ABSTRACT: The disclosure describes a press brake for a ram comprising an automatic control to stop and start the ram mechanism within preset desired positions in order to impart improved operation thereof. In one embodiment, a microswitch is used in cooperation with an air valve to automatically stop the operation of the ram at a desired point and then release the ram for completion of the ram operation. Other embodiments are disclosed.
BACKGROUND OF THE INVENTION

The forming of metal sheet and parts into a desired configuration is accomplished in a ram comprising a framework supporting a stationary brace above which a ram is reciprocated. The brake and ram are provided with mating metal-forming dies designed to accomplish a desired metal-forming operation in a metal sheet interposed therewith. The pressing operation, that is the reciprocation of the ram, is accomplished mechanically employing a high-speed shaft and a friction clutch through a reduction gear to a slower shaft connected to a pinion mechanism for operation of the ram which is thereby moved toward and away from the brake. The necessary flywheel is provided for uniformity of speed and inertia of the ram. The operator controls the machine by a foot treadle to engage the clutch and bring the ram down to the work piece. Release of the treadle can stop the ram and a second depression of the treadle sequentially can gradually carry the ram and dies into contact with the metal sheet to cause the required formation of a crimp, bend or other form of bend in conformity with the dies used. Large sheets of metal are normally bent at high speeds because this may cause the sheet to whip, distort or buckle into an undesired form and may be dangerous to the operator.

Accordingly, it is a desiderate in this art to enable the operator to have close control of the operation of the ram. Means are already provided to stop the press at the top of the stroke through a top limit switch and to stop the descent of the ram at a predetermined point, which may be at or just before its initial engagement of that die with the surface of the metal sheet. Provision is made in the prior art to provide for a succeeding movement of the manual foot switch to cause a slip engagement of the clutch for slow movement of the ram until the end of its downstroke. At this point, the engagement of the clutch is changed from a slip action to full engagement until the ram is raised to its uppermost position. By these means the ram is moved downward and upward at full speed when it is not doing work but is moved slowly during the actual work period to eliminate whipping and spoilage of the work piece.

The point at which the downward movement of the ram is stopped preliminary to the start of the slip engagement cycle is subject to adjustment to accommodate different working operations. Such devices are generally operated electrically and apply a number of switches and relay contacts in connection with the main clutch-operating solenoid. Mechanical linkages and levers are connected to the foot treadle and one or more limit switches with spring-controlled rods and mechanical make-break contacts are employed. Means are required to prevent arcing of the contacts and different arrangements of these parts including air-operated solenoids are used to accomplish different sequences of modes of operation.

The devices of this kind are variously designed, that is, to operate by another operation of the treadle, by release of the treadle, to eliminate complete stoppage of the ram, to eliminate slip engagement of the clutch and the like. Although flexibility in the operation of the ram are attained, each must employ different circuitry and different linkages for its accomplishment.

SUMMARY OF THE INVENTION

The instant invention concerns a simple electromechanical control of a ram brake which does not involve a multitude of circuitry elements to attain the desired flexibility of operation. More particularly the invention employs a pair of adjustable switch plates connected to oscillate with the ram and aligned so as to engage a microswitch in the path of movement and control the opening and closing of an air valve to limit or shut off the airflow from the air regulator foot valve. The switch plates are carried in a slotted upright carrying a guide flange and means are provided to affix the switch plates at determinable points along the slotted upright. A start cylinder is provided to control a solenoid operated air valve through a ram (micro) switch, which is normally closed, so that the foot treadle valve is in full control of the movement of the ram. When the ram switch is opened a control relay is actuated to momentarily stop the ram. Operation of the foot treadle cuts off the relay and allows full power for the final thrust.

DESCRIPTION OF THE DRAWINGS

An embodiment of this invention is shown in the drawings wherein:

FIG. 1 is a side perspective view of a ram press with the control means of this invention;

FIG. 2 is an enlarged view of the side of the ram press, partially cut away to show the control means of this invention in more detail;

FIG. 3 is a fragmentary front view of one form of mechanical adjustment and visual indicia that may be used with the control means of this invention;

FIG. 4 is a partial cross-sectional view taken along lines 4—4 of FIG. 1;

FIG. 5 is a fragmentary side view of the moving and stationary parts of the ram at the top of the ram stroke;

FIG. 6 is a fragmentary side view like FIG. 5 showing the ram at an intermediate point in the ram stroke before reaching the work piece;

FIG. 7 is a fragmentary side view like FIGS. 5 and 6 showing the ram at the bottom of its stroke; and

FIG. 8 is a diagrammatic representation of the hydraulic and electrical control means of this invention.

THE PREFERRED EMBODIMENT

Referring to FIGS. 1, 2 and 3, there is shown a press brake having a bed or fixed brake 10 supported on side frames 12 and 14, carrying ways upon which the movable ram 16 is arranged to be reciprocated in a vertical plane. The ram is preferably operated by hydraulic power controlled through a source of compressed air entering through the line 18 connected to the filter 20, the regulator 22 and the oiler 24 to the conduit 26 and air regulator foot valve 28 with protective cover 30. The outlet 32 from the foot valve 28 connects to the air valve 34 which in turn is connected via line 36 to the quick exhaust valve 38 to control the main air cylinder 40. The operation of the main air cylinder reciprocates the down rod 42 which is connected to a clutch (not shown) inside the press to operate the movable ram 16.

In accordance with this invention, the upright support 50 is affixed to the movable ram 16 by means of the bolts 52 and extends substantially vertically and in spaced relationship along the side of the side frame 14 to a point above the ram and above the eye level of the operator. The support 50 can have any desired configuration and is shown in the form of an angle iron. At the extended upper end of the support 50 there is affixed a cam bracket 54 having a longitudinal slot 56 in its outer side. A scale 58 is affixed along the side facing the operator.

