Oct. 22, 1940. G. R. MURRAY ET AL 2,218,684

CONTROL FOR POWER HAMMERS

Filed April 25, 1939 5 Sheets-Sheet 1

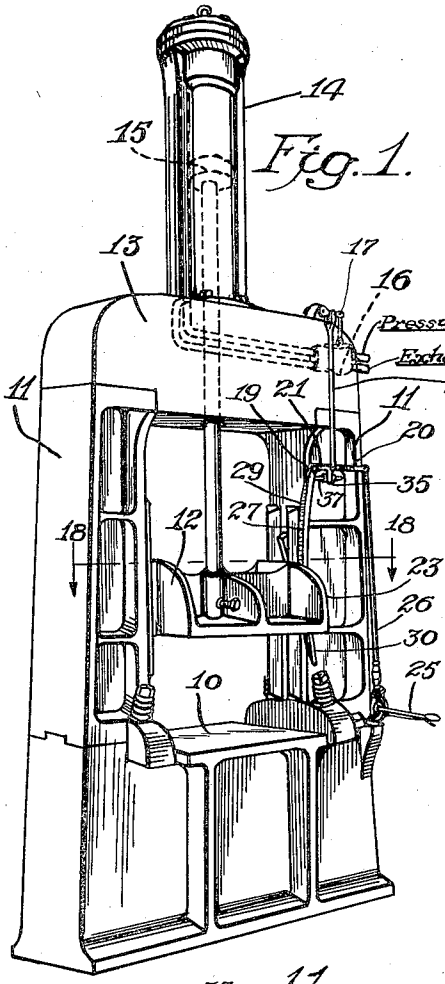


Fig. 1.

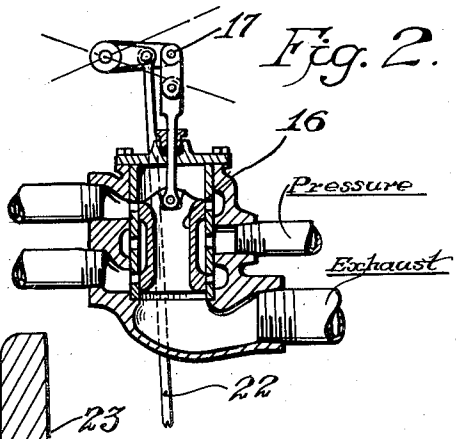


Fig. 2.

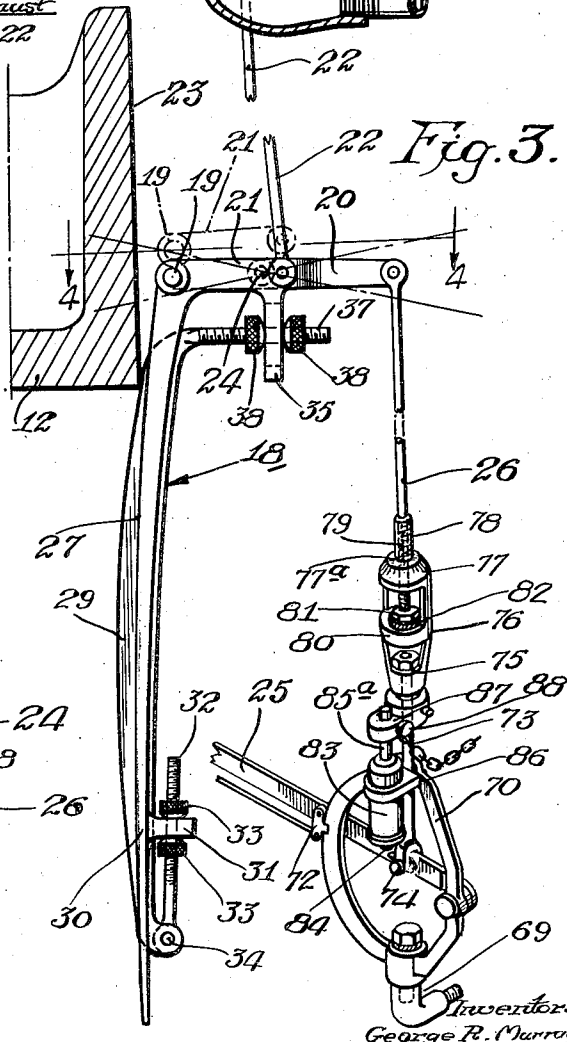


Fig. 3.

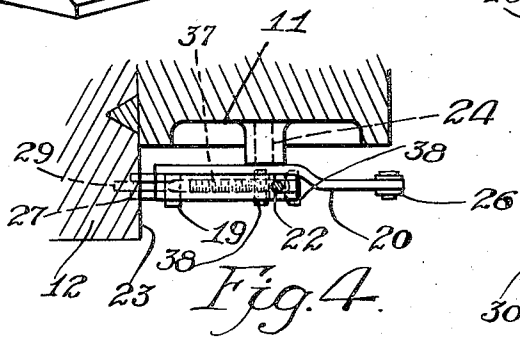


Fig. 4.

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Oct. 22, 1940. G. R. MURRAY ET AL 2,218,684

CONTROL FOR POWER HAMMERS

Filed April 25, 1939 5 Sheets-Sheet 2

Fig. 5.

