Oct. 9, 1945. H. E. BALSIGER ET AL 2,386,184

HYDRAULIC CONTROL DEVICE

Filed Nov. 28, 1940 3 Sheets-Sheet 1

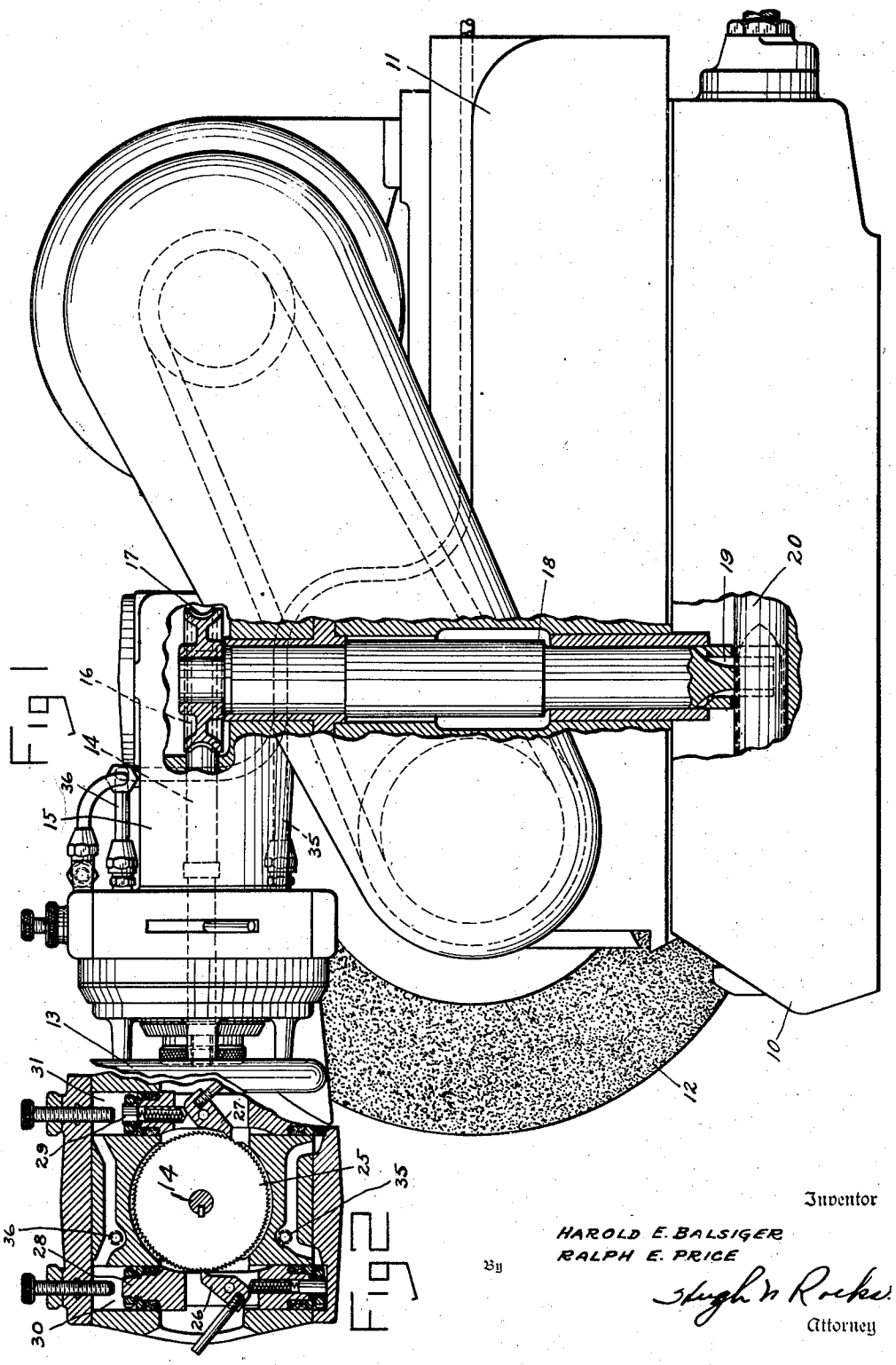


Fig 1

Fig 2

