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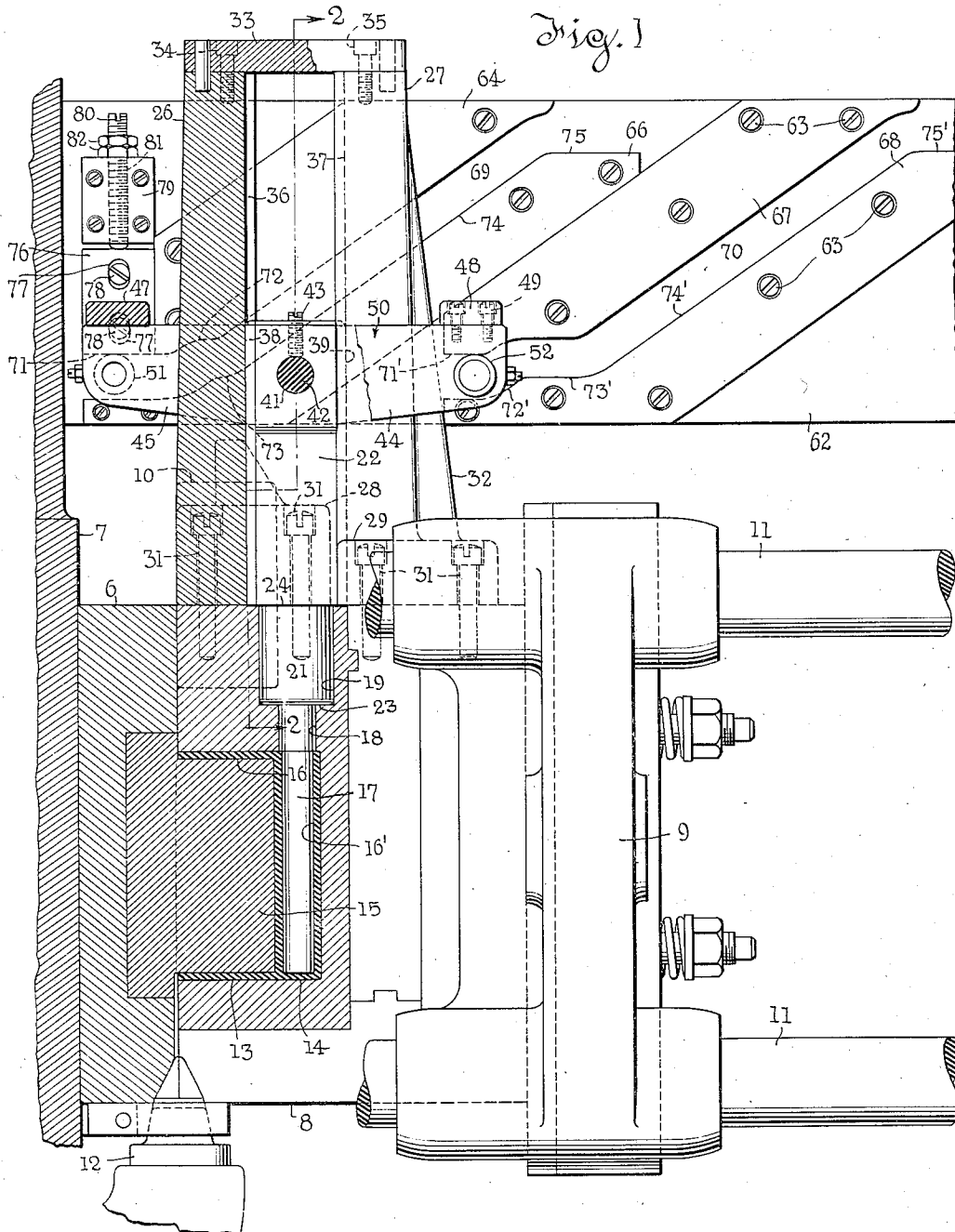
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2,033,036