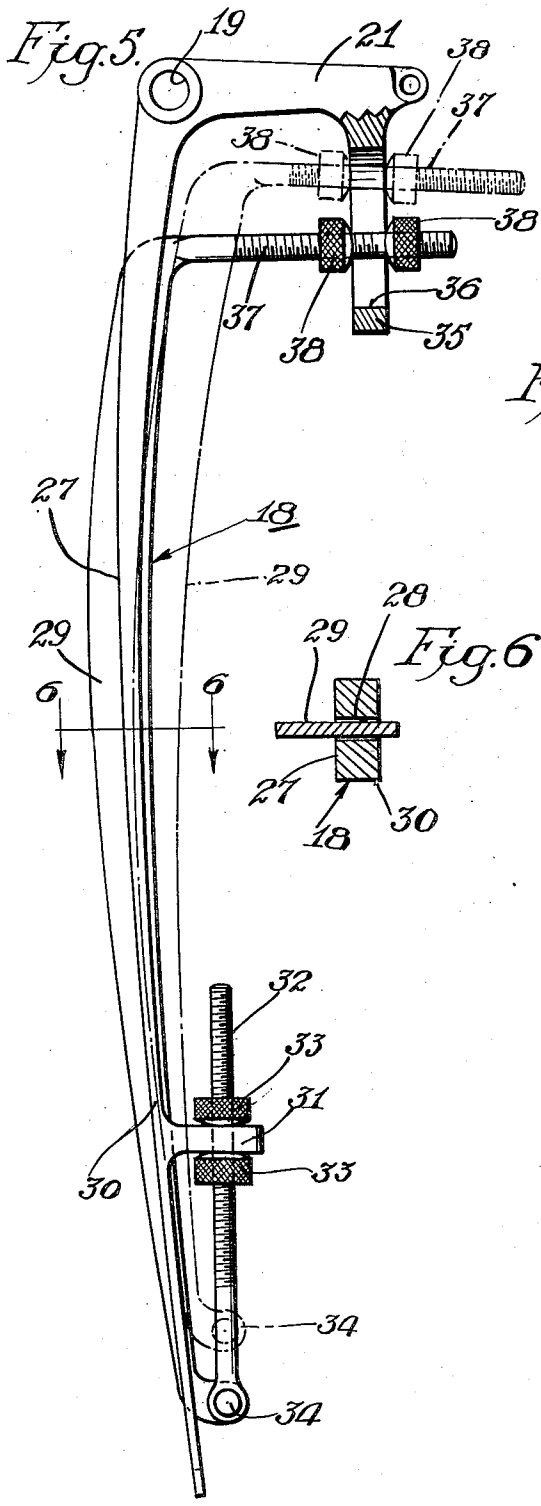


Fig. 6

Fig. 7.

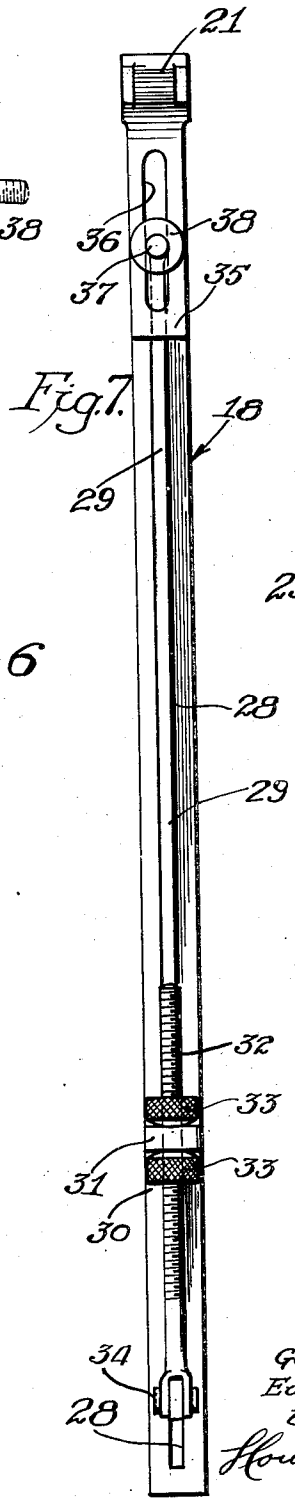
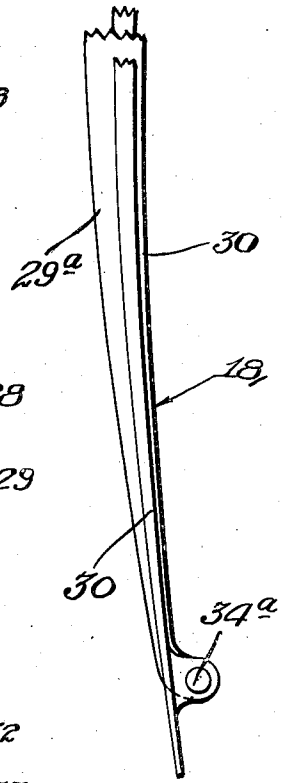


Fig. 8



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Oct. 22, 1940. G. R. MURRAY ET AL 2,218,684

CONTROL FOR POWER HAMMERS

Filed April 25, 1939 5 Sheets-Sheet 3

Fig. 9.