Inventor

HAROLD E. BALSIGER
RALPH E. PRICE

By Hugh M. Rocke

Attorney

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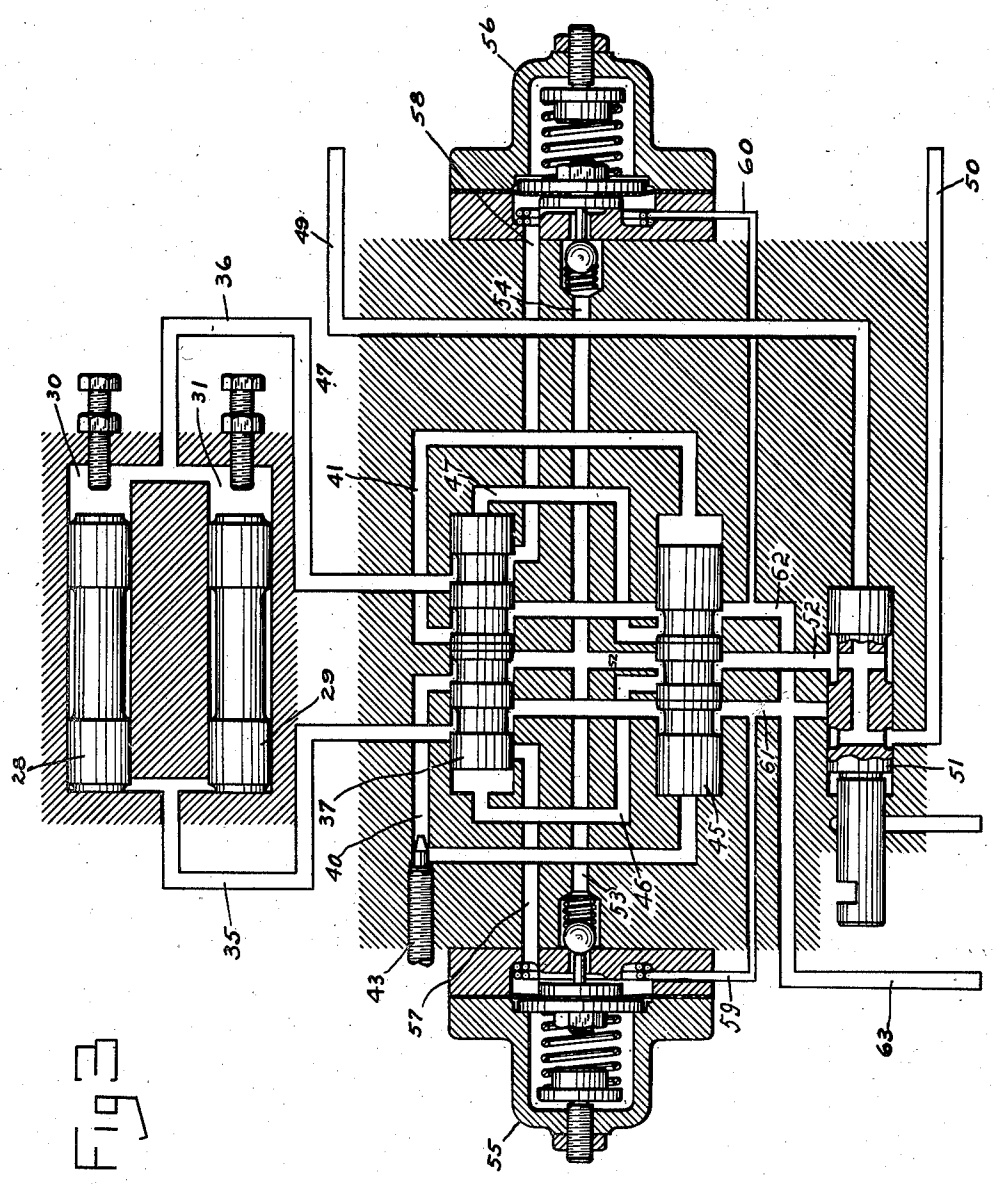