DIE CASTING MACHINE

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2 Sheets-Sheet 1



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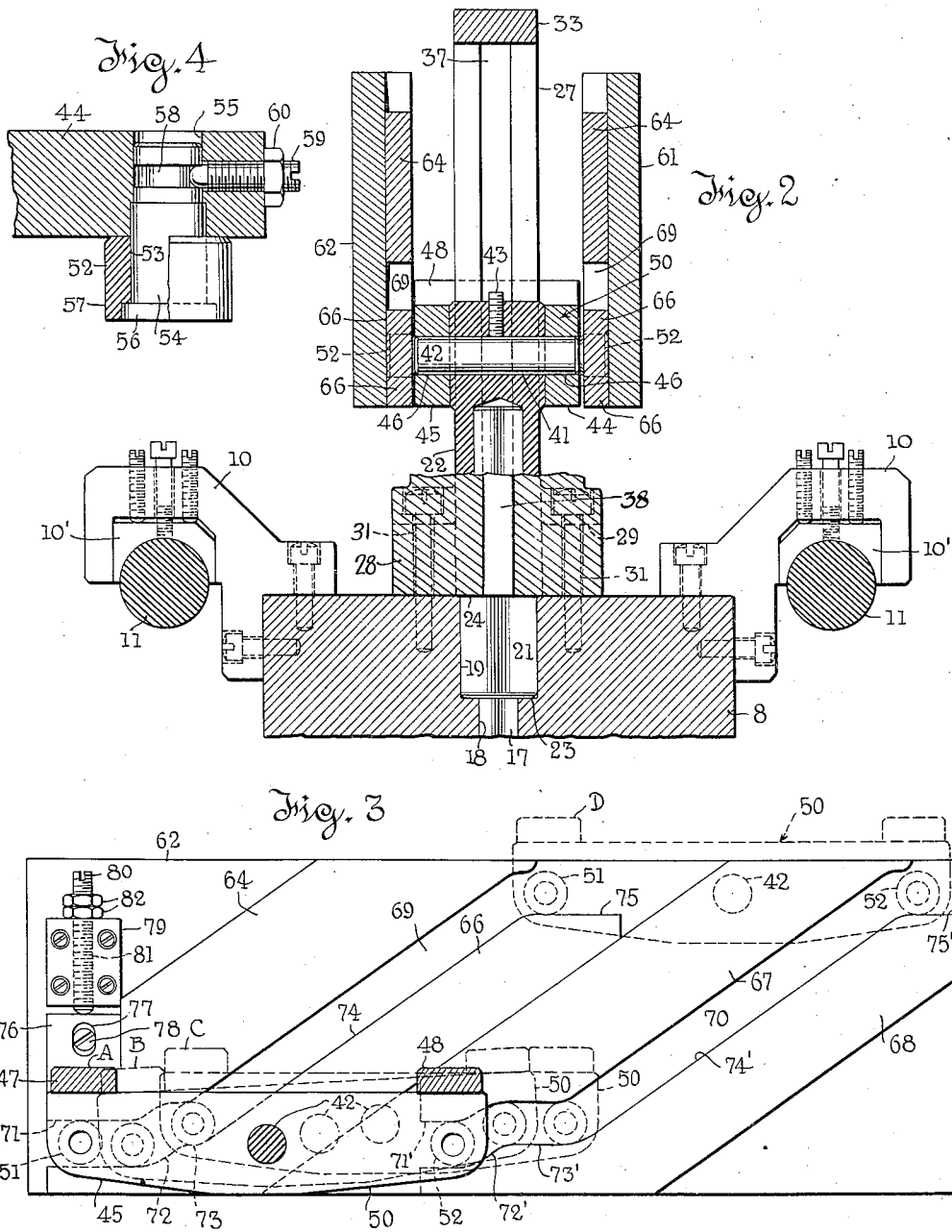
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2 Sheets-Sheet 2



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DIE CASTING MACHINE

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14 Claims. (Cl. 22—93)

This invention pertains to die casting apparatus and particularly to mechanism for actuating cores, slides or similar parts of die casting machines.

A particular object of the invention is to provide simple and efficient mechanism in a die casting machine for effecting automatic insertion and withdrawal of the core or cores in the die during operation of the machine. The core actuating mechanism is adapted for use with practically all types of cores, but is especially designed for pulling long cores requiring considerable power to remove them from the casting in the die cavity.