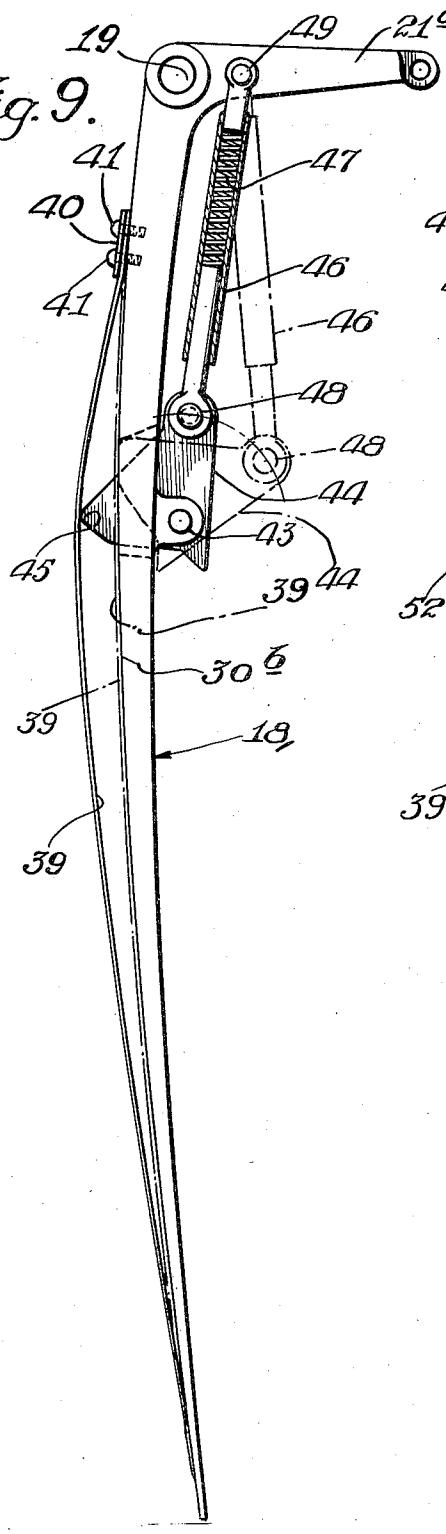


Fig. 10.

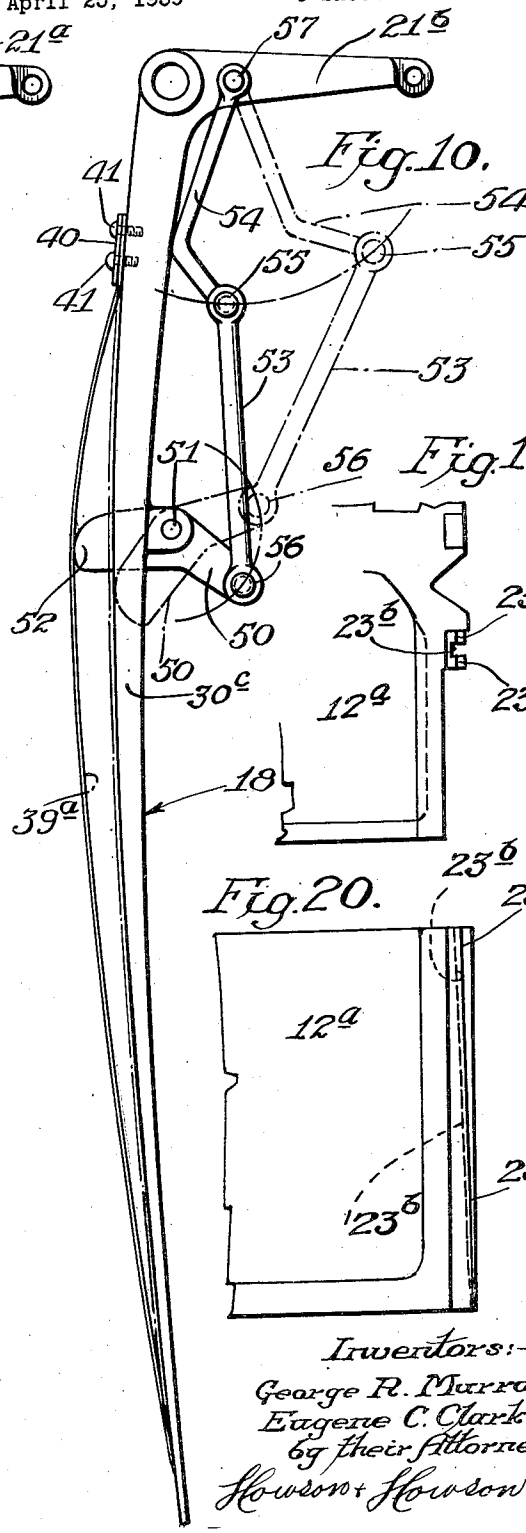


Fig. 19.

Fig. 20.

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Oct. 22, 1940. G. R. MURRAY ET AL 2,218,684

CONTROL FOR POWER HAMMERS

Filed April 25, 1939 5 Sheets-Sheet 4

Fig. 11.

