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Harada et al.

[11] **3,841,143**

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[54] **APPARATUS FOR CONTROLLING THE ACTUATION OF AN ACCESSORY DEVICE IN AN OIL PRESSURE ACTUATED PRESS**

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[52] **U.S. Cl.** **72/453**, 72/22, 72/421

[51] **Int. Cl.** **B21j 13/08**

[58] **Field of Search** ..... 72/453, 22, 23, 421; 100/269 R, 256, 53

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[57] **ABSTRACT**

An apparatus for controlling the actuation of an accessory device of an oil pressure-actuated press in such a manner that the accessory device, such as a scrap cutter, a product feed device, a product knock-out device, or an air ejector, can be actuated in a predetermined phase in the slide stroke of the press even when the stroke distance is varied. The press is of the type which comprises a pair of limit switches operable at the upper and lower limits of the stroke of a slide, the position of at least one of the limit switches being variable so as to vary the stroke distance of the slide. The apparatus of the invention constitutes a power source, a stationary variable resistance connected to the power source, a stationary contact which engages the variable resistance and is likewise connected to the power source, with the position of the stationary contact being variable in response to a change in the operative position of the limit switch of the press, a shifting contact further being disposed in engagement with the variable resistance, and Schmidt trigger circuits having inputs connected to the shifting contacts and outputs connected to a press accessory device actuating mechanism.