Referring to FIGS. 2, 3 and 4, these parts are shown in more detail wherein an upper slide cam or switch plate 60 and a lower slide cam or switch plate 62 are provided, the former having an upwardly curved cam surface 64 at the lower inside corner and edge and the latter having a downwardly curved cam surface 66 at the upper inside corner and edge. The plates 60 and 62 are essentially planar in configuration and have their inner flat surfaces i.e. the surface 68 held against the outside wall 70 of the cam bracket 54, which has a square cross section, by means of the threaded stud 72 having a knurled hand knob 74. A similar threaded stud with hand knob 76 holds the plate 62, said studs extending through a washer 78, a hole 80 in the plates and through the slot 56 to engage a clamp nut 82 on the inside of the cam bracket. Thus, by loosening the knobs 74 and 76, the plates 60 and 62 can be independently positioned in a vertical plane along the slot 56, and upon tightening the knobs are firmly positioned at desired
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of the ram 16 into its down cycle continues and the start cylinder 103 holds the switch 122 in its dotted line position and the solenoid valve 34 opens. This carries the switch plate 62 away from the roller 150 and the ram moves downward under full force of the drive mechanism until the switch plate 60 contacts the roller 150 (FIG. 6) and again moves the switch to the dotted line position of FIG. 8, again deactivating the solenoid valve 34 and the ram 16 stops just above the workpiece 154.

If the foot treadle valve 28 is released at or before the activation of the microswitch the ram stops because the start switch goes to the normally closed position and final adjustment of the workpiece on the die is made by the operator. Reactivation of the foot treadle valve 28 moves the start switch to its normally open position and the solenoid valve 34 opens moving the die 158 back against the workpiece and the die 156 as shown in FIG. 7.

By the combination of the air assist foot treadle valve 28 and the selective stop control imparted by the Microswitch 90 and the adjustable switch plates 60 and 62, the operator has complete control of the press brake. The valve 28 is an air-regulated control valve which means the farther the treadle is pushed down the more air pressure is applied to the down rod 160 of the ram 16 and the solenoid valve 34 is opened further. The selective stop control plates 60 and 62 allow the operator to stop the ram 16 anywhere in the cycle automatically, just by moving these cams to preset positions along the slot 56 of the bracket 54. This means that the operator does not need to inch the ram down to the workpiece 154. One touch of the foot treadle valve 28 brings the ram 16 to the workpiece or position shown in FIG. 6. By setting the bottom control plate 62 at the proper position, the ram 16 can be stopped at the top of the cycle, for single-cycle operation. Also if the control plate 62 is moved to the bottom of the slot 156, a position below the lowerrmost limit of movement of the ram, so that it does not contact the roller 150, the press brake operates in a continual cycle for the repeat operation with the foot treadle valve 28 in complete control at all times.

While this invention has been described fully and completely with special emphasis upon certain preferred embodiments, it is to be understood that within the scope of the appended claims this invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A control for a press brake having aligned press brake and ram elements reciprocably movable relative to each other for the performance of work on a workpiece therebetween, comprising:
   a. a guide means mounted on said movable ram for movement therewith along the longitudinal axis substantially vertical to said press brake;
   b. a pair of lengthwise spaced switch plates supported by said guide means, and switch plates being independently movable along the longitudinal axis of said guide means and having opposed cam edges on a side thereof;
   c. a microswitch having a feeler arm, said microswitch being fixedly mounted and positioned so that the end of the feeler arm extends within the path of movement of said opposed cam edges;
   d. power switch means to connect and disconnect a power source for actuating said elements for reciprocable movement with respect to one another;
   e. said switch blade being adjustably positionable along said guide means for varying the lengthwise space between said cam edges thereby to engage and disengage said microswitch at desired points along the path of movement of said ram element; and
   f. means connecting said microswitch to said power switch means to override said power switch and stop said ram.

2. A press-brake comprising:
   a. supporting frame;
   b. relatively movable brake and cam elements mounted on said frame for reciprocable movement toward and away from each other;
c. a source of pneumatic power connected to means for moving one of said elements in relation to the other to predeterminedly contour a workpiece;
d. a solenoid operated valve for controlling the source of pneumatic power;
e. a pair of cam plates adjustably mounted in spaced relationship on said ram element for movement therewith;
f. a microswitch fixedly positioned on said frame in the path of movement of said cam plates for engagement therewith;
g. a manually operated valve to control the source of pneumatic power to said solenoid valve; and
h. said microswitch being connected to energize said solenoid operated valve upon disengagement and engagement with said cam plate means whereby the relative movement of said elements toward each other is interrupted at spaced intervals.
3. A press-brake in accordance with claim 2 in which:
a. said source of pneumatic power is connected through said manual valve to said solenoid valve and to a start cylinder;
b. a circuit including said microswitch and a second switch in series therewith to connect and disconnect said solenoid valve;
c. said start cylinder being in operable relation to said solenoid valve;
d. re-actuation of said manual valve moves said start cylinder and closes said circuit to open said solenoid valve to complete the cycle of movement of said relatively movable elements.
4. A press-brake in accordance with claim 3 including:
a. a bracket member on said frame having a longitudinal slot therein; and
b. means to hold said cam plates at spaced fixed positions along said longitudinal slot members for engagement with said microswitch at the top and near the bottom of said cycles.
5. A press-brake in accordance with claim 4 in which:
a. said bracket member has a scale therealong to mark the relative positions of said cam plates from each other.

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