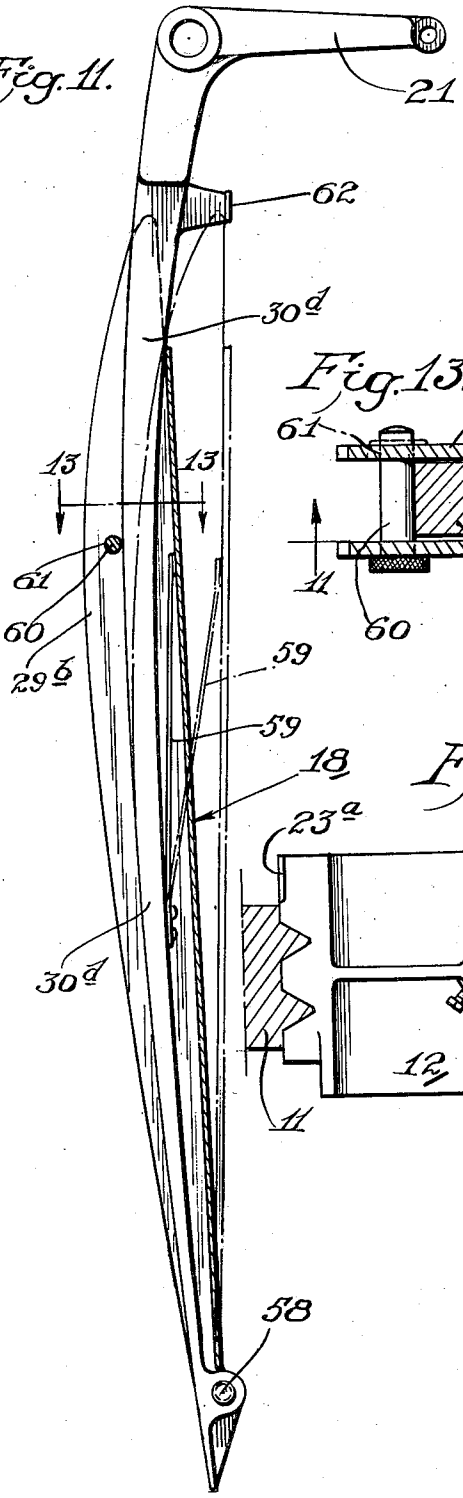


Fig. 13.

Fig. 18.

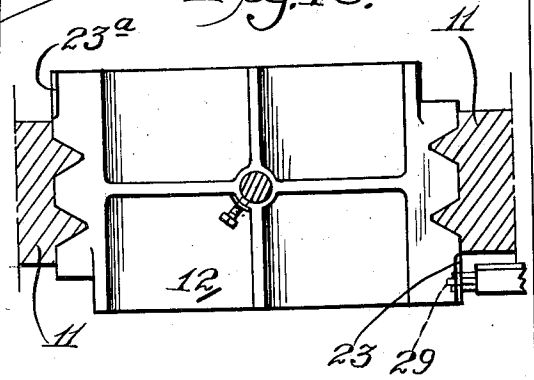
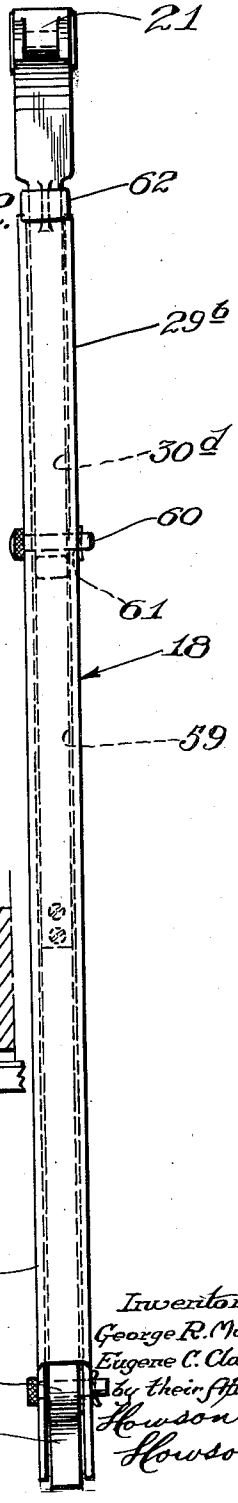


Fig. 12.



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Oct. 22, 1940. G. R. MURRAY ET AL 2,218,684

CONTROL FOR POWER HAMMERS

Filed April 25, 1939 5 Sheets-Sheet 5

Fig. 14.

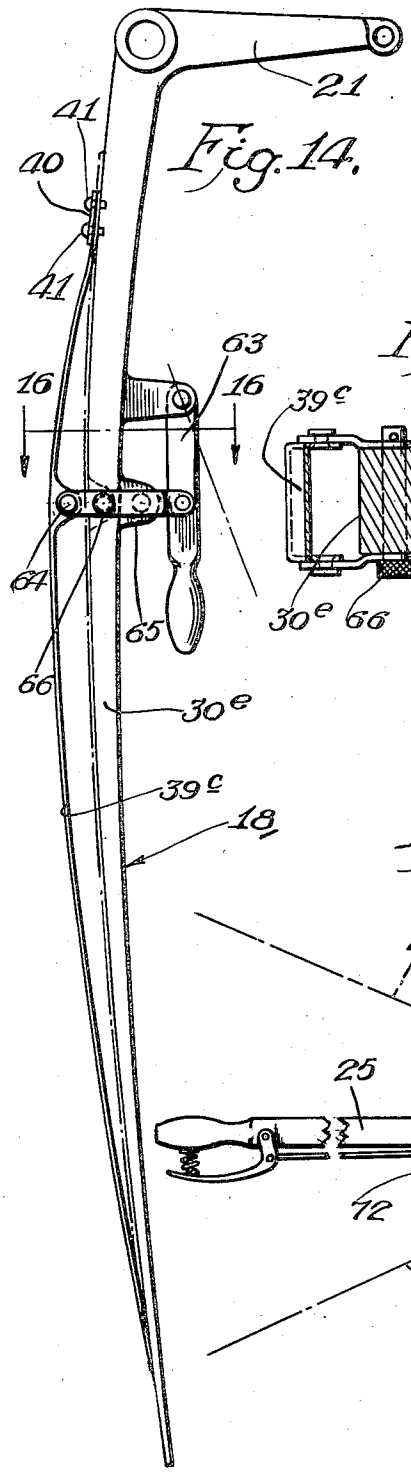


Fig. 16.

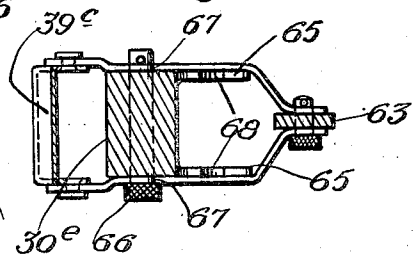


Fig. 15.