4 Claims, 3 Drawing Figures

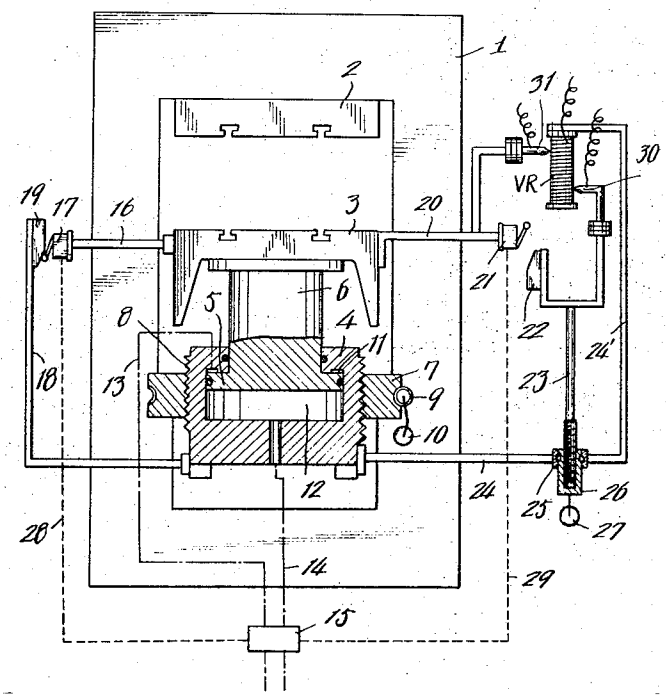


FIG. 1

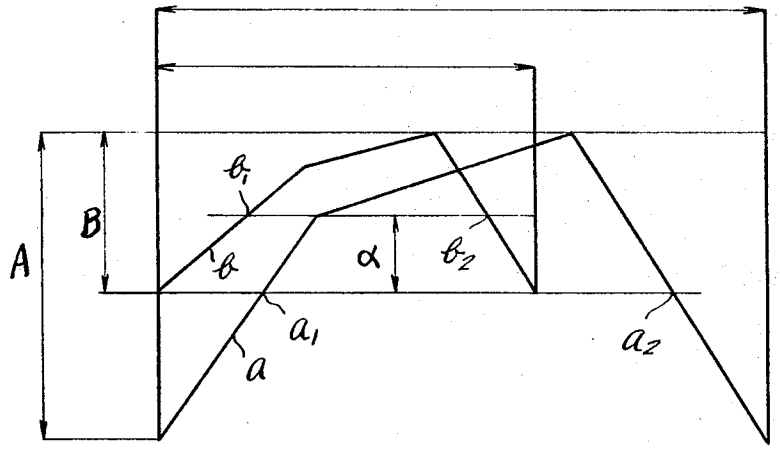


FIG. 3

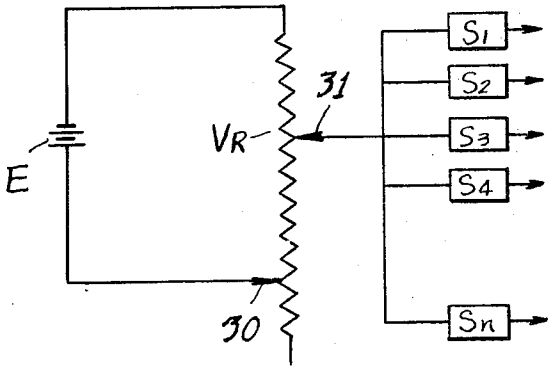
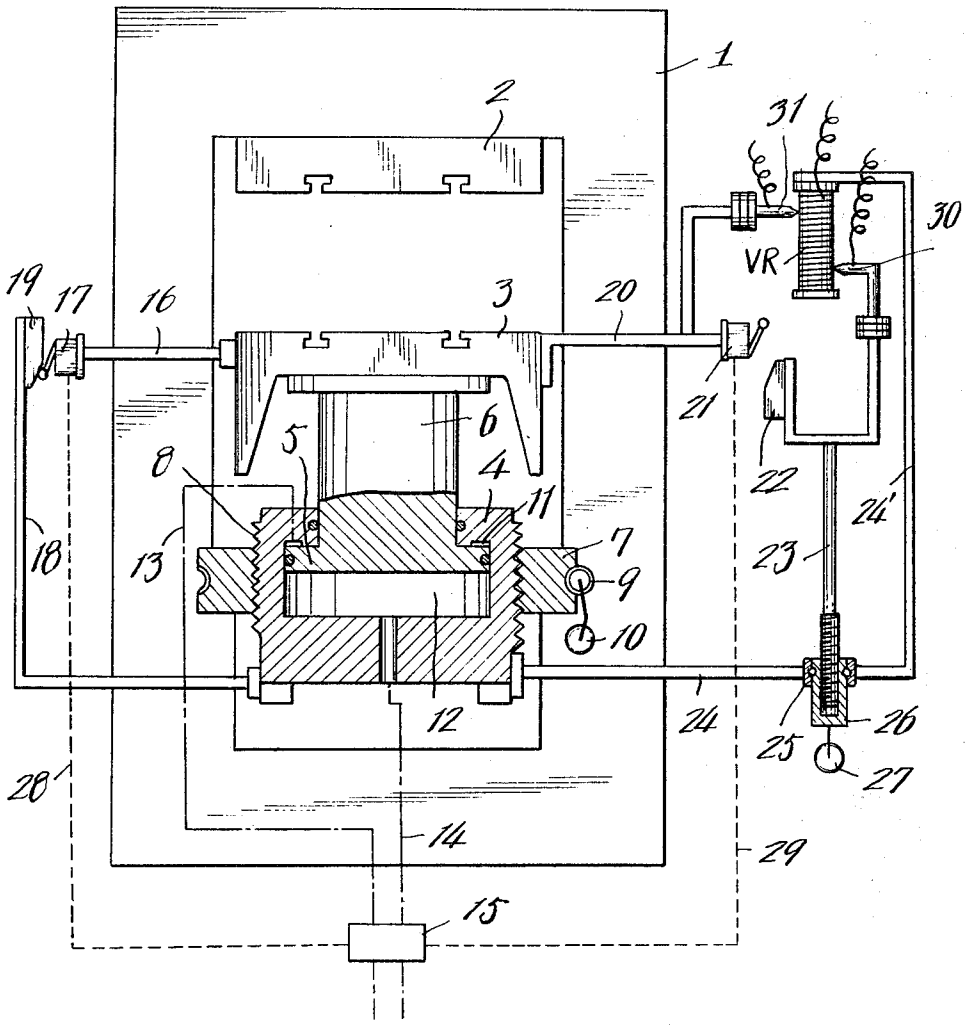