A further object consists in so designing the core pulling mechanism that a jerk or a succession of jerks is imparted to the core at the start of the pull to work the core loose from the casting, after which it is fully removed therefrom.

Another important object is the provision for operation of the core by its actuating means so as to preclude the setting up of undesirable strains in the actuating means or the core, or binding of the core in the die. Manually adjustable means also are included for insuring accurate positioning of the core in the die. Other objects will appear hereinafter.

A practical embodiment of the invention now in use, is disclosed in the accompanying drawings, wherein:—

Figure 1 is a front elevation of a portion of a die casting machine including the improved core actuating means, the die being shown closed and the core projecting into the die cavity. Certain of the parts are broken away or shown in section to reveal the details more clearly.

Figure 2 is a section on line 2—2 of Fig. 1 with the parts in the same position.

Figure 3 is a front elevation similar in part to Fig. 1 and showing in dotted lines the successive positions assumed by the core actuating element of the core actuating mechanism as the core is inserted or withdrawn; and

Figure 4 is a horizontal section through a corner of the core actuating element, showing one of the cam engaging rollers carried thereby.

The improved core actuating means comprising the present invention are shown in the accompanying drawings as applied to a die casting machine of the type set forth in my prior Patent No. 1,607,677, dated Nov. 23, 1926. In this machine there is a stationary die half 6 which is suitably mounted on a hot plate 7 forming part of the frame of the machine. The movable die half 8 is mounted on a carriage 9 lo-

cated on guide rods 11, the latter extending from hot plate 7 to the opposite or driving end of the machine (not shown). Carriage 9, together with die half 8, is adapted to be moved back and forth on guide rods 11 by suitable mechanism (not shown) to open and close the die. A pair of brackets 10, 10 suitably secured to the upper corners of die half 8 and having adjustable pillow blocks 10', 10' engaging guide rods 11, 11 serve further to support the die part in its movements.

When the die is closed, as shown in Fig. 1, suitable mechanism (not shown) brings the goose-neck nozzle 12 into communication with an opening in the under side of the die, and molten metal is forced from the goose-neck nozzle into the mold cavity.

In the die illustrated, the cavity 13 is formed by a recess 14 in movable die half 8 into which projects a block 15 attached to the fixed die half 6. Cavity 13 is designed to produce a casting 16 of tray-like shape having a cylindrical chamber 16' at one side. This chamber 16' is formed by a comparatively long, cylindrical core 17 depending into the die cavity from the upper part of movable die half 8. The particular form of die shown for producing the specially designed casting 16 is for purposes of illustration only. It will be obvious that the core actuating mechanism hereinafter described may be used in making practically any type of casting and also for operating practically all types of cores, slides and analogous members mounted in the die. The upper portion of core 17 is fitted for reciprocation in a passage 18 leading from the die cavity. This passage communicates with a larger cylindrical recess 19 in the top of the die half into which is also fitted for free reciprocation the lower reduced cylindrical end 21 of a vertically slidable head 22. Core 17 is securely mounted in the lower end of slidable head 22 so that these parts, which make up the core assembly, may be moved as a rigid unit. Shoulders 23 and 24 on the core assembly described, engage the bottom of recess 19 and the top of the die, respectively, to limit the insertion of the core into the die cavity.

Core head 22 is arranged for vertical reciprocation between a pair of standards or slides 26, 27 rigidly mounted on top of movable die half 8. These standards are formed with similar base portions 28, 29, respectively, having openings through which extend machine screws 31 to secure the standards firmly to the die part. A vertical rib 32 on slide 27 further strengthens this

part. At the upper ends the slide members are tied together by a cross bar 33 secured to the slides 26, 27 by machine screws 34, 35. Slides 26, 27 have grooves 36, 37 on their inner faces in which engage tongues 38, 39 on core head 22, thereby providing means for properly guiding the core assembly during its upward and downward movements as the core 17 is inserted and withdrawn during the operation of the machine.