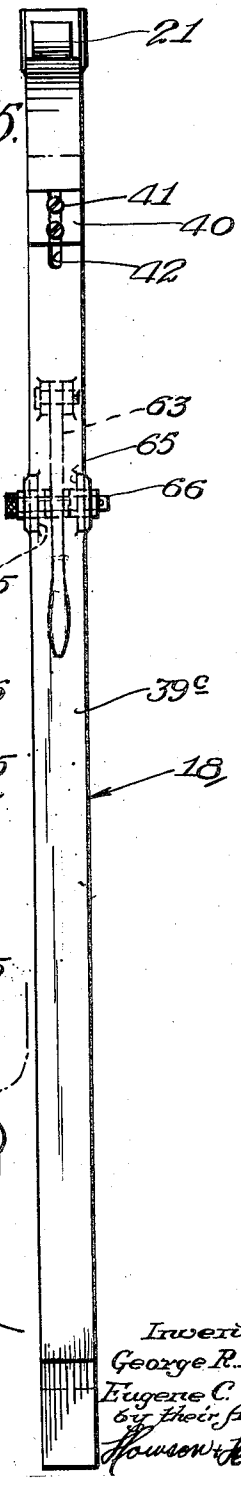
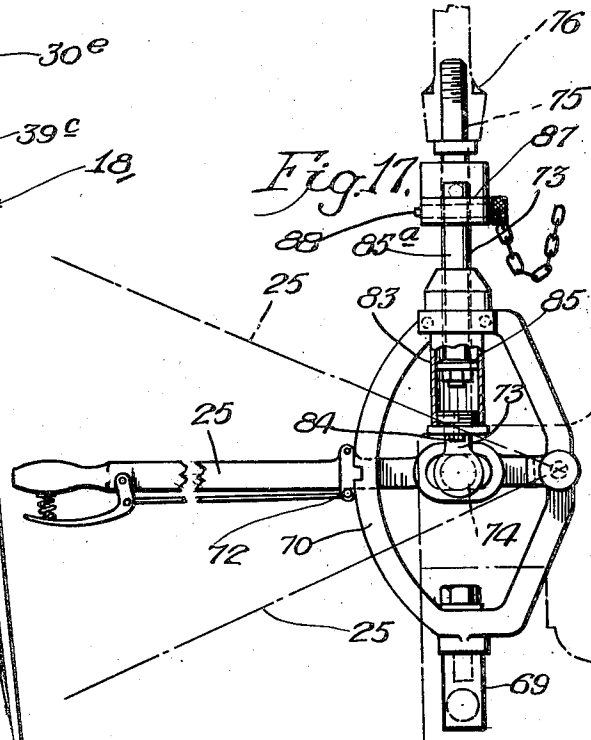


Fig. 17.



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UNITED STATES PATENT OFFICE

2,218,684

CONTROL FOR POWER HAMMERS

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Application April 25, 1939, Serial No. 269,998

26 Claims. (Cl. 121—30)

This invention relates to a control for power hammers or presses and has for a particular object thereof the provision of a control means which will greatly increase the flexibility of a hammer, press or the like and will enable operation thereof at a wide speed range.

Another object of the invention is the provision of a control mechanism which will enable a mechanism of this character to be alternatively operated as a hammer or press.

A further and more specific object of the invention is the conversion of the ordinary cam employed for controlling movements of power hammers and presses to a type such that it may be readily converted to enable operation of the hammer either automatically or under manual control.

A further object of the invention is to eliminate the present inequalities in hammer and press actions resulting from unbalancing of the ram due to the formation of control surfaces thereon.

These and other objects we attain by the construction shown in the accompanying drawings wherein, for the purpose of illustration, we have shown a preferred embodiment of our invention and wherein:

Fig. 1 is a perspective view of a hammer embodying a control constructed in accordance with our invention;

Fig. 2 is a vertical sectional view through the control valve;

Fig. 3 is a view partially in perspective of the control mechanism for the valve illustrating its cooperation with the ram;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 is an enlarged detail vew partially in section of the control mechanism illustrated in Fig. 3;

Fig. 6 is a section on line 6—6 of Fig. 5;

Fig. 7 is a rear elevation of the mechanism shown in Fig. 5;

Fig. 8 is a fragmentary side elevation of a slight modification of the construction shown in Figures 3 to 7;

Fig. 9 is a side elevation of a modification of our invention showing the cam in solid lines in the position where the control is automatic and in dotted lines in the position where the control is manual;

Fig. 10 is a side elevation of a similar construction but slightly modified from that of Fig. 9;

Fig. 11 is a section on line 11—11 of Fig. 13 illustrating a further modification of our invention;

Fig. 12 is a rear elevation thereof;

Fig. 13 is a section on line 13—13 of Fig. 11;

Fig. 14 illustrates a modification of the structure shown in Figures 11 to 13;

Fig. 15 is a front elevation thereof;

Fig. 16 is a section on line 16—16 of Fig. 14;

Fig. 17 is a side elevation of the control lever shown in Fig. 3;

Fig. 18 is a section on line 18—18 of Fig. 1, illustrating the balanced construction of the ram;

Fig. 19 is a fragmentary plan view showing a modified ram construction in which dual cam surfaces are applied in lieu of the single cam surface ordinarily utilized on such rams; and

Fig. 20 is a fragmentary side elevation of the ram of Fig. 19.