Fig 3

Inventor

HAROLD E. BALSIGER

RALPH E. PRICE

By Hugh M Rocke

Attorney

Oct. 9, 1945. H. E. BALSIGER ET AL 2,386,184

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Filed Nov. 28, 1940 3 Sheets-Sheet 3

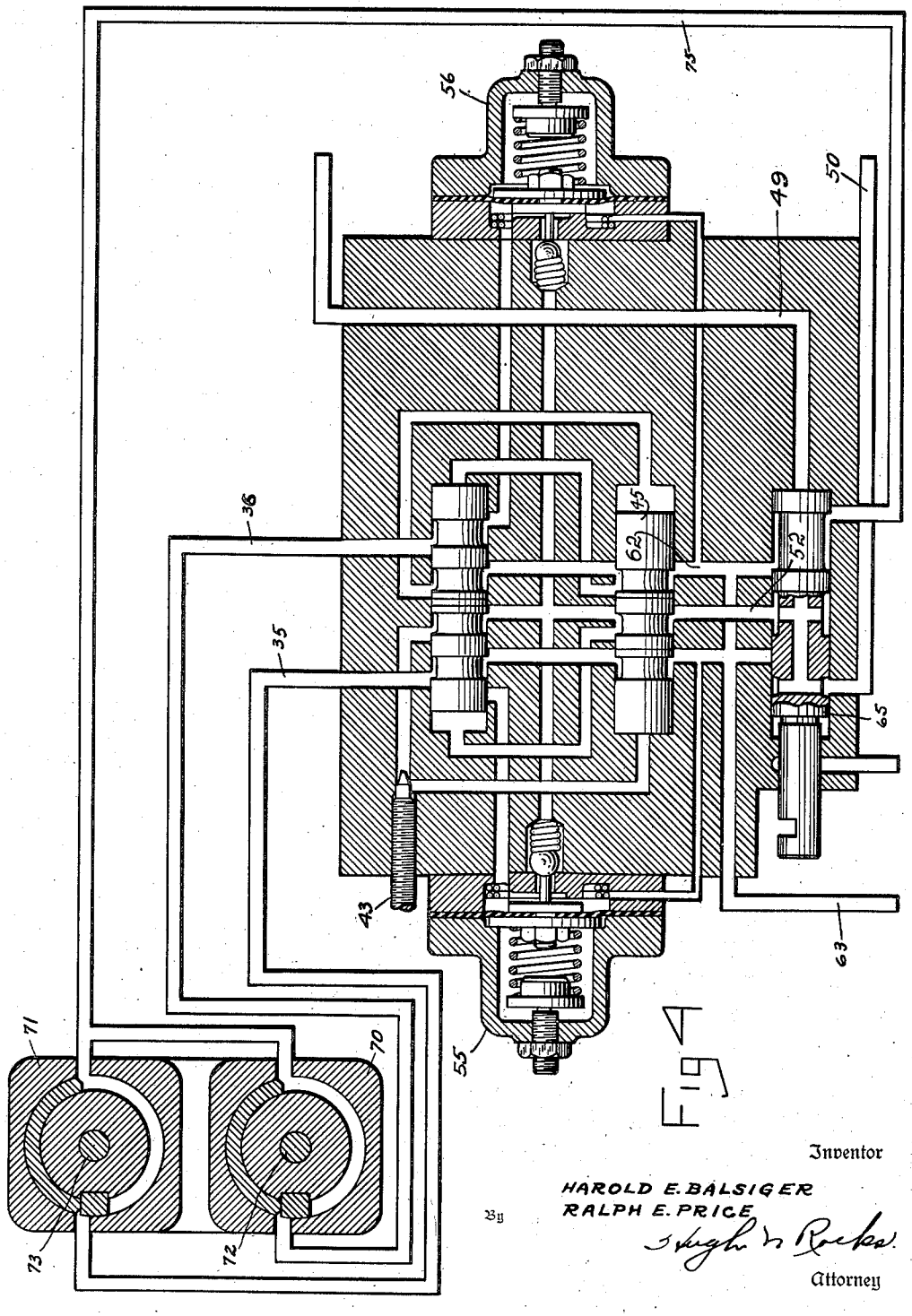


Fig. 7

Inventor

HAROLD E. BALSIGER

RALPH E. PRICE

By Hughes & Rockwell

Attorney

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UNITED STATES PATENT OFFICE

2,386,184

HYDRAULIC CONTROL DEVICE

Harold E. Balsiger, Waynesboro, Pa., and Ralph E. Price, Highfield, Md., assignors to Landis Tool Company, Waynesboro, Pa.

Application November 28, 1940, Serial No. 367,618

4 Claims. (Cl. 121—158)

This invention relates to hydraulic control devices, particularly for changing a constant flow of fluid into an intermittent flow of fluid.

It is an object of our invention to provide a self-actuating reversing mechanism which is entirely hydraulic in its functioning.

A further object is to provide a device wherein the pressure for operating same is different than that supplied to the driven mechanism thereby.

In the drawings:

Figure 1 is an end elevation of a grinding wheel support partly in section.

Figure 2 is a front sectional elevation of a pressure operated ratchet mechanism for actuating a feeding mechanism.

Figure 3 is a hydraulic diagram of a means for supplying fluid under pressure to said ratchet mechanism in the form of impulses.

Figure 4 shows the same device used with a backrest.

