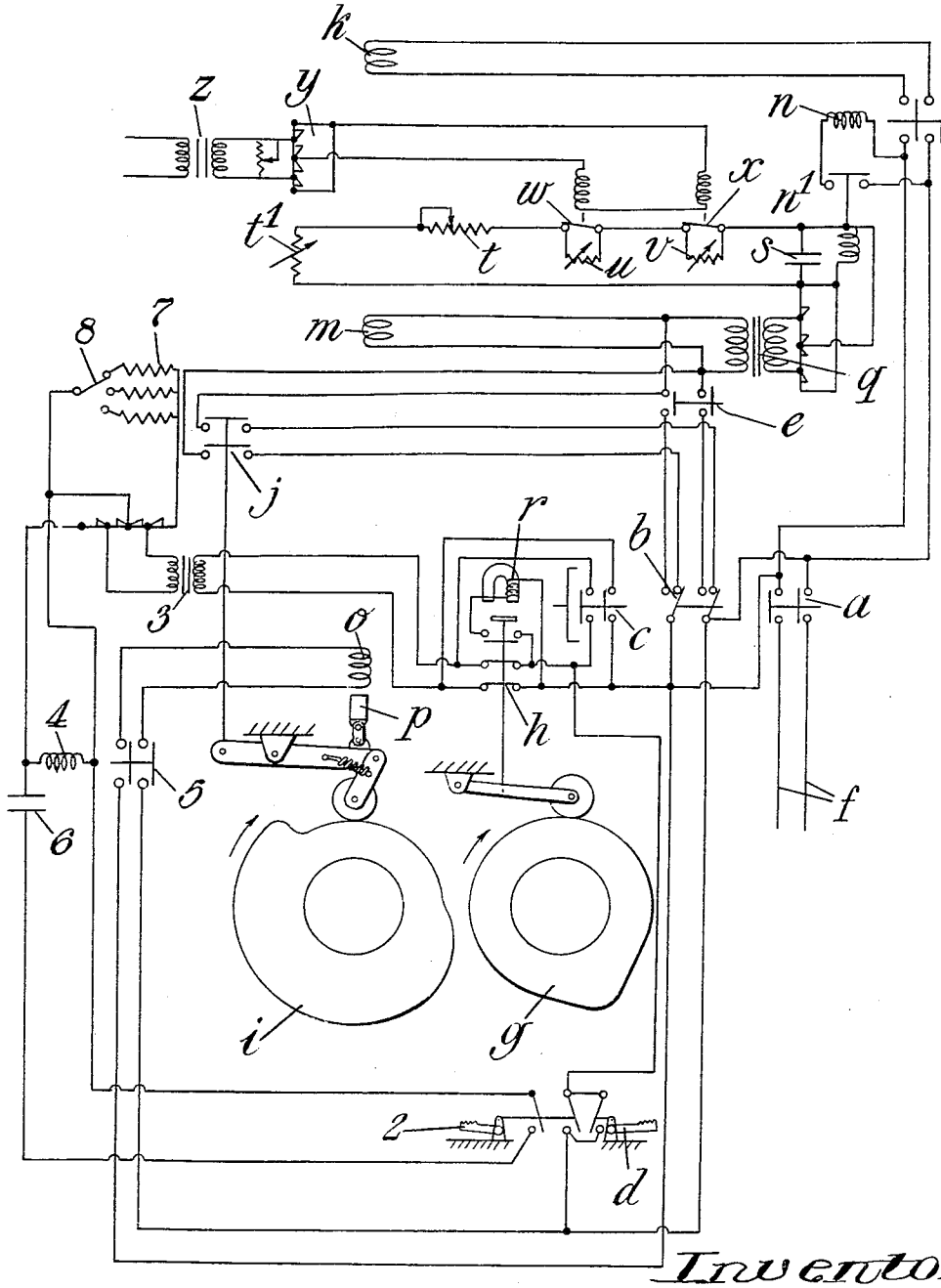
May 15, 1956 J. FOSTER 2,745,530

FORGING PRESS CONTROL

Filed March 14, 1952



Inventor

John Foster

By Glascock Downing Seebold

Attys.

United States Patent Office

2,745,530

Patented May 15, 1956

2,745,530

FORGING PRESS CONTROL

John Foster, Openshaw, Manchester, England, assignor to B. & S. Massey Limited, Openshaw, Manchester, England, a British company

Application March 14, 1952, Serial No. 276,718

Claims priority, application Great Britain March 27, 1951

4 Claims. (Cl. 192—144)

This invention relates to improvements in control gear for presses and forging machines.

