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MULTIPLE DEPTH CONTROL FOR POWER PRESS BRAKES

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3 Sheets-Sheet 1

Fig. 1.

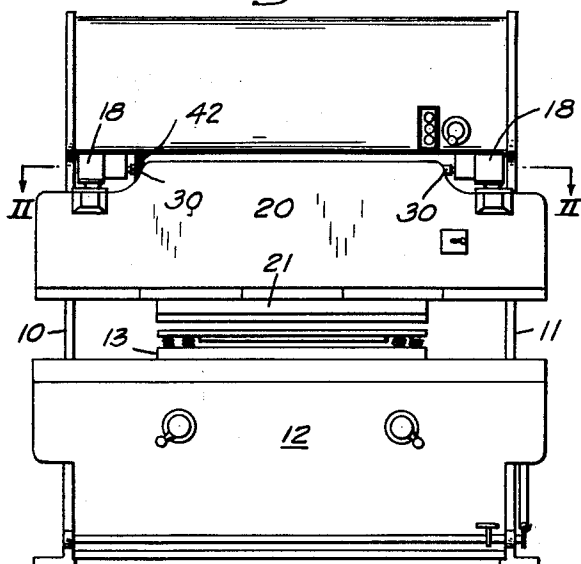
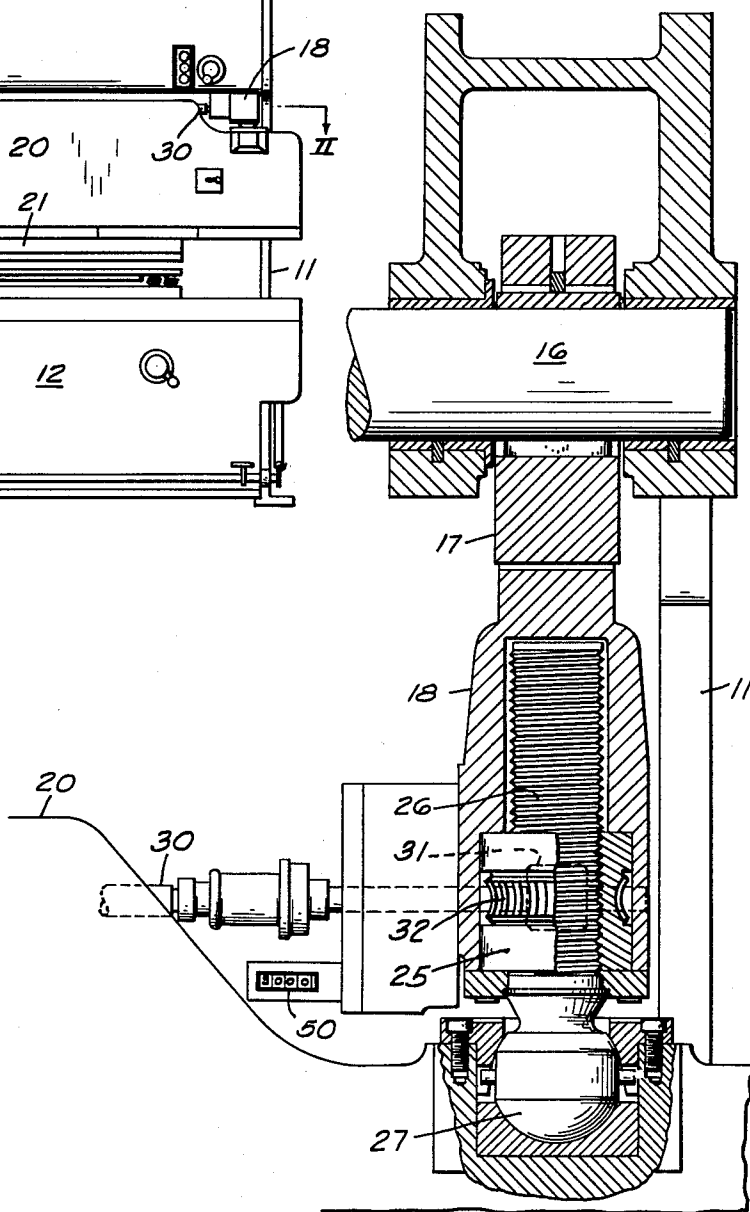


Fig. 3.