This invention is primarily a means for providing a supply of fluid under pressure in the form of impulses. The ratchet type feed mechanism and backrest operating mechanism are shown to demonstrate the construction and operation of the device. Obviously its use is not limited to feed and backrest mechanisms but rather to all pressure operated devices which require a pulsating supply of fluid under pressure.

Numeral 10 indicates the wheel slide base of a grinding machine, 11 a grinding wheel support, and 12 a grinding wheel rotatably mounted in said support. A handwheel 13 on a handwheel shaft 14 is rotatably mounted in a bracket 15. A worm gear 16 on said shaft 14 engages a worm wheel 17 on a vertical shaft 18. A pinion 19 on said vertical shaft engages a rack 20 in the slide base 10. Rotation of said vertical shaft by handwheel 13 thus results in a sliding movement of wheel support 11 on slide base 10.

The means for actuating said feed mechanism consists of a ratchet wheel 25 rotatable with said shaft 14 and having piston operated pawls 26 and 27 for rotating same. Said pawls are actuated by pistons 28 and 29 respectively in cylinders 30 and 31 respectively, and each engages and rotates the ratchet wheel while the other is being reset.

Fluid under pressure is supplied to opposite ends of said pistons thru lines 35 and 36. Said fluid under pressure is directed thru said lines alternately by a pressure operated valve 37. Said valve also directs fluid alternately thru lines 40 and 41 to opposite ends of a second valve 45. A throttle valve 43 in line 40 determines the rate of flow therethru and hence the speed of operation of the affected parts. Said second valve 45 directs fluid thru lines 46 and 47 alternately to opposite ends of said first mentioned valve 37.