Referring now more particularly to the drawings, the numeral 10 generally designates an anvil; 11, guides extending upwardly therefrom and guiding a ram 12, and 13, a head supported by the guides and mounting the power cylinder 14 of a piston 15 controlling operation of the ram 12. The operation of the piston is controlled by a valve 16 and operation of this valve is, in turn, controlled by mechanism hereinafter more particularly described.

The valve 16 is supported from a pivotal support 17 and its elevation is controlled through a cam generally designated at 18 which is pivoted at 19 upon a lever 20. This cam includes an arm 21 connected with the valve 16 through a link 22 and cooperates with the ram 12 and, more particularly, a vertical side surface 23 formed thereon. The lever 20 is pivoted at 24 and constitutes through a hand lever 25 and link 26 a means for vertically shifting the pivot 19 of the cam which is generally of bell-crank formation, the cam proper forming a long arm and the arm 21 forming a short arm of this bell crank. Our invention relates particularly to the construction of the long or working arm of the cam and contemplates the construction thereof whereby the cam may be substantially instantaneously modified to enable the valve control to become automatic or manual as may be desired.

In the form of our invention illustrated in Figures 3 to 7, the long arm of the primary cam is provided with a primary surface 27 which, when in cooperation with the surface 23, provides for manual operation of the ram; that is to say, when this surface is in engagement with the ram movements of the ram are under control of the lever 25. After completion of each stroke, initiation of the following stroke must be by operation of the lever 25 and by proper positioning of the lever 25 the ram can be made to balance at any par-

ticular point in its travel. This surface, in the construction now under discussion, is slotted as at 28 and within the slot is arranged a secondary blade 29. The lower end of the primary cam proper, indicated at 30, is provided with an ear 31 through which an arm 32 is vertically adjustably directed and its adjusted position maintained by means of lock nuts 33. The blade 29 is pivoted to the lower end of this arm as at 34. The arm 21 has a depending lug 35 which is vertically slotted at 36 and the upper end of the blade has a right-angular extension 37 which is threaded and directed through the slot of the lug 35. It may be held in either transversely or vertically adjusted positions in this slot by means of lock nuts 38 and it will be obvious, as illustrated in Figure 5, the surface of the blade 29 may be withdrawn to an extent such that it lies behind that of the cam proper 30 or projected so that it has engagement with the ram surface 23 and so controls the movements of the ram. In its projected position it will serve to cause automatic operation of the ram so that the same will strike repeated blows without operation of lever 25. Obviously, through the vertical and transverse adjustments obtainable, the extent of movements of the blows may be varied to suit the work in hand, thus rendering the hammer extremely flexible in operation. It is, likewise, obvious that shifts in the position of the secondary cam element or blade 29 may be readily effected without materially delaying a series of operations.

In the form shown in Figure 8, the construction of Figures 3 to 7 is modified to the extent that no vertical adjustment of the secondary cam is provided, the blade 29*a* being mounted in a fixed pivot 34*a* carried by the main body 30 of the cam.

In the form shown in Figure 9, the main body 30*b* has a spring leaf 39 affixed thereto at its lower end and vertically slidable through a guide 40 attached thereto adjacent its upper end, this guide construction being more particularly illustrated in Fig. 15 of the drawings and comprising simply a plate attached to the main body by screws 41 which extend through a vertical slot 42 formed in the upper end of the leaf spring. Spring leaf 39, which forms an auxiliary cam, thus has its upper end slidable with relation to the primary cam body 30*b*.

Pivoted to the main body 30*b* at a point intermediate its ends, and indicated at 43, is a lever 44 having at one end a nose 45 adapted for engagement with the inner surface of the spring leaf 39. This lever forms one element of a toggle mechanism the second element of which comprises an extensible arm 46 pivoted at its upper end to the short arm 21*a* of the main body of the cam and at its lower end to the inner end of lever 44. A spring 47 serves to keep the sections of the arm in their extended position and the movements of lever 44 permit the pivot 48 connecting the lever and arm to be moved from side to side of a line connecting the axes of the pivot 43, and the pivot 49 connecting the upper end of the arm to the short arm 21*a* of the cam structure. Obviously, the lever 44 may thus be locked either in its operative position illustrated in solid lines in Fig. 9, thereby holding the secondary cam 39 in its extended or operative position, or in its inoperative position illustrated in dotted lines in the same figure, in which position cam 39 lies closely against the surface of the primary cam body 30*b* and forms the actual working surface therefor.

Figure 10 illustrates a modification of the structure shown in Fig. 9 wherein the spring pressure controlling the position of the toggle mechanism is applied by the secondary cam spring leaf 39*a* which otherwise corresponds directly to and is mounted in the same manner as the spring leaf 39 of Fig. 9. In this figure a lever 50 is pivoted intermediate its ends to the main cam body 30*c* as at 51, and has a nose 52 for engagement with the spring leaf 39*a*. The inner end of the lever 50 has connected thereto one link 53 of a toggle mechanism, the other link of which is indicated at 54 and is pivotally connected between the upper end of the link 53 and the short arm 21*b* of the cam structure. The pivotal connection 55 between the links 53 and 54 may be swung to opposite sides of a line connecting the pivotal connections 56 and 57 between the link 53 and lever 50 and the link 54 and arm 21*b* respectively, thus locking the toggle mechanism in its set position by reason of the spring action exerted against the nose 52 by the spring leaf 39*a*.