FIG. 2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APPARATUS FOR CONTROLLING THE ACTUATION OF AN ACCESSORY DEVICE IN AN OIL PRESSURE ACTUATED PRESS

BACKGROUND OF THE INVENTION

This invention relates generally to an oil pressure-actuated press and more particularly, to an apparatus for controlling the actuation of an accessory device of the press such as a material or product feed device, a scrap cutter, a product knock-out device or an air ejector, for example, in such a manner that the accessory device can be actuated in a predetermined phase in the slide stroke even when the stroke distance is varied.

In any of the prior art oil pressure-actuated press, whenever the stroke distance of the slide is varied and/or dies are replaced by those having different heights, the position of a limit switch or switches which are adapted to generate signals for actuating a device accessory to the press has to be adjusted.

Such adjustment of the position of the limit switch or switches renders the manipulation of the press troublesome. That is, in an oil pressure-actuated press, when it is assumed that the stroke distance of the slide is A or B and the slide moves describing the operation curve *a* or *b* as shown in FIG. **1**, in order to generate signals for actuating the accessory device of the press in the middle point a_1 and a_2 or b_1 and b_2 of the stroke distance as shown in FIG. **1**, the position of limit switch or switches have to be displaced by an amount α. Such adjustment of the limit switch or switches involves a time consuming tedious operation.

SUMMARY OF THE INVENTION

Therefore, one principal object of the present invention is to provide an apparatus for controlling the actuation of an accessory device in an oil pressure-actuated press which can effectively eliminate the disadvantages inherent in the prior art apparatus for controlling the actuation of an accessory device in an oil pressure-actuated press referred to hereinabove.

Another object of the present invention is to provide an apparatus for controlling the actuation of an accessory device in an oil pressure-actuated press which can control the actuation of the accessory device without the necessity for varing the position of the limit switch or switches even when the stroke distance of the slide is varied.

A further object of the present invention is to provide an apparatus for controlling the actuation of an accessory device in an oil pressure-actuated press which can eliminate the necessity for re-positioning or adjusting the position of the limit switch or switches even when dies having different heights are employed.

According to the present invention, an oil pressure-actuated press has been provided which comprises a pair of limit switches adapted to be operated at the upper and lower limits of the stroke of a slide, respectively, for controlling an oil pressure controlling electromagnetic valve associated with an oil pressure-operated cylinder that is adapted to operate said slide and in which the operative position of at least one of said limit switches is variable so as to vary the stroke distance of said slide, characterized in that an apparatus for controlling the actuation of an accessory device in said press comprising a power source, a stationary variable resistance connected to one terminal of said power source, a stationary contact engaging said variable resistance and connected to the other terminal of said power source, a shifting contact in engagement with said variable resistance and conventional Schmidt trigger circuits having the inputs connected to said shifting contact and the outputs connected to the input of a press accessory device actuation means.

The above and other objects and attendant advantages of the present invention will be more readily apparent to those skilled in the art from a reading of the following description in conjunction with the accompanying drawings which show one preferred embodiment of the present invention for illustration purpose only, but not for limiting the same in any way.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram showing the stroke of the slide in an oil pressure-actuated press;

FIG. **2** is a schematic view in partial section of one preferred embodiment of apparatus for controlling the actuation of a device accessory to an oil pressure-operated press in accordance with the present invention; and

FIG. **3** is a circuit showing operative relationship between electric components of said apparatus of FIG. **2**.