Fluid from any suitable source such as a pump and a relief valve passes thru line 50, shutoff valve 51 and line 52 to valve 45 and on to valve 37. Branch lines 53 and 54 carry fluid under pressure to reducing valves 55 and 56 respectively from which it is conducted thru lines 57 and 58 at reduced pressure to valve 37 and then to lines 35 and 36. When used with a feed mechanism as in Figures 1, 2 and 3 or any other mechanism where a reduced pressure is not desired, valves 55 and 56 may be adjusted to wide open position by means of the adjusting screw so that there is no reduction in pressure in fluid passing therethru. When this mechanism is used to rotate the adjusting screws of a two shoe backrest, the reducing valve permits a different pressure on each shoe. Pressure is reduced to a point where it is just sufficient to maintain contact between the shoes and the work. Bleeder lines 59 and 60 provide a cushioning effect on the operation of said regulating valves. Said bleeders join exhaust passages 61 and 62 from valves 37 and 45. Said exhaust passages join and form a single passage 63. Pressure may build up in lines 35 and 36 to the point or points for which valves 55 and 56 are set. At this point the diaphragm in the valve is lifted to release the ball valve, and a spring plus the pressure in line 52 prevents further flow therethru. Any tendency to increase pressure in lines 52 is controlled by the relief valve in the system. To shift valve 51 to inoperative position, a passage 49 conducts fluid under pressure from any suitable source to the inner end of said valve. In this case the source of fluid under pressure is the supply to a pressure operated footstock shown in detail on application Serial No. 339,192 filed June 6, 1940, now Patent Number 2,313,482, granted March 9, 1943.

Figure 4 shows our invention applied to the operation of a backrest of the type disclosed in Patent No. 2,286,620 granted June 16, 1942. For this application the two reducing valves may be adjusted to provide a different pressure on each shoe. This figure shows a sectional elevation of a pair of hydraulic motors 70 and 71 for adjusting screws 72 and 73 to move the work engaging members (not shown) toward and away from operative position. The patent discloses piston type motors for rotating the adjusting screws while motors 70 and 71 are of the oscillating paddle type. The fluid lines 35 and 36 lead to the motors 71 and 70 respectively. The valve mechanism is iden-

tical with that disclosed in Figure 3 except that the start and stop valve of Figure 3 is replaced by a valve 65. For this reason it is thought unnecessary to repeat the details of Figure 3. Valve 65 differs from valve 51 in that the inner end consists of two narrow spaced lands instead of a single wide land. In operative position said valve directs the exhaust fluid from the backrest thru a passage 75 to the reservoir thru the space between said two lands. Said passage 75 is connected thru said valve to exhaust passage 62.

Operation

Operation of our device may be initiated by shifting valve 51 manually or otherwise to the position shown in Figure 3. Fluid at full line pressure is conducted thru line 50, valve 51 and line 52 to valves 37 and 45. Valves 55 and 56 may be adjusted so that the ball valves will be held in the wide open position at all times. In the positions of said valves shown, valve 45 connects line 52 with line 46 to direct fluid to shift valve 37 to the right. Valve 37 then connects line 52 with line 40 to direct fluid to shift valve 45 to the right. Valve 45 then directs fluid thru line 47 to shift valve 37 to the left, and valve 37 connects lines 52 and 41 to direct fluid to shift valve 45 to the left again. When valve 45 moves to the left, exhaust fluid passes thru valve 43 in line 40. Valve 37 directs said exhaust fluid to exhaust passages 61 or 62.

In the right hand position of valve 37, pressure line 58 from valve 56 is connected to line 36 to direct fluid at a pressure less than line pressure to shift feed pistons 28 and 29 to the left. Said pistons move to the end of their stroke substantially instantaneously while valves 37 and 45 function at a rate which is dependent on the setting of valve 43. In the opposite position of said valve 37, fluid from valve 55 is directed thru passage 35 to shift said pistons to the right. The frequency of the driving impulses is determined by the setting of valve 43.

Fluid for operation of the footstock or for operating any other pressure operated mechanism at the end of a grinding operation may be directed thru line 49 to shift valve 51 to inoperative position and thus cut off the supply of fluid under pressure from line 50. At the same time valve 51 connects ports 52 and 61 so that both ends of cylinders 30 and 31 are opened to exhaust.