A simple form of the mechanism is illustrated in Figures 11 to 13, in which the secondary cam is in the form of a U-shaped structure designated at 29*b*, and is pivoted to the primary body 30*d* at the lower end thereof, as indicated at 58. The secondary cam is adapted to swing about the pivot 58 from a position where the primary cam is entirely housed between the arms of the U to a position where it projects from these arms to function as the cam's surface. A spring 59 is arranged between the base of the U and the adjacent surface of the primary cam 30*d* and serves normally to move the secondary cam to its withdrawn position, the limit of this position being defined by a stop 62 shown in the present instance as a T-shaped lug projecting from the rear surface of the primary cam 30*d*. In order that the secondary cam may be held in its extended or operative position the arms thereof are provided with openings 61 through which a pin 60 may be passed to engage against the outer or working surface of the primary cam 30*d*. This structure corresponds closely to that illustrated in Figure 8 with the exception of the fact that the adjustment of the position of the secondary cam will not be micrometric as regards its projection.

A similar structure is illustrated in Figures 14 to 16 with the exception of the fact that in lieu of a solid secondary cam of the type illustrated in Figures 11 to 13, we employ the spring leaf type of secondary cam illustrated in Figures 9 and 10. In these figures the primary cam 30*e* has a spring leaf 39*c* secured thereto at its lower end and slidably engaged therewith at its upper end. Pivoted to the rear face of the primary cam 30*e* is a lever 63 which is linked to the spring leaf at a point intermediate its ends and indicated at 64. The rear of the primary cam 30*e* is provided with apertured ears 65 adapted to receive a pin 66 which may be passed selectively through pairs of openings 67 or 68 provided in cam 30*e* and the ears 65 as shown in Fig. 14 and thus serve to retain the leaf 39*c* in either its extended or withdrawn position. It will be understood that the cam, whether primary or auxiliary, is under manual control, and that the adjustments or regulation of hammer or press action available by means of the cam constructions hereinbefore set forth may be supplemented by an adjustable connection between the mechanical or manual operating mechanism and the cam. This connection is preferably effected as follows:

Upon the hammer frame, and more particularly

upon a support 69 carried thereby, a yoke 70 is vertically swiveled, this yoke supporting the pivoted lever 25 having a central neutral point in which it may be retained by means of a latch mechanism generally designated at 72. The yoke guides a vertical link 73, the lower end of which is pivoted at 74 in a slot formed in the lever and the upper end of which has swiveled engagement at 75 and a connecting yoke 76. Connecting yoke 76 embodies a pair of spaced cross bars through the upper bar 77 of which the lower end of link 26 extends and in which the link has a rotating fit through an enlargement or bushing 78 which is fixed to the link and which bears spaced indicia lines 79 coacting with the upper surface 77a of cross bar 77 to visually indicate the longitudinal adjustment of link 26. The lower end of the link is threaded in the lower cross bar 80 and is provided with adjusting and lock nuts 81 and 82 for coaction with the cross bar. By loosening the nuts 81 and 82 and rotating the connecting yoke 76, the effective length of link 26 may be adjusted, and through this adjustment the vertical position of primary cam 18 changed. Since cam 18 controls the neutral point of the valve 16, it follows that adjustment of the length of this link will serve as an adjustment for the vertical position which the ram will occupy when the lever 25 is placed in its neutral point. Also, obviously, by vertically shifting lever 25 the ram may be caused to approach or recede from the anvil as desired, and at a rate of speed corresponding to the speed of movement of the lever.

It often happens that careless or incompetent workmen when operating on materials requiring a slow hammer or pressing stroke will move such levers too rapidly, thereby causing defective operation of the mammer. This may be prevented by the use of the dash pot construction illustrated at 83, this dash pot having an orifice 84 which controls the rate at which its piston 85 may be shifted. The dash pot is clamped to the swiveled yoke 70 as at 86 and the piston stem 85a thereof is connected to an arm 87 secured to the link 73 through a removable pin 88. By varying the size of orifice 84 the rate at which the lever 25 may be shifted can be varied at will. This variation may be accomplished by the use of interchangeable fixed orifi, as illustrated at 84, or the like.

It will be noted that by use of the yoke 70 the handle 25 may be swiveled horizontally so that it may be placed within convenient reach of the workman when he is best positioned to observe the operation of the hammer.

As a further means for improving the control of the ram in operation, we likewise place the same in perfect balance. In the ordinary cam-controlled ram, the cam surface when formed on the ram throws the ram out of balance with the result that considerable vibration is set up and there is a great deal of wear on the meeting surfaces of the ram and guides. Furthermore, the blow struck by the ram is unbalanced with consequent errors in the finished product which must be compensated for in the design of the dies. In accordance with our invention we provide the usual cam-engaging surface 23 upon the ram but duplicate this surface at the diagonally opposed corner of the ram as indicated at 23a so that the ram is statically balanced.

Where cams of the type illustrated in Figures 1, 3 to 8 and 11 to 13 are provided, the cam-engaging surface of the ram may be readily modified to increase the efficiency and effect of the cams themselves and thus provide a still wider range of action. Such an arrangement is illustrated in Figures 19 and 20 wherein the ram 12a has a dual cam surface the sections of which are indicated at 23b and 23c. It will be noted that in the figures above referred to each cam comprises the central blade element flanked by side blade elements which are unitarily connected. The cam surface 23b coacts with the central blade element while the cam surface 23c is divided into two sections coacting with the flanking secondary blade elements. Since either surface 23b or 23c can be readily modified in manufacture, the type of hammer operation resulting from alternate use of the primary and secondary cams taken in conjunction with the adjustment provided at the control lever will permit a wide change in operating conditions.

Since the construction illustrated is capable of considerable modification without departing from the spirit of our invention, we do not wish to be understood as limiting ourselves thereto except as hereinafter claimed.