The means for automatically withdrawing the core as the die is opened and for inserting the core as the die is closed will now be described. Core head 22 has a transverse opening 41 therein near its upper end in which is secured a pivot pin 42 by means of a set screw 43. The extremities of pin 42 project beyond the sides of core head 22 and pivotally support a pair of parallel rocker arms 44, 45 each of which is provided intermediate its ends with an opening 46 to receive the pivot pin. As shown in Figs. 1 and 2, rocker arms or levers 44, 45 extend along the front and rear faces of standards 26, 27 and at their extremities are connected firmly together by cross bars 47, 48 secured to the rocker arms by machine screws 49. Rocker arms 44, 45 and cross bars 47, 48 thus form a rigid rectangular frame or lever element 50 pivotally mounted on the upper end of core head 22 by means of which the core head and its attached core 17 are adapted to be actuated by certain cam means described later.

A pair of anti-friction rollers 51, 51 (only one of which is shown) is mounted on the hot plate end of the core actuating element 50, and a similar pair of rollers 52, 52 on the opposite end of the element. These rollers are located on the outer faces of the rocker arms 44, 45 and are adapted for engagement with the cam means referred to.

All of the rollers are alike and are similarly mounted; hence only one, front roller 52, will be described. Referring particularly to Fig. 4, it will be seen that the roller proper consists of a ring through the opening 53 of which extends a stub shaft 54 mounted in an opening 55 in rocker arm 44. Shaft 54 has a head 56 and the roller has a corresponding rabbet 57 whereby the roller is secured for rotation on the shaft and there is eliminated any projection of the shaft beyond the side of the roller. An annular groove 58 in stub shaft 54 is engaged by a set screw 59 in the end of the rocker arm to hold the shaft in place. A lock nut 60 secures the set screw.

Located above the die and extending from hot plate 7 to the driving end of the machine, to which they are connected, is a pair of stationary combination bars 61, 62. These bars, which are adjustable towards and from each other, carry on their inner faces the cam means with which the two pairs of rollers 51, 51 and 52, 52 coact during opening and closing of the die to operate lever element 50 and thus actuate core 17. The bars also carry certain manual position adjusting means for the core.

Since the cam means and the manual position adjusting means referred to are duplicated on each of the combination bars 61, 62 only those on rear bar 62 will be described. Secured to the inner face of bar 62 by means of screws 63 are two pairs of cam blocks 64, 66 and 67, 68. Blocks 64, 66 are spaced apart to provide a cam groove 69 towards the hot plate 7 and blocks 67, 68 are spaced to form a partially similar cam groove 70. As shown in Figs. 1 and 2, rollers 51, 51 at the hot plate end of lever element 50 are located in the opposed and alined grooves 69, 69 on the pair of bars 61, 62, while rollers 52, 52 at the opposite

end of lever element 50 are located in the opposed and alined grooves 70, 70.

Cam groove 69 consists of a lower horizontal portion 71, a short inclined portion 72, a short horizontal portion 73, an extended inclined portion 74 and an upper horizontal portion 75. Cam groove 70 consists of a lower horizontal portion 71' arranged in horizontal alinement with portion 71 of groove 69, although somewhat shorter than the latter, an inclined portion 72', a horizontal portion 73' somewhat longer than portion 73 of groove 69, an inclined portion 74' paralleling portion 74 of groove 69, and an upper horizontal portion 75' horizontally alined with portion 75 of groove 69.

From Figs. 1 and 2, and also full line position "A" of Fig. 3, it will be seen that the parts are so proportioned that, when the die is in normal closed position and the core inserted ready to shoot a casting, rollers 51, 51 at one end of the core actuating element 50 are located in the lower horizontal portions 71, 71 of cam groove 69, 69, and rollers 52, 52 at the opposite end of the lever element are disposed in the corresponding lower portions 71', 71' of cam grooves 70, 70.

At this time, actuating element 50 is in substantially horizontal position, and engagement of the upper edges of cam grooves 69, 70 with rollers 51, 52 has forced core head 22 and the attached core downwardly so that shoulders 23 and 24 on the core assembly engage die part 8 as described. This limits downward movement of the core into the die cavity and therefore controls the shape and certain dimensions of the casting being made, as for instance the depth of chamber 16' and the thickness of the lower wall in the case of the casting 16 illustrated in Fig. 1.