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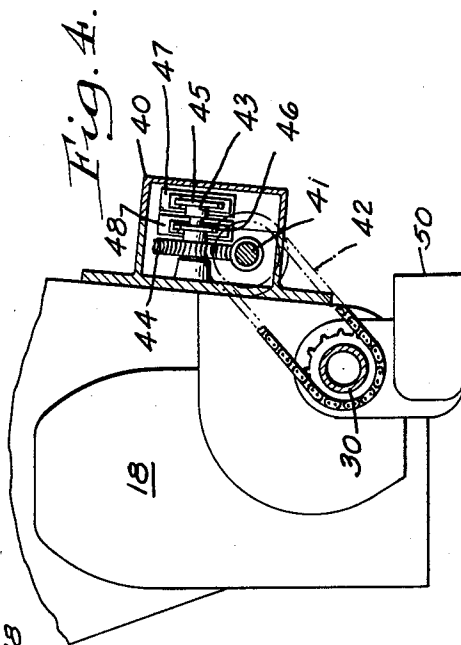
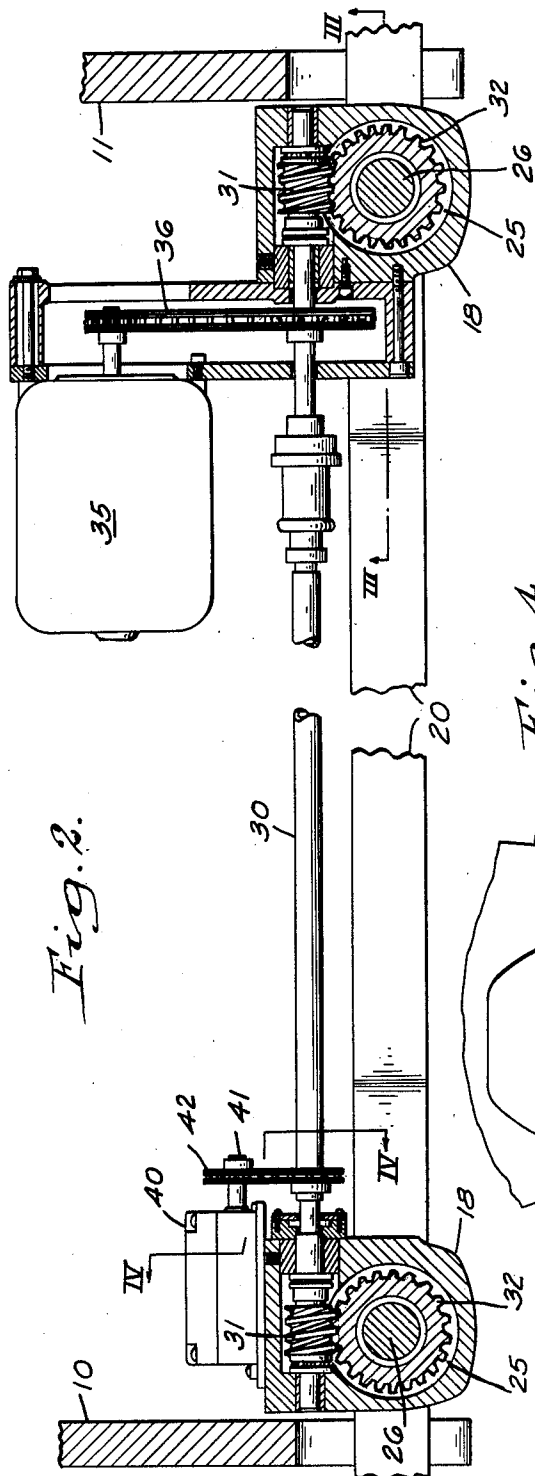
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