In my Patent No. 2,577,882, I have described an arrangement which provides for continuous running, single strokes or inching of the ram. In some operations it is necessary to apply a fixed number of strokes, usually a small number, to the work, the work being in some cases turned or moved between strokes, and according to the present invention I provide further electrical means whereby on actuating a switch the desired number of strokes is obtained and then the ram is brought to rest in its raised position.

This arrangement has the advantage that the operator can devote his whole attention to manipulating the work, and does not have to count the strokes or time the releasing of the switch exactly to stop the ram in its raised position.

The arrangement according to the invention may comprise switch means for connecting the clutch solenoid and the brake relay to a current supply source, a relay for effecting the closing of said switch means, adapted to be energised by operation of a switch for obtaining multiple strokes, means for cutting off the current supply to the relay after one stroke has occurred, and an adjustable delay circuit associated with the relay for keeping it energised for a limited number of strokes after its current supply has been cut off.

A convenient arrangement according to the invention is illustrated diagrammatically in the accompanying drawing.

A rotary selector switch has contacts at *a* for switching on and off, contacts at *b* for selecting inching or normal operation, shown in the position for normal, and contacts at *c* for selecting single and multiple stroke or continuous operation, shown in the single and multiple stroke position. A foot lever *d* is depressed to obtain either single stroke or continuous operation, according to the position of the selector switch and a foot lever 2 is depressed to obtain a preset number of strokes. A push button switch *e* is used for inching. Current is supplied by the leads *f*. There is a single and multiple stroke cam *g* actuating contacts *h* for single and multiple stroke working, and a control cam *i* controlling contacts *j*.

The clutch is controlled by a piston in a cylinder having a solenoid operated spring-loaded air valve, with a small inlet port and a large exhaust port, so that engagement of the clutch by displacement of the piston on admission of air to the cylinder is slightly delayed, while release occurs quickly. The valve is operated by a solenoid *m* the current supply to which is controlled directly by contacts *j*. The brake is released by the opening of an air valve mounted on the brake cylinder to give quick release, the valve being opened when a solenoid *k* is energised and closed by spring means when the solenoid is de-energised. Consequently, when solenoids *k* and *m* are energised the clutch engagement occurs only after the brake has been released. In the circuit of brake solenoid *k* are contacts actuated by a relay *n* which can be energised by a low voltage relay n^1. As described below, there is a delay circuit associated with the relay n^1 to give a time lag between the opening of contacts *j* and the opening of the relay contactor, in order to delay the brake application, until the clutch has been released.

The drawing shows contacts *b* and *c* in the single and multiple stroke position. On closing contacts *a* and depressing foot lever *d*, a circuit is completed through a transformer 3 the secondary of which energises a coil 4 through a rectifier bridge to close contacts 5 and complete a circuit to a coil *o* which attracts armature *p* and thereby closes contacts *j*, whereby a circuit is completed through clutch solenoid *m* and transformer *q*, the secondary of which energises relay n^1 through a rectifier bridge and thereby causes relay *n* and consequently brake solenoid *k* to be energised. Then as stated above the brake is released quickly while the clutch engagement is slightly delayed. The cam *g* opens contacts *h* after a stroke of the press, whereby armature *p* is released and contacts *j* opened to prevent further operation. A holding coil *r* keeps contacts *h* open as long as pedal *d* remains depressed.

For continuous working, contacts *c* are closed, and therefore transformer 3, coil 4 and coil *o* are energised when pedal *d* is depressed and the clutch and brake solenoids are energised as above and remain energised. When the pedal is released the control cam *i* holds the armature *p* up until the ram approaches its uppermost position and then lets it drop to open contacts *j*.

For multiple strokes the foot switch 2 energises the transformer 3 by way of the contacts *h* controlled by the single stroke cam *g*, and the transformer secondary energises the relay coil 4 through a rectifier and also, through a contact on the foot switch 2, charges a condenser 6 across the coil 4, which has an adjustable resistance 7 in parallel with it. The relay coil 4 closes the contacts 5 to energise the solenoid *o*. After one stroke the single stroke cam *g* opens the circuit of the transformer 3, but the relay coil 4 remains energised until the condenser 6 has discharged through the resistance 7. Then the condenser 6 is discharged, the relay coil 4 becomes de-energised and the contacts 5 open the solenoid *o* circuit and the ram is stopped on reaching its raised position. The time of discharge of the condenser 6 depends on the value of the resistance 7, and by means of a switch 8, any one of three resistances of different values can be selected, the values being such that the corresponding times of discharge allow e. g. one, two or three strokes to take place after the cam *g* has opened the circuit of the transformer 3, before the ram is stopped. Obviously a single resistance with tappings could be used instead of separate resistances.