In order that accurately dimensioned castings may be produced, provision is made for insuring proper positioning of the core in its lowermost or normal position in the die notwithstanding such inaccuracies or variations as may occur in the sizes or relative location of the several core positioning parts. For this purpose certain duplicate manual adjusting means are located on the combination bars 61, 62. Only that on bar 62 will be described. As shown in Fig. 1 the lower edge of a block 76 mounted on the inner face of bar 62 forms the upper edge of portion 71 of cam slot 69 against which roller 51 bears, slot 69 being somewhat wider than the roller. Block 76 is adapted for vertical adjustment and for this purpose is provided with a pair of vertical slots 77 through which extend clamping screws 78 secured to bar 62. Fixedly attached to bar 62 above block 76 is another block 79 having an adjusting screw 80 extending through a threaded longitudinal passage 81 therein. Lock nuts 82 secure screw 80 in adjusted position.

With this arrangement, after screws 78 and lock nuts 82 of both of the adjusting means are loosened, screws 80 may be adjusted to force blocks 76 downwardly. This moves rollers 51, 51 downwardly and actuating element 50 swings downwardly about rollers 52, 52 as a pivot, since the latter fulcrum on the upper sides of portions 71', 71' of cam grooves 70, 70. As a result, core head 22 is moved downwardly in its slides to position core 17 accurately in the die cavity. Screws 78 and lock nuts 82 are now tightened so that the adjustment described cannot be disturbed and thus the core will be accurately located in the die each time it closes, preparatory to making a casting.

In describing the operation of the core pulling

means, it will be assumed that the die is closed with the core properly positioned therein and that a casting has just been shot as illustrated in Fig. 1.

1. When die half 8 moves to the right to open the die, it carries with it the core assembly, the actuating element 50 pivoted on the upper end thereof, and the slide structure for core head 22. With cam tracks 69, 70 formed as shown, as die half 8 moves to the right, rollers 52, 52 engage upwardly inclined portions 71', 71' of groove 70, 70 before rollers 51, 51 reach inclined portions 72, 72 of grooves 69, 69. This swings the right hand end of actuating element 50 upwardly with the rollers 51, 51 at the opposite end fulcruming on the lower sides of cam slots 69, 69 as illustrated in dotted line position "B" of Fig. 3. As a result, a sharp, powerful leverage jerk or pull is imparted to the vertically slidable head 22 and its core at the start of the core withdrawing action which effectively serves to work the core loose from the casting.

As die part 8 continues to the right, rollers 52, 52 enter horizontal portions 73', 73' of groove 70, whereupon rollers 51, 51 engage inclined portions 72, 72 of grooves 69, 69. This causes the left hand end of lever element 50 to swing upwardly with rollers 52, 52 fulcruming on the lower edges of grooves 70, 70. In this manner, lever element 50 is swung into the substantially horizontal position indicated at "C" in Fig. 3, as rollers 51, 51 enter portions 73, 73 of groove 69, 69. This results in a second powerful leverage jerk being applied to the core assembly so that the core is completely loosened in case it should still tend to stick.

Rollers 51, 51 engage inclined portions 74, 74 of grooves 69, 69 and rollers 52, 52 traverse inclined portions 74', 74' of grooves 70, 70 as die half 8 moves further to the right. This continues the upward sliding movement of core head 22, with lever element 50 remaining in horizontal position, until core 17 is completely withdrawn from the casting. Following this movement, rollers 51, 51 enter horizontal portions 75, 75 of grooves 69, 69 and rollers 52, 52 enter horizontal portions 75', 75' of grooves 70, 70 as indicated in dotted line position "D" (Fig. 3), whereupon the upward movement of the core ceases. Shortly after this, die part 8 reaches the end of its opening movement.

When die part 8 returns to the die closed position of Fig. 1, core 17 will be automatically restored to its exact original position in the die ready for shooting the next casting. During the closing movement of the die the operation of the core actuating means will be the same as in the opening movement, except that the several movements of the parts will be in the reverse order and in opposite directions.

