ABSTRACT OF THE DISCLOSURE

A horizontal forging machine having hydraulic die gripping and power drive of a heading slide making possible the shaping of forgings through the motion of gripping dies; the gripping force of these dies, the amount of their stroke and the time of gripping being adjustable. The opening of dies is accomplished by mechanical means. High operating speeds of this forging machine are possible along with the benefits resulting from the hydraulic gripping of the dies. The forging machine may be provided with hydraulic or mechanical ejectors to remove forgings out of the dies. This forging machine can be made with a horizontal or vertical die parting plane.

BACKGROUND OF THE INVENTION

An object of this invention is to provide an improved horizontal forging machine, or horizontal double-action forging press, in which dies are gripped hydraulically while the heading slide has a mechanical drive. The hitherto known horizontal forging and upsetting machines have had a mechanical, generally cam- or toggle-and-lever operated, drive of the grip slide. This type of drive has a rigid kinematic characteristic, which means that neither the length of stroke of the gripping die nor the time of die closing can be changed. The slide must arrive at a certain position conditioned by the kinematic configuration of the system irrespectively of pressures that are produced during its movement. This necessitates the incorporation of a mechanism to prevent overload risks, which in turn renders impossible completing the shaping of the forgings by the grip slide and arbitrarily preset the amount of die gripping force. There are also known machines designed for die forging in which both the drive of the grip slide and the drive of the heading slide are of the hydraulic type, for example, the machines described in U.S.S.R. Pat. 118,068 and German Pat. 892,847. These design developments can be reduced, as a principle, to a combination of vertical and horizontal presses which, because of the necessity to change over the slides at their return points, does not allow the high operating speed and productivity that is possible with the mechanically driven forging machines.

SUMMARY OF THE INVENTION

The horizontal forging machine according to this invention does not exhibit the above-mentioned shortcomings because the heading slide is power operated and the dies are hydraulically gripped and mechanically released. This permits maintaining the high operating speed of the machine, compared with a forging machine fitted with fully mechanically-operated drive, benefiting, at the same time, in full from advantages offered by the hydraulic drive applied to the closing of the dies.

The high operating speed of the forging machine is also important for shortening the time of contact between the punches and the hot work which contact time greatly influences the operating life of these punches.

Compared to the known types of horizontal forging machines, the one according to this invention offers the following basic advantages:

1. The possibility of a deep, transverse shaping of forgings;
2. The possibility of a choice to forge by using a single stroke or series of strokes of the grip slide;
3. The possibility of disengaging the grip slide drive and using only the main slide;
4. The possibility of changing the amount of stroke and the time of die closing; and
5. The provision of a highly reliable hydraulic protection to prevent the risk of overloading the die closing system.

The advantages specified above allow for a remarkable widening of processing capabilities of horizontal forging machines according to this invention as compared to the capabilities previously offered by this type of machine.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic view of an embodiment of the present invention with parts shown in section; and FIG. 2 is a section taken along line 2—2 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A movable top die 2 mounted in a gripping slide 16 is pressed against a stationary die 1. The gripping slide 16 is connected with a fluid actuated clamping cylinder 7. A valve 12 is provided between cylinder 7 and a pressurized fluid supply tank 9. The valve is mechanically operated from crankshaft 4 which drives a heading slide 3. This slide 3 carries a fluid pumping cylinder 5 and a roller 13 which moves under a cam 14 which is fitted to a lever 15 for lifting the gripping slide 16. A fluid actuated locking pin 22 is spring-biased towards a position in which it locks the lever 15 in its upper position. A fluid actuated ejector 18 is located under the stationary die 1, while a mechanically-operated ejector 19 is built into the gripping slide 16.

The operation of the horizontal forging machine according to this invention is as follows: at the beginning of the stroke of the heading slide 3, the roller 13 rolls out from under the cam 14 thus closing the dies 1 and 2; FIG. 1 shows this position of the horizontal forging machine. The heading slide 3 keeps on moving forward while the cylinder 5 located in the rear part of the slide forces the fluid through the non-return valve 6 to deliver it to the cylinder 7 for die gripping. As soon as the pressure prevailing in this cylinder reaches a preset value, a pressure-actuated switch 8 opens the flow from the cylinder 5 to the supply tank 9 which contains fluid under low pressure. The slide 3 engages a workpiece 10 gripped by the dies 1 and 2 and begins a return stroke sucking in a new portion of fluid into the cylinder 5, the dies being all the time gripped until a cam mechanism 11 coupled to a crankshaft 4 opens the prefill and exhaust valve 12. Soon afterwards, the roller 13 enters under the lobe of cam 14 and lifts the lever 15 which moves upwards the gripping slide 16 with the die 2 mounted therein. The movement of the slide 16 is braked by a hydraulic stop 17 at its final stage. Pressure produced therein may be utilized to drive the ejector 18 to push the gripping out of the die. A mechanically-operated ejector 19 or a fluid actuated ejector 20 may be mounted in the gripping slide 16. When the machine has been preset to a single-stroke operation mode, both slides, i.e. the heading slide 3 and the gripping slide 16, are stopped in their initial position after the crankshaft 4 makes a full turn and the clutch actuating it comes out of engagement. A control valve 20 is coupled to the clutch control system in such a way that when the clutch becomes disengaged, when the grip slide 16 is in its upper position, pressurized
fluid is let out from cylinder 21 while locking pin 22, actuated by a spring 23, slides under the level 15 thus preventing the slide 16 from dropping. With the clutch again in operation, the locking pin 22 is withdrawn, the slide 3 moves forward, and the roller 13 rolls out from under the cam 14 and the gripping slide 16, under the action of fluid pressure in tank 9, comes down to close the dies 1 and 2. Simultaneously, the cam mechanism 11 breaks the communication between the clamping cylinder 7 and the tank 9. Under the action of pressure fed from cylinder 5, the dies grip the workpiece