When used for operating a steady rest as disclosed in Figure 4, reducing valves 55 and 56 may be adjusted independently for the pressure best suited to the respective shoe adjusting motors 71 and 70. As explained in Hollengreen Patent 2,286,620, granted June 16, 1942, it is desirable to duplicate manual adjustment of a steady rest as nearly as possible. This invention provides another means for supplying fluid under pressure in the form of impulses. The reason for providing a pulsating supply of fluid under pressure lower than pump pressure to the cylinders 70 and 71 is that the force required to overcome the starting friction in the threaded portions 72 and 73 is more than enough to hold the work engaging shoes in contact with the work. In fact it is great enough to cause a slight distortion of the work. A pulsating supply of fluid at a low pressure has the effect of the greater pressure so far as over coming the starting friction of the screw is concerned, and at the same time it exerts only sufficient pressure on the work engaging shoes to hold said shoes in contact with the work. Because of the difference in mechanical structure of the mechanisms for moving the two shoes, a different pressure might be required for the operation of each, and for this reason two reducing valves 55 and 56 are used. These valves may be set independently for any desired pressure. With the pressure reduced as described, a reasonable approximation of manual operation is effected. An operator never adjusts both shoes of a steady rest simultaneously. For this reason, our device which directs the pulsating fluid under pressure to the motors 71 and 70 alternately more nearly approximates manual operation. Obviously lines 35 and 36 could be joined so as to actuate motors 71 and 70 simultaneously but the method disclosed is preferred. For resetting the backrest, fluid under pressure in line 49 shifts valve 65 and continues on thru passage 75 to reverse the movement of motors 70 and 71 and thus withdraw the backrest shoes (not shown) to an inoperative position. As mentioned in connection with the description of Figure 3, pressure line 52 is connected to exhaust line 61, in this case, by valve 65 which also cuts off the supply of fluid under pressure from line 50. Thus both motors 70 and 71 may be reversed continuously and simultaneously and returned to starting position.

We claim:

1. Hydraulic control means for a pressure operated device, including a pressure operated reciprocating valve for directing a supply of fluid under pressure intermittently to said device, means for reciprocating said valve, including a reversing valve for directing fluid alternately to opposite ends of said first mentioned valve, connections between said first mentioned valve and said reversing valve for directing fluid under pressure alternately to opposite ends of said reversing valve for reciprocating said reversing valve, separate connection from said first mentioned valve to said pressure operated device and a valve in the line to one end of said reversing valve for adjusting the rate of movement thereof.

2. Hydraulic control means for a pressure operated device, including a pressure operated reciprocating valve for directing a supply of fluid under pressure intermittently to said device, means for reciprocating said valve, including a reversing valve for directing fluid alternately to opposite ends of said first mentioned valve, connections between said first mentioned valve and said reversing valve for reciprocating said reversing valve, and means for maintaining one pressure on said device and another pressure for operating said valves.

3. Hydraulic control means for a pressure operated device, including a pressure operated valve having a plurality of outlet passages leading therefrom, a reversing valve for directing fluid under pressure to effect a reciprocatory movement of said pressure operated valve, two of said outlet passages leading directly to opposite ends of said reversing valve, another of said outlet passages leading to said pressure operated device, a supply of fluid under pressure for distribution by said pressure operated valve, a portion of said supply being conducted directly to said valve for distribution thru certain of said passages, another portion of said fluid supply being directed thru a pressure reducing valve, and then to said pressure operated valve for distribution to other of said passages.

4. In a metal working machine, a backrest operating means including a reversible fluid motor, connections for supplying fluid under pressure al-

ternately to opposite sides of said motor including a control valve, a device in one of said connections for transforming the continuous flow of fluid into a pulsating flow for effecting an intermittent movement of said motor, a shutoff valve in said connections, means operable at the end of a machining operation for directing fluid under pressure to shift said shutoff valve to stop position, said shutoff valve then directing said fluid thru the other of said connections to reset said backrest operating means.

HAROLD E. BALSIGER.
RALPH E. PRICE.