It is an important feature of the core actuating mechanism described that, although powerful pulling action is obtained, this is accomplished at all times by a straight line movement of pull on the core so that the core is not subjected to side strains and there is no likelihood of the core binding in the die. This is due principally to the floating arrangement of the core actuating element 50 in the several cam grooves whereby the actuating element may automatically shift or accommodate itself in the grooves and thereby relieve any binding action tending to take place between the several parts, more particularly between core 17 and the die, and between core head 22 and its slides. In this connection, it will be noted that as each rocking movement is imparted to actuating element 50, either in withdrawing or

in inserting the core, the rollers 51, 51 or 52, 52 about which element 50 fulcrums are free to move in their cam grooves. This permits automatic shifting of the fulcrum point and thus insures straight line transmission of force from the actuating element 50 to the core assembly.

It is not intended to limit the invention to the cam groove arrangement shown which imparts two separate jerks or pulls to the core as the die opens. Obviously, by modifying the cam tracks, one or even more than two such pulls may be provided for if found desirable. Likewise, although the proportions of lever element 50 indicate an approximately 1:1 leverage ratio, this may be varied of course to suit conditions. The described mechanism is also adapted for use in the operation of slides or other movable parts mounted in the die.

Various changes and modifications other than those mentioned may be made in the mechanism without departing from the scope of the invention except as the same may be limited by the appended claims.

What is claimed is:

1. In a die casting machine, the combination of a support; a die part carried by the support; cam means on the support, said die part and said cam means being arranged for relative movement; a member mounted for movement in the die part; and a lever element operatively engaging said member and also operatively engaging the cam means at a plurality of points, said cam means being constructed and arranged so as to operate the lever element about one of said points as a fulcrum upon relative movement between the die part and the cam means and thereby actuate the movable member.

2. In a die casting machine, the combination of a support; a die part carried by the support; cam means on the support, said die part and said cam means being arranged for relative movement; a member mounted for movement in the die part; a lever element pivotally connected intermediate its ends to said member; and roller means on said lever element engaging the cam means on each side of said pivotal connection, said cam means being constructed and arranged so as to operate the lever element about one of said roller means as a fulcrum upon relative movement between the die part and the cam means and thereby actuate the movable member.

3. In a die casting machine, the combination of a support; a die part carried by the support; cam means, including a pair of cam surfaces, carried by the support, said die part and said cam means being arranged for relative movement; a member mounted for movement in the die part; and a lever element adapted for operation to actuate said member, said lever element being pivotally connected to said member and operatively engaging said cam surfaces, the cam surfaces being constructed and arranged so that, upon relative movement between the die part and the cam means, one of said cam surfaces operates the lever element about a fulcrum on the other cam surface and said other cam surface permits shifting of said fulcrum.

4. In a die casting machine, the combination with a support, a die part mounted for movement thereon and a core or the like arranged for movement in the die part, of stationary cam means on the support; and a lever element pivotally connected to the core and operatively engaging the cam means at a plurality of points, said cam means being constructed and arranged

so as to operate the lever element about a fulcrum on the cam means upon movement of the die part and thereby actuate the core.

5 In a die casting machine, the combination
with a support, a die part mounted for move-
ment thereon and a core or the like arranged for
movement in the die part, of stationary cam
means on the support; and a lever element piv-
10 otated intermediate its ends on the core and oper-
atively engaging the cam means on each side
of the lever pivot, said cam means being con-
structed and arranged so as to operate the lever
element about a fulcrum on the cam means upon
15 movement of the die part and thereby actuate the
core.

6. The combination in a die casting machine
of a frame; a die part mounted for movement
thereon; a movable core or the like in the die
part; stationary cam means on the frame, in-
20 cluding a pair of cam grooves; a lever element
pivoted intermediate its ends on the core; and
roller means on the lever element at each side
of its pivot and located in said cam grooves for
operative engagement therewith, said grooves be-
25 ing constructed and arranged so as to operate
the lever element about one of said roller means
as a fulcrum upon movement of the die part and
thereby actuate the core.