We claim:

1. In a power hammer, press or the like, a ram, a cylinder for operating the ram, a valve controlling the supply of fluid pressure to said cylinder, a vertically positionable cam coacting with said ram to control said valve to operate said ram through said cylinder as an oscillating hammer, a second vertically positionable cam to control said valve to operate said ram through said cylinder as a press, means to render either cam inoperative at will and a lever controlling the vertical positions of said cams.

2. In a power hammer, press or the like, a ram, a cylinder for operating the ram, a valve controlling the supply of fluid pressure to said cylinder, a vertically positionable cam coacting with said ram to control said valve to operate said ram through said cylinder as an oscillating hammer, a second vertically positionable cam to control said valve to operate said ram through said cylinder as a press, means to render either cam inoperative at will, a lever controlling the vertical positions of said cams, and means to adjust the position of either cam with respect to a given position of said lever.

3. A structure as set forth in claim 1 wherein one of said cams is mounted on the other thereof.

4. A structure as set forth in claim 2 wherein one of said cams is mounted on the other thereof.

5. A structure as set forth in claim 1 wherein one of the cams is vertically adjustably mounted on the other thereof.

6. A structure as set forth in claim 2 wherein one of the cams is vertically adjustably mounted on the other thereof.

7. In a power hammer, press or the like, a ram, a cylinder for operating the ram, a valve controlling the supply of fluid pressure to said cylinder, a vertically positionable multi-part cam coacting with said ram to control said valve to operate said ram through said cylinder and on each part thereof a working face for coaction with the ram, means to render either working face of the cam inoperative at will and a lever controlling the vertical position of said cam.

8. In a power hammer, press or the like, a ram, a cylinder for operating the ram, a valve controlling the supply of fluid pressure to said cylinder, a vertically positionable multi-part cam coacting with said ram to control said valve to operate said ram through said cylinder and on each part thereof a working face for coaction with the

ram, means to render either working face of the cam inoperative at will, a lever controlling the vertical position of said cam, and means to adjust the position of said cam with respect to a given position of said lever.

9. In a power hammer or the like, a frame, a ram, a vertically adjustable cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, and a swiveled connection between said links.

10. In a power hammer or the like, a frame, a ram, a vertically adjustable cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, and a member having swiveled connection with one and adjustable connection with the other of said links.

11. In a power hammer or the like, a frame, a ram, a vertically adjustable cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, a member having swiveled connection with one and adjustable connection with the other of said links, and coacting scale and index means on said other link and said yoke indicating the adjusted position of the link.

12. In a power hammer or the like, a frame, a ram, a vertically adjustable cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, a swiveled connection between said links, and means limiting the speed at which the control lever may be moved.

13. In a power hammer or the like, a frame, a ram, a vertically adjustable cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, a member having swiveled connection with one and adjustable connection with the other of said links, and means limiting the speed at which the control lever may be moved.

14. In a power hammer or the like, a frame, a ram, a vertically adjustably cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, a swiveled connection between said links, and a dash pot operatively connected between said yoke and control lever.

15. In a power hammer or the like, a frame, a ram, a vertically adjustable cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, a swiveled connection between said links, a dash pot operatively connected between said yoke and control lever, and an adjustable orifice for said dash pot.

16. In a power hammer or the like, a frame, a ram, a vertically adjustable cam coacting with the ram and controlling by its vertical position the vertical position of the ram and means to vertically adjust the cam comprising a lever pivoted intermediate its ends to the frame and to one end of which the cam is pivoted, a vertically swiveled yoke carried by the frame, a control lever pivoted thereto, a link connected to the control lever, a second link connected to the opposite end of the first-named lever, a swiveled connection between said links, and a dash pot operatively connected between said yoke and control lever including a pin removable to disable the connection.

17. A device as claimed in claim 1 wherein the second cam comprises a flexible element attached at one end to the first cam and in one position thereof forming the working surface of the first-named cam, and means are provided for extending said second cam to its operative position.

18. A device as claimed in claim 2 wherein the second cam comprises a flexible element attached at one end to the first cam and in one position thereof forming the working surface of the first-named cam, and means are provided for extending said second cam to its operative position.

19. A device as claimed in claim 1 wherein the second cam comprises a flexible element attached at one end to the first cam and in one position thereof forming the working surface of the first-named cam, and means are provided for extending said second cam to its operative position comprising a toggle mechanism connecting said first cam and said flexible element.

20. A device as claimed in claim 2 wherein the second cam comprises a flexible element attached at one end to the first cam and in one position thereof forming the working surface of the first-named cam, and means are provided for extending said second cam to its operative position comprising a toggle mechanism connecting said first cam and said flexible element.

21. A device as claimed in claim 1 wherein the second cam is a rigid element pivotally connected to the first cam at one end thereof and means are provided for holding the second cam in pivotally adjusted positions with relation to the first cam.

22. A device as claimed in claim 2 wherein the second cam is a rigid element pivotally connected to the first cam at one end thereof and means are

provided for holding the second cam in pivotally adjusted positions with relation to the first cam.

23. A device as claimed in claim 1 wherein the second cam is a rigid structure pivoted to the first cam, means for adjusting the pivotal connection between the first and second cams longitudinally of the first-named cam, and means for maintaining the second cam in adjusted positions about the pivot thereof.

24. A device as claimed in claim 2 wherein the second cam is a rigid structure pivoted to the first cam, means for adjusting the pivotal connection between the first and second cams longitudinally of the first-named cam, and means for maintaining the second cam in adjusted positions about the pivot thereof.

25. A device as claimed in claim 1 wherein the ram has cam faces for coaction with each of said cams.

26. A device as claimed in claim 2 wherein the ram has cam faces for coaction with each of said cams.

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