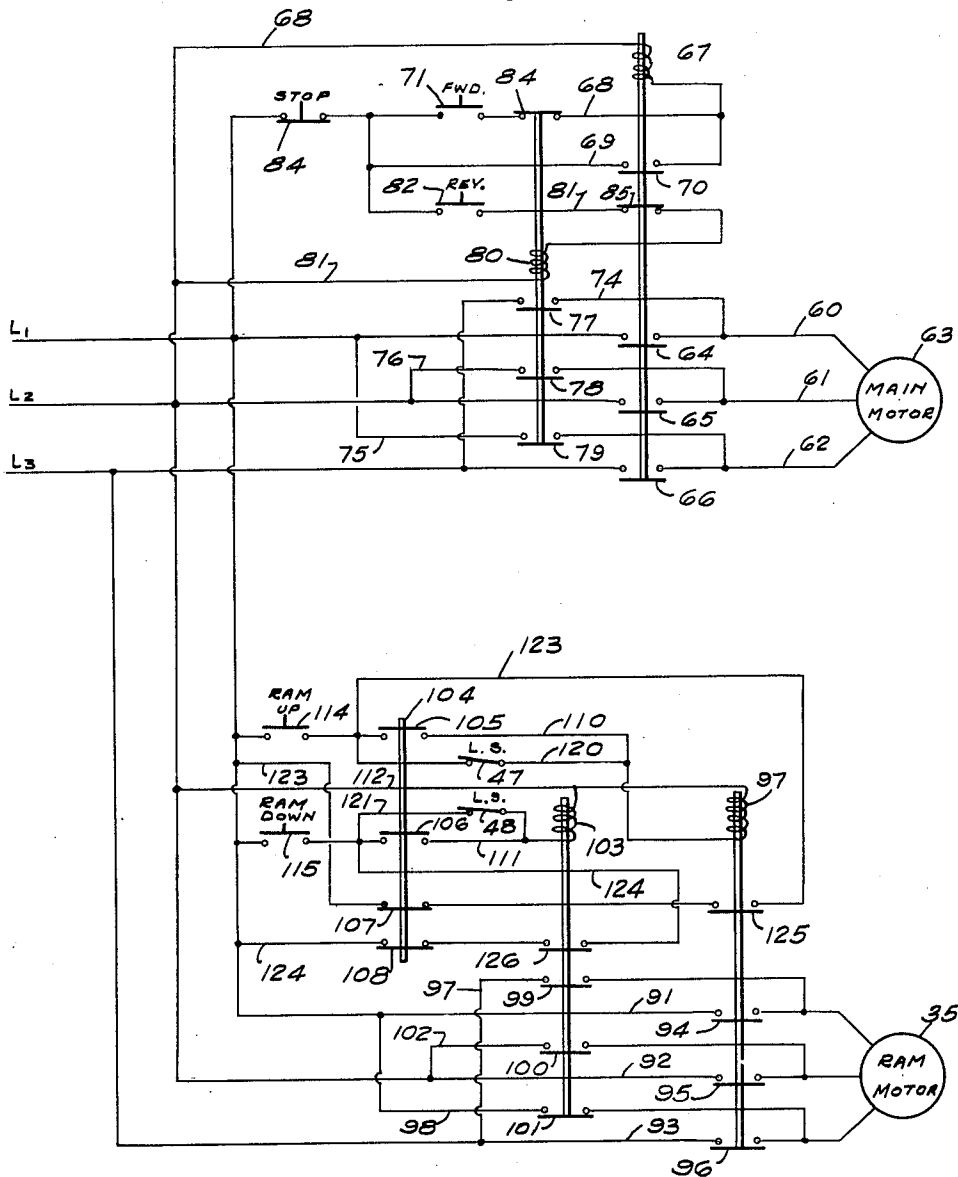
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MULTIPLE DEPTH CONTROL FOR POWER PRESS BRAKES