7. In a die casting machine, the combination
30 with a support, a die part mounted for move-
ment thereon and a core or the like arranged
for movement in the die part, of stationary cam
means on the support; and a lever element piv-
otally connected to the core and operatively en-
35 gaging the cam means at a plurality of points,
said cam means being constructed and arranged
so as to operate the lever element a plurality of
times to impart a succession of movements in
one direction to the core upon movement of the
40 die part in one direction.

8. In a die casting machine, the combination
with a support, a die part mounted for move-
ment thereon and a core or the like arranged
for movement in the die part, of stationary cam
45 means on the support; a lever element pivotally
connected to the core and operatively engaging
the cam means at a plurality of points, said cam
means being constructed and arranged so as to
operate the lever element first about one of said
50 points as a fulcrum and then about the other
point as a fulcrum upon movement of the die
part in one direction and thereby impart a suc-
cession of movements to the core.

9. In a die casting machine, the combination
55 with a support, a die part mounted for move-
ment thereon and a core or the like arranged
for movement in the die part, of stationary cam
means on the support, including a pair of spaced
members having a plurality of pairs of opposed
60 cam grooves; and a lever element pivotally con-
nected to the core and having projections oper-
atively engaging said pairs of cam grooves, said
cam grooves being constructed and arranged so
as to operate the lever element about certain of
65 said projections as a fulcrum upon movement of
the die part and thereby actuate the core.

10. The combination in a die casting machine
of a frame; a die part mounted for opening and
closing movements thereon; a movable core or
70 the like in the die part; stationary cam means on
the frame; and a lever element pivotally con-

nected to the core and operatively engaging the
cam means at a plurality of points, the cam
means being constructed and arranged so as to
operate the lever element about a fulcrum on
the cam means and then move the lever element
8 bodily, or vice versa, upon movement of the die
part thereby to actuate the core.

11. The combination in a die casting machine
of a frame; a die part mounted for movement
thereon; a movable core or the like in the die
10 part; guide means projecting from said die
part; a head on said core movably mounted in
the guide means; stationary cam means on the
frame; and a lever element pivotally connected
to said core head and operatively engaging the
15 cam means at a plurality of points, the cam
means being constructed and arranged so as to
operate the lever element about a fulcrum on
the cam means upon movement of the die part
and thereby actuate the core head and the core. 20

12. The combination in a die casting machine
of a frame; a die part mounted for movement
on the frame; a movable core or the like in the
die part; guide means projecting from the die
25 part; a head on the core movably mounted in
said guide means; stationary cam means on the
frame, including a pair of spaced bars having
two pairs of opposed cam grooves; a rocker ele-
ment pivotally mounted intermediate its ends
on the core head; a pair of anti-friction rollers
30 at one end of said rocker element operatively en-
gaging one of said pairs of cam grooves; and a
second pair of anti-friction rollers at the oppo-
site end of the rocker element operatively en-
gaging the other pair of cam grooves, said cam
35 grooves being constructed and arranged so as to
operate the rocker element about at least one of
said pairs of rollers as a fulcrum upon move-
ment of the die part and thereby actuate the
core head and the core. 40

13. The combination in a die casting machine
of a support; a die part movably mounted there-
on; a movable core or the like in the die part;
stationary cam means on the support; an opera-
45 tive connection between the core and the cam
means, said cam means being constructed and
arranged so as to actuate the core upon move-
ment of the die part; and manually adjustable
means acting on said operative connection be-
50 tween the core and the cam means when the die
part is in closed position to control positioning
of the core in the die part.

14. The combination in a die casting machine
of a frame; a die part mounted thereon for move-
ment between open and closed positions; a mov-
55 able core or the like in the die part; stationary
cam means on the frame, including a pair of cam
grooves and a manually adjustable member form-
ing part of one of said grooves; and a lever ele-
ment pivotally connected intermediate its ends
60 to the core and having projections thereon oper-
atively engaging said grooves on each side of
the lever pivot, the grooves being constructed
and arranged so as to operate the lever element
upon movement of the die part and thereby
65 actuate the core, and one of said projections
on the lever element engaging said adjustable
member when the die part is in closed position
to control the position of the core in the die
part.

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