PREFERRED EMBODIMENT OF THE INVENTION

The present invention will be now described by referring to the accompanying drawings and more particularly, to FIGS. **2** and **3** thereof which show one preferred embodiment of the invention. In FIG. **2**, numeral **1** denotes the main frame of an oil pressure-actuated press, numeral **2** denotes the bolster fixedly secured to the main frame and numeral **3** denotes the slide. As seen in any conventional oil pressure-actuated press, the boltster **2** and slide **3** have mating dies mounted thereon, respectively, which cooperate with each other in performing a processing operation on a work piece (not shown). The slide **3** is fixedly secured to the upper end of a support member **6**; the lower end of which has an integral piston **5** received in an pressure oil cylinder **4**. The cylinder **4** is in threaded engagement with a worm wheel **7** at **8** and the worm wheel is rotatably supported in a fixed position on the main frame **1**. The worm wheel **7** is in turn meshing with a warm **9** which is adapted to be rotated by means of a motor **10** which is also suitably mounted on the main frame **1**. When the worm **9** is rotated by the motor **10** in one or the other direction, the rotational movement of the worm is transmitted to the warm wheel **7** and the worm wheel in turn moves the cylinder **4** upwardly or downwardly and accordingly, the slide **3** supported by the support member moves upwardly or downwardly so that the height of the slide can be adjusted as desired in conformity with the height of the dies employed. The pressure oil cylinder **4** has upper and lower oil chambers **11** and **12** separated by the piston **5** and these oil chambers are communicated through an electromagnetic valve **15** with a pressurized oil supply means (not shown) by means of oil passages **13** and **14**, respectively.

Fixedly secured to and horizontally extending from one side of the slide **3** (the left-hand side as seen in FIG. **2**) is a support rod **16** which has a limit switch **17** at the free or outer end for detecting the upper limit of the stroke of the slide **3**. A substantially L-shaped support rod **18** is fixedly secured to and horizontally and verti-

cally from one side of the cylinder **4** (the left-hand side as seen in FIG. **2**) and the vertical extension of the support rod **18** has at the upper end a plate cam **19** secured thereto for detecting the upper limit of the slide stroke in cooperation with the limit switch **17** when the limit switch **17** engages the cam plate as the slide reaches the upper limit of its stroke. A further support rod **20** extends horizontally from the other side of the slide **3** and has at the free or outer end a limit switch **21** fixedly secured thereto. (The support rod **20** has an upwardly extending extension for the purpose to be described hereinbelow.) The limit switch **21** is adapted to be engaged by a plate cam **22** at the upper end of a vertical support rod **23** (or more particularly, on one of two upper extensions of the rod **23**) for detecting the lower limit of the slide stroke, and the support rod **23** has an external thread on the lower end portion in engagement with an internally threaded cylindrical member **26** rotatably received in a ring member **25** which is provided in the horizontal arm of a substantially L-shaped support rod **24** which extends horizontally from the other side of the cylinder **4** and then upwardly. The threaded cylindrical member **26** is adapted to be rotated by a motor **27** to adjust the position of the plate cam **22** and accordingly, the lower limit of the slide stroke thereby to vary the distance of the slide stroke. The above-mentioned limit switches **17** and **21** are connected to the above-mentioned electromagnetic valve **15** by means of circuits **28** and **29,** respectively and respectively control the changeover between the rising and descending movement of the slide by controlling the electromagnetic valve **15** at the upper limit and lower limit of the slide **3,** respectively.

The vertical extension **24'** of the above-mentioned support rod **24** has an inwardly extending extension from which a variable electric resistance VR suspends vertically and the resistance is adapted to be engaged on one side by a stationary contact **30** supported on the other extension of the above-mentioned cam support rod **23.** The other side of the resistance VR is adapted to be engaged by a shifting contact **31** supported at the extreme end of the upwardly extending extension of the support rod **20** on which the switch **21** is supported. The variable resistance VR and contacts **30,31** cooperate with a power source of direct current, E in providing an electric circuit as shown in FIG. **3** in which the shifting contact **31** is selectively connected to the inputs of a plurality of Schmidt trigger circuits S_1, S_2, S_3, S_4, ... S_n and the outputs of which are connected to an actuation means of the press accessory device (not shown).