The single stroke foot switch *d* energises the solenoid *o* by way of the single stroke cam contacts *h* but independently of the condenser circuit. Also each foot switch *d* or 2 energises the solenoid *o* independently of the condenser circuit when the selector switch *c* is in the continuous running position. When making forgings from the bar, it is often desirable to use two or three dies in a press and to give the work say four strokes in the preforming die impression, turning the bar between the strokes, and one stroke in the finishing impression or impressions. In such a case the operator can obtain the desired operation of the press automatically with the present arrangement, by simply pressing the multi-stroke foot switch once and the single stroke switch once or twice, whereby the work is greatly facilitated.

For inching, contacts *b* are changed over, so that clutch solenoid *m* and transformer *q* are energised when push button contacts *e* are closed.

In parallel with the relay n^1, there are a condenser *s* and a circuit containing a variable resistance *t* and a

trimming resistance t^1 and two adjustable resistances u, v which are normally short-circuited by spring-loaded, electro-magnetically operated contactors w, x, the operating coils of which are connected in series across a rectifier bridge y across the secondary of a current transformer z, the primary of which is in series with one of the phases of the motor supply. When the motor speed drops, its current increases, and the pull of the contactors w, x also increases. The spring loadings are such that the contactors open at different values of the current, e. g. one half and three quarters of the maximum current. Consequently when the motor slows down under load, extra resistances are connected in series with resistance t.

The RC circuit in parallel with relay n^1 constitutes the delay circuit for retarding the release of the relay when its circuit is broken, and the amount of delay is increased, by means of the resistances u, v, roughly in proportion to the motor current. Consequently when the motor speed is reduced the application of the brake is further delayed, for the purpose of ensuring that the ram will come to rest as near as possible to its top dead centre position. There may be a considerable reduction of the motor speed during a heavy working stroke.

An alternative form of delay circuit includes a neon lamp, and variable and adjustable resistances as described above in series with the relay coil, with a condenser across the current supply. In this case the relay contactor does not drop until the neon arc breaks as the voltage of the condenser drops after the current supply circuit has been opened. The relay n^1 could then directly actuate the contacts in the brake solenoid circuit.

What I claim is:

1. In a control system for presses, and forging machines having a ram actuated by an eccentric shaft, a brake for arresting the eccentric shaft and a clutch for coupling the eccentric shaft to a driving medium, of the type comprising a clutch-operating solenoid, a brake-operating solenoid, contacts for connecting the brake solenoid to a current supply source, a brake relay for actuating said contacts, switch means for connecting the clutch solenoid and the brake relay to a current supply source, and a delay circuit associated with the brake relay for retarding the opening of the relay when disconnected from the current supply source, the arrangement which

comprises: a switch-closing relay for effecting the closing of said switch means, a switch for energising the switch-closing relay to close the switch means and thereby cause the clutch to be engaged and the brake to be released, and the ram to be actuated, means for cutting off the current supply to the switch-closing relay after one stroke of the ram has occurred, and an adjustable delay circuit associated with the switch-closing relay for keeping it energised after its current supply has been cut off, until the ram has performed a limited number of strokes.

2. In a control system for presses and forging machines, an arrangement as claimed in claim 1, and having push button contacts for connecting the clutch solenoid and the brake relay to a current supply source, for use when inching of the ram is required.

3. In a control system for presses and forging machines, an arrangement as claimed in claim 1, and having a cam adapted to break the circuit of the switch-closing relay after one stroke of the ram, and adjustable resistance-capacity delay means associated with the switch-closing relay for maintaining it energised after its circuit has been broken, until the ram has performed a limited number of strokes.

4. An arrangement as claimed in claim 1, having a condenser and a variable resistance and a plurality of further resistances, constituting the delay circuit associated with the brake relay, said variable resistance and said further resistances being connected in series with one another and in parallel with the condenser, spring-loaded electro-magnetically operated contactors normally short-circuiting said further resistances, means for deriving a current for operating said contactors proportional to the current of the motor driving the machine, the spring-loadings being adjusted so that the resistances are put in circuit successively as the motor current increases.

References Cited in the file of this patent

UNITED STATES PATENTS

1,993,413	Mellon	Mar. 5, 1935
2,065,820	Mellon	Dec. 29, 1936
2,299,007	Bundy	Oct. 13, 1942
2,577,882	Foster	Dec. 11, 1951