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Fig. 5.



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MULTIPLE DEPTH CONTROL FOR POWER PRESS BRAKES

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This invention relates to power press brakes and more particularly to means whereby press strokes of various predetermined depths may readily be selected by the operator.

In power press brake operation it is frequently desirable to perform successive bending operations on a sheet metal workpiece wherein one or more bends are made with the upper movable die descending to a particular depth with respect to the lower fixed die and wherein one or more additional bends are made with the movable die descending to a different depth relative to the lower die.

Merely by way of illustration, a press brake may be fitted with mating V-shaped punch and die members which, when the upper die completely enters the lower die, forms a right angle bend. In another bending operation on the same workpiece with the same dies it may be desired to form an obtuse angled bend by moving the upper die downwardly to a lesser depth. Numerous other examples of press brake operations requiring successive strokes of varying depth might be cited but the general problem will be readily recognized by those skilled in the sheet metal working art.

The present apparatus provides means for effecting such successive bends or similar forming operations repeatedly and alternately without the necessity for manually adjusting or setting the machine each time. The operator merely presses one or another of a plurality of selector buttons or moves a selector switch to one or another of a plurality of positions, the necessary adjustment being made automatically by the depth adjusting mechanism of the machine. Means are further provided whereby the automatic depth selecting and adjusting mechanism may readily be adjusted and set up to establish two or more accurately predetermined depth positions to which the movable member of the press brake will descend upon appropriate preselection by the operator.

In hydraulic press brakes wherein fluid pressure cylinders move the ram of the press, variable strokes are more easily provided for by adjustable limit switches which control the shifting of valves which in turn control pressure cylinder operations. However, in mechanical press brakes wherein cranks or eccentric mechanisms having fixed throws effect ram movements the provision of adjustable depth selection means is less readily accomplished. The present invention relates to this latter class of power press brakes.

Speaking generally, the present invention provides means whereby the pressing of a button by the operator or the placing of a switch in a predetermined position selects one of a plurality of working stroke depth positions and whereby the height adjustment means of the press brake then operates automatically to adjust the press brake mechanism to produce strokes of the desired selected depth. By this means an operator may repeatedly perform alternate or successive press brake operations which require strokes of different depths by an instantaneous selection operation requiring no attention other than the pressing of a button or the placing of a switch operator in a particular position.

A single embodiment of the apparatus of the present invention is illustrated in the accompanying drawings and described in the following specification but it is to be understood that such embodiment is set forth merely by way of example and that the scope of the invention is

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not limited excepting as defined in the appended claims.

In the drawings:

FIG. 1 is a general elevational view of a power press brake which may be provided with one form of the depth control apparatus of the present invention;

FIG. 2 is a fragmentary cross-sectional view taken approximately on the line II—II of FIG. 1;

FIG. 3 is a fragmentary vertical cross-sectional view taken approximately on the line III—III of FIG. 2;

FIG. 4 is a fragmentary cross-sectional view taken approximately on the line IV—IV of FIG. 2; and

FIG. 5 is a schematic wiring diagram of the electrical control portion of one form of the apparatus of the present invention.

Like characters of reference denote like parts throughout the several figures of the drawing. The general construction of a press brake embodying the principles of the present invention is conventional and comprises a pair of side frames 10 and 11 rigidly connected at their lower portions by a bed 12 which supports a lower die member 13.

The upper portions of the side frames 10 and 11 give bearing support to a main drive shaft 16, shown in FIG. 3, which is provided with eccentric or crank formations 17 which reciprocate a pair of connecting rods 18 which have ball and socket connection at their lower ends with a ram or crosshead 20 for reciprocating the latter toward and away from bed 12, the ram 20 being provided with an upper die member 21 complementary to the lower die member 13.

Referring now particularly to FIGS. 2 and 3, each connecting rod 18 is bored to receive a nut member 25 which is rotatable in the connecting rod but held against axial movement relative thereto. The internal threads of nut 25 engage external threads on a stem member 26 which has ball and socket connection with crosshead 20 as at 27. Accordingly, rotative adjustment of nut 25 increases or decreases the effective length of connecting rod 18 and thus, without altering the amplitude of the stroke as determined by the eccentricity of the eccentric or crank formation 17, shifts the ram 20 upwardly or downwardly so that the stroke occurs at a different vertical position and accordingly has a different lower extremity.

Power means are conventionally provided for effecting the foregoing stroke adjustment, the degree of adjustment being conventionally under manual control of the operator. It is to be understood that the eccentrics 17 produce a stroke of a given fixed amplitude and that the adjustment referred to merely reorients this fixed stroke vertically to adjust the points; where the top and bottom limits of ram movement occur. A stroke adjustment shaft 30 is carried by and is journaled at its ends in the connecting rods 18 and has fixed thereto a pair of worms 31 which engage external worm wheel teeth 32 on nut 25. A reversible electric motor 35 is connected to adjustment shaft 30 by a chain and sprocket connection 36 so that the effective lengths of the connecting rods 18 are jointly and synchronously lengthened or shortened by energization of motor 35 for rotation in one direction or the other.

In the apparatus of the present invention the drive motor 35 and the transmission means 36 are fixed to the right-hand connecting rod 18 and automatic depth control means are mounted upon the left-hand connection 18. Such means may comprise a rotary limit switch assembly 40 which includes an input shaft 41 having chain and sprocket connection with the height adjustment shaft 30 as at 42. A cam shaft 43 is driven from input shaft 41 by worm drive connection 44.