The above-mentioned Schmidt trigger circuits S_1, S_2, S_3, S_4 . . . . . S_n are, respectively, set to be operated when, for example, the input voltage of the shifting contact **31** is at 2 V, 2.5V, 5 V, 6.5 V . . . . . 8 V, respectively. These Schmidt trigger circuits are of conventional, well-known construction.

Now assuming that the stroke distance of the slide **3** is set as 200 mm by the upper and lower limit cam plates **19** and **22,** the slide **3** moves describing the curve *a* as shown in FIG. **1,** the voltage at the variable resistance VR varies within the range 2V ~ 8V as the shifting contact **31** shifts along the resistance VR and signal for actuating the accessory press device are generated in the middle points $a_1$and a_2 of the slide stroke distance, the voltage at the resistance VR is **5V** when the actuation signals are generated.

Therefore, when the slide **3** reaches the middle points a_1 and a_2 of its stroke distance and the shifting contact **31** reaches the middle point of its shifting movement range, the Schmidt trigger circuit S_3 which is set for operation at **5V** generates signals for actuating the press accessory device.

Alternatively, in order to vary the stroke distance of the slide **3** from 200 mm to 100 mm, the threaded cylindrical member **26** is rotated by the motor **27** to raise the lower limit detection cam plate **22** by 100 mm. The upward movement of the lower limit cam plate **22** by the above-mentioned distance in turn varies the effective resistance value of the variable resistance VR whereby the voltage range of 2V ~ 8V can be obtained within the slide stroke distance of 100 mm. Therefore, even if the slide stroke distance is varied from 200 mm to 100 mm and the slide moves describing the curve *b* as shown in FIG. **1,** when the slide reaches the middle points b_1 and b_2 of the slide stroke distance, the Schmidt trigger circuit S_3 set for operation at 5V provides signals for actuating the press accessory device.

As clear from the foregoing, according to the present invention, even when the stroke distance of the slide is varied, by simply adjusting the operative position of the lower limit switch, the actuation of the press accessory device can be simply and effectively controlled. In addition, even when it is desired to actuate the press accessory device in any desired position within the slide stroke distance range, if the Schmidt trigger circuits are set accordingly, the actuation of the press accessory device can be easily controlled.

Though this invention has been described with reference to a preferred embodiment thereof, other embodiments of this invention will occur to those skilled in the art which are with the scope of the following claims.

What is claimed is:

1. In an oil pressure-actuated press which comprises a pair of limit switches for operating at the upper and lower limits of the stroke of a slide, respectively, for controlling an oil pressure controlling electromagnetic valve associated with a pressurized oil cylinder which operates said slide and in which the operative position of at least one of said limit switches is variable so as to vary the stroke distance of said slide, the improvement comprising an apparatus for controlling the actuation of an accessory device in said press, said apparatus comprising a power source, a stationary variable resistance connected to one terminal of said power source, a stationary contact engaging said variable resistance and connected to the other terminal of said power source, the position of said stationary contact being variable in response to change in said operative position of at least one of said limit switches, a shifting contact in engagement with said variable resistance and Schmidt trigger circuits having inputs connected to said shifting contact and outputs connected to the input of a press accessory device actuation means.

2. The apparatus as set forth in claim **1,** wherein said pair of limit switches are fixedly secured to said slide and adapted to respectively close a circuit, said apparatus further including said limit switches which are engaged by cams connected to and supported by said pressurized oil cylinder, respectively.

3. The apparatus as set forth in claim **2,** wherein said cams and said stationary contact are supported on support rods which are supported on said pressurized oil

cylinder, the engaging position of said cams with respect to said limit switches being variable so as to vary the stroke distance of said slide and the position of said support rods being vertically adjustable.

4. The apparatus as set forth in claim **1,** wherein the position of said pressurized oil cylinder is vertically adjustable in accordance with the height of particular dies employed.

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