of fork 37 and the depth of central portion 42 are made sufficient to prevent disengagement of these parts during normal operation of the machine. Guide walls 43, 43 on stud 39 likewise are made sufficiently long to prevent sidewise disengagement between the parts.

In order that sleeve 36 may be secured fast in properly adjusted position, lock nuts 44, 45 are provided for this purpose on rods 32, 33.

In operation, assuming the parts are in the position of Figs. 1 and 2 with the die open and power is applied to drive shaft 14, connecting rods 20, 20′ will move to the right and impart a corresponding movement to cross member 22, die carriage pusher rods 23, 23′, and elevator pusher rods 28, 28′. As a result, die carriage 8 will be moved to the right on guide rods 3, 3, 3′, 3′ until movable die part 9 engages fixed die part 5. Simultaneously, goose neck nozzle 10′ is raised by the connections described into contact with a perforated nipple plate 46 pivoted on the frame (see solid line position of Fig. 3). Following this, the goose neck, as will appear shortly, has a final upward movement which carries it into registry with the die through the opening in the nipple plate.

Die carriage 8 is preliminarily adjusted on the guide rods and secured by nuts 25, 26, so that the die parts 5 and 9 are brought together shortly before cross member 22 completes its movement to the right. Struts 31, 31, 31′, 31′ are adjusted accordingly, that is, each is shortened or lengthened, as need be,

to provide normally a gap between the base of slot 38 and the outer end of stud 39, (see the full line position of the parts in Fig. 3). This gap is made equal to the amount cross member 22 travels to the right after closing the die. Hence, when the die parts are brought together, cross member 22 continuing its movement to the right causes coil springs 27, 27′ to be compressed against the die carriage 8, pusher rods 23, 23′ sliding freely through the die carriage to permit this action. During this short relative movement between cross member 22 and die carriage 8, goose neck 10 moves to the die charging position shown in full lines in Fig. 3. Simultaneously, the gap between the base of slot 38 of the turn-buckle fork and the outer end of stud 39 is closed up, and the parts brought into firm contact, (see dotted line position of Fig. 3). In other words, until the strut parts just mentioned come into engagement, the die parts 5, 9 are only held together resiliently. When the engagement mentioned takes place, a rigid bracing or locking of the movable die part against the fixed die part is effected. This provides for maintenance of the die faces in firm engagement with each other, and securely locks the parts in this condition, until the die operating mechanism is reversed, as will appear shortly.

Each of the turn-buckle assemblies 31, 31, 31′, 31′ having been similarly adjusted, they will act simultaneously on the entire die carriage 8 in order to force all parts of the carriage and the attached die part into engagement with the fixed die part. It is to be noted that the several strut devices are so located and attached to the die carriage, that is, substantially at the corners thereof, that the most effective bracing is accomplished. Of course, other arrangements of the struts could readily be provided for to accommodate special conditions, such for instance as where die carriages or die parts of peculiar shapes or unusual sizes are used.

After the charge of metal from goose neck 10 has been forced into the closed die and permitted "to freeze", the die actuating mechanism operates in the opposite direction, carrying connecting rods 20, 20′ to the left, together with cross member 22. At a result, adjustable struts 31, 31, 31′, 31′ start moving to the left away from the die, and goose neck 10 starts to descend towards the position of Fig. 1. As cross member 22 and pusher rods 23, 23′ continue their movement to the left, nut 25, 25′ engage die carriage 8 and move it to the left, so as to separate the die parts 5 and 9. The short movement between the completely closed position of the die parts and the point at which nuts 25 engage die carriage 8 relieves most of the compression on springs 27, 27′, and permits the fork 37 of each of the turn-buckle devices to return to the full line position of Fig. 3. The parts continue their movement to the left, until the full-open position of Fig. 1 is reached. The machine is now ready for the next casting operation.

As explained above, the purpose of the turn-buckle devices 36, 36, 36′, 36′ is to take care of dies of different thicknesses. In order to accommodate dies of even greater thicknesses, and to provide for increased range of operation, the arrangement shown in Figs. 6 and 7 has been devised. Here, the lugs 35 on cross member 22 are made wider and are provided with two sets of pivot pin openings, instead of one. The forward openings 46 serve for ordinary usage, that is, where dies of the more common thicknesses are used; while the rear set of openings 47 may be used to receive the pivot pins 34, when even thicker dies are used.

A modified form of the turn-buckle or die locking device 31 is shown in Fig. 8. With this arrangement, the right hand portion of the adjusting member 36 is not changed in construction, nor is that of the parts between this member and cross member 22. Between adjusting member 36 and die carriage 8, however, the construction is slightly different. A bracket 48 is threaded into die carriage 8 and is provided with a pair of perforated ears 49 to receive a pivot pin 50. The left end of a rod 51 is pivotally mounted on pin 50, while the opposite end of the rod is arranged for sliding engagement with an elongated opening 52 in the left end of the adjusting member 36.

In operation, this modified construction functions, to all intents and purposes, the same as does the preferred form of the device. However, instead of providing for the spring take-up to take place adjacent die carriage 8, this is effected between the right hand end of rod 51 and the inner end of opening 52 in the adjusting member. This appears clearly from Fig. 8, in which the normal position of the right hand end of rod 51 is indicated in dotted lines at 53. This is the position of the rod both when the die is open and just before the relative movement between cross member 22 and die carriage 8 begins during the die closing operation.