In the present instance a pair of cams 45 and 46 are independently angularly adjustable on cam shaft 43 and have the usual peripheral projections adapted to open,

respectively, one or the other of a pair of normally closed limit switches 47 and 48 mounted in the rotary limit switch casing. The manner in which closure of one or the other of the switches 47 and 48 automatically controls operation of the adjusting motor 35 and the manner in which one or the other of such switches is preselected to automatically attain a given stroke depth adjustment will now be described with reference to the wiring diagram, FIG. 5.

A conventional counter unit 50 is driven from adjusting shaft 30 and positioned where it may be observed from the front of the machine. The geared relationship between the adjusting shaft 30 and the dial mechanism of the counter unit 50 may be such that the counter may be read in inches and decimal fractions of inches with respect to any desired reference point as, for instance, the maximum upward or downward adjusted positions of the ram 20.

In FIG. 5 the conductors of a three wire A.C. power supply are conventionally designated L_1 , L_2 and L_3 and conductors 60, 61 and 62 lead therefrom to a main motor 63 which drives the main eccentric shaft 16 of the press. Normally open switches 64, 65 and 66 in these conductors are jointly closable by a solenoid winding 67. A primary energizing conductor for winding 67 is designated 68 and a holding circuit conductor is designated 69. A further normally open switch 70 in holding circuit conductor 69 is likewise closed by energization of winding 67 so that momentary closing of a push button switch 71 in primary conductor 68 establishes a forward running of the main motor 63.

For reverse running supply conductor L_1 and L_3 are reversely connected to main motor 63 by means of conductors 74 and 75 and a shunt conductor 76 in L_2 conductor 61 is provided for reverse running. Normally open switches 77, 78 and 79 in conductors 74, 75 and 76 are jointly closable by a solenoid winding 80 in an energizing conductor 81 having a normally open push button reverse running switch 82. The conductors 68 and 81 connect in parallel across conductors L_1 and L_2 and have a common normally closed stop switch 84. For protective purposes normally closed switches 85 and 86 in the forward and reverse conductors 68 and 81 are opened by operation of the reverse and forward running solenoids 80 and 67, respectively, to insure that both forward and reverse running circuits cannot be established at the same time.

The foregoing circuitry is standard for main motor operation and is set forth schematically merely to complete the disclosure of the present apparatus. That is, the upper half of the circuitry illustrated in FIG. 5 is mainly conventional circuitry for operating the main motor of the press brake which rotates the main drive shaft 16 for reciprocating the ram 20 in working and return strokes.

This conventional reciprocation is under the control of forward, reverse and stop buttons which control the switches 71, 82 and 84, respectively, of FIG. 5 in an entirely conventional manner.

Reference will now be had to the novel portion of the circuitry shown in the lower half of FIG. 5 which is devoted to control of motor 35 which effects up and down adjustment of the effective length of the connecting rods 18.

The ram adjusting motor 35 likewise has three energizing conductors designated 91, 92 and 93 which, for forward running, connect directly to the motor 35 from live conductors L_1 , L_2 and L_3 . Normally open switches 94, 95 and 96 in these three energizing conductors are adapted to be jointly closed by a solenoid winding 97 for adjusting the ram in an upward direction. For reverse operation the supply lines L_1 and L_2 are reversely connected to the motor 35 by conductors 97 and 98 and normally open switches 99, 100 and 101 are provided in conductors 97 and 98 and a shunt conductor 102 in conductor 92.

Switches 99, 100 and 101 are closed by energization of a solenoid winding 103. A manually operable gang switch 104 includes four jointly operable switches 105, 106, 107 and 108 which condition the circuitry, alternatively and selectively, either for automatic adjusting operation in accordance with the present invention or for ordinary manual adjustment as conventionally practiced. In FIG. 5 the switches 107 and 108 are closed and the switches 105 and 106 are open whereby the circuits are arranged for automatic adjustment operation.

Movement of the gang switch 104 downwardly as viewed in FIG. 5 closes switches 105 and 106 and opens switches 107 and 108, thus setting the circuits for manual adjustment operation. In this manual position conductors 110 and 111 and a common return conductor 112 connect the solenoid windings 97 and 103 across supply conductors L_1 and L_2 . Normally open push button switches 114 and 115 are interposed between supply conductor L_1 and conductors 110 and 111 may be operated as desired to "inch" the adjustment in either direction by causing the ram motor to rotate in one direction or the other for producing random settings which may be calibrated by cut and try methods or by reference to the afore-said counter 50.

When the gang switch 104 is returned to the position illustrated in FIG. 5 conductors 110 and 111 are opened at the switches 105 and 106 and alternative conductors 120 and 121 in effect replace the same. These conductors contain the normally closed limit switches 47 and 48 described previously herein. In addition, holding circuit conductors 123 and 124 connect around or in parallel with respect to the manual push button switches 114 and 115, these holding circuit conductors being closed during automatic adjustment setting of gang switch 104 by closure of the switches 107 and 108.

From the foregoing it will be noted that if push button switch 114 is closed momentarily with the gang switch in the automatic position illustrated in FIG. 5, the circuit comprising conductor 120 and winding 97 is immediately energized and, by means of a switch 125 which is thus closed, a holding circuit through conductor 123 and conductor 120 is established whereby solenoid 97 will remain energized and ram adjusting motor 35 will continue to move the ram adjustment upward, that is, the connections 18 will continue to be shortened, until cam 45 opens limit switch 47 to interrupt the holding circuit. Thus the adjusted setting of cam 45 accurately determines the upper of the two depth positions of ram 20.

An identical but reverse automatic adjusting operation takes place when switch button 115 is momentarily depressed, there being a holding circuit switch 126 in conductor 124 corresponding to the switch 125 of the up adjustment operation. In this case of course the adjustment of ram 20 is downward and the setting of cam 46 determines the point at which limit switch 48 opens and interrupts the holding circuit through conductors 124, 121 and 112.

The operation described in the two preceding paragraphs provides novel means whereby the operator, by momentary depression of either of the switches 114 or 115 and without further attention on his part, causes the ram adjustment motor to move an automatic predetermined time to bring the ram adjustment to either of two preselected positions of adjustment.

In addition to the foregoing operation the circuitry of the lower half of FIG. 5 may also be employed in the conventional manner wherein the operator presses either the up or the down button, 114 or 115, and holds it depressed until the adjustment reaches a desired manually observed position. This conventional ram adjustment operation is effected by reversing the position of the gang switch 104 from that illustrated in FIG. 5, whereupon the foregoing automatic pre-selection operation is discontinued and the adjustment is entirely by visual observation of the operator.

4. In a power press brake having a bed and a crosshead reciprocable toward and away from the bed, a drive shaft, eccentric means thereon and means connecting the same to said crosshead for reciprocating the latter, adjustment means for varying the effective length of said connecting means, to vary the depth of the reciprocating movement of said crosshead toward said bed, and motor means for moving said adjustment in opposite directions, a cam shaft and means driving the same from said adjustment means, a plurality of angularly adjustable cams on said shaft, a plurality of control circuits operable to actuate said motor means, a normally closed switch in each of said circuits, each of said cams being adapted to open one of said switches when such cam reaches a predetermined angular position as determined by the adjusted setting thereof on said cam shaft, and means for selectively rendering any of said control circuits operative for automatic positional adjustment of said crosshead.

8. In a power press brake having a bed and a crosshead reciprocable toward and away from the bed, a drive shaft, eccentric means thereon and means connecting the same to said crosshead for reciprocating the latter, adjustment means for varying the effective length of said connecting means to vary the depth of the reciprocating movement of said crosshead toward said bed, and motor means for rotating said adjustment in opposite directions,

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a cam shaft and means driving the same from said adjustment means, a plurality of angularly adjustable cams on said shaft, a plurality of control circuits operable to actuate said motor means, each control circuit comprising parallel initiating and holding circuit portions, a normally closed switch in each of said holding circuit portions, each of said cams being adapted to open one of said switches when such cam reaches a predetermined angular position as determined by the adjusted setting thereof on said cam shaft, and switch means in each of said initiating circuit portions for selectively closing the associated holding circuit portion to render any of said

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control circuits operative for automatic positional adjustment of said crosshead.

References Cited by the Examiner

UNITED STATES PATENTS

2,678,078	5/54	Yurka	153—21
2,761,175	9/56	Myerson	18—33
2,946,234	7/60	Jahnke	83—527

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