In adjusting the modified form of device, it is merely necessary to back up lock nut 45. Adjusting member 36 may then be manipulated to lengthen or shorten the strut, as required. The slidable and rotatable connection between member 36 and rod 51 permits rotation of member 36, after which it may be secured by lock nut 45.

What is claimed is:

1. The combination in a die casting machine of a fixed die part; a movable die part; means for yieldably forcing said movable die part into closed position against said fixed die part; and means, adapted to function after a predetermined yielding of said forcing

means, to positively maintain the movable die part in closed position.

2. In a die casting machine, the combination of a separable die, comprising a plurality of die parts; operating means having a yieldable connection with one of said die parts to move the part between open and closed positions; and means, in addition to said yieldable connection, for positively securing said die part in closed position.

3. In a die casting machine, the combination of a fixed die part; a movable die part; guides for said movable die part; pusher rods for reciprocating said movable die part between open and closed positions; yieldable connections between said pusher rods and the movable die part; and means, associated with the pusher rods, for engaging the movable die part and locking it in closed position upon compression of the yieldable connections.

4. In a die casting machine, the combination of a movable die part; guide rods for said die part; pusher rods for operating said die part between open and closed positions; springs interposed between the pusher rods and the die part; and a strut movable with the pusher rods and slidably connected to the die part.

5. In a die casting machine, the combination of a fixed die part; a movable die part; guides for said movable die part; actuating means for operating said movable die part between open and closed positions; a yieldable connection between the actuating means and the movable die part adapted for compression immediately following closing of the die; and a strut mounted on said actuating means for rigidly engaging the movable die part upon compression of the yieldable connection.

6. The combination in a machine of the character described of a frame; a fixed die part; a reciprocable die part; means for operating said movable die part between open and closed positions; connections between said operating means and the movable die part adapted to yield upon closing of the die to permit predetermined independent movement of the operating means; and a plurality of struts on the operating means for rigidly securing the movable die part in closed position at the end of said predetermined movement of the operating means.

7. In a die casting machine, the combination of a fixed die part; a die part adapted for movement between open and closed positions; operating means slidably connected to said movable die part; and rigid, bracing means for the movable die part located on said operating means and in addition to said slidable connection, said bracing means and the movable die part having normally separated portions adapted to be brought into positive engagement with each other when the die is closed.

8. In a die casting machine, the combination of a fixed die part; a die part adapted for movement between open and closed positions; operating means connected directly to said movable die part and including a sliding connection; and bracing means, in addition to said sliding connection, extending between said operating means and the corners of the movable die part, said bracing means being arranged for positive engagement with the movable die part only upon operation of said sliding connection when the die closes.

9. In a die casting machine, the combination of a fixed die part; a die part adapted for movement between open and closed positions; operating means connected directly to said movable die part and including a sliding connection; and adjustable, bracing means, in addition to said sliding connection, extending between the operating means and the movable die part, for positive engagement with the movable die part only following operation of said sliding connection when the die closes.

10. In a die casting machine, the combination of a fixed die part; a die part adapted for movement between open and closed positions; operating means connected directly to said movable die part and including a yieldable connection with the movable die part; and a multi-part strut extending between said operating means and the movable die part, said parts having a turn-buckle connection with each other, the strut being arranged to engage the movable die part positively only upon yielding of said connection when the die closes.

11. The combination in a die casting machine of a movable die part; means connected directly to said die part for operating the die part between open and closed positions, said means including a slidable connection with the die part; and a multi-part strut extending between the operating means and the die part, said strut parts being connected together for relatively fine adjustment; and a plurality of spaced connections for the strut on said operating means, said strut and the die part having normally separated portions arranged for positive engagement with each other when said die part is moved to closed position.

12. In a die casting machine, the combination of a movable die part; means connected directly to said die part for operating the die part between open and closed positions, said means including a yieldable connection; a multi-part strut slidably connected to the die part and pivotally connected to the operating means; and an adjustable connection between said strut parts, said strut being arranged to engage the die part positively only following operation of said yieldable connection when the die part is moved to closed position.

13. The combination in a die casting machine of a fixed die part; a movable die part;

guide rods on which the movable die part is mounted; means for operating the movable die part between open and closed positions, said operating means including connections with the movable die part adapted to yield following closing of the die; and a plurality of adjustable struts extending between the operating means and the movable die part for engagement with the movable die part when said yieldable connections are actuated.

14. The combination of a movable die part; operating means connected directly to said die part for moving the die part between open and closed positions, said means including a yieldable connection with the die part; a multi-part strut extending between the operating means and the die part; and an adjusting member having a threaded engagement with one of said strut parts and a sliding connection with the other, said last-mentioned strut part and the adjusting member being arranged to engage positively with each other only upon yielding of said connection when the die is closed.

15. In a die casting machine, the combination of a fixed die part; a movable die part; means for operating the movable die part between open and closed positions and adapted to over-travel after the die has been closed; yieldable connections between the operating means and the movable die part to permit such over-travel; and locking means for engaging the movable die part at the end of the over-travel of the operating means.

In testimony whereof I have signed my name to this specification.

TORBJORN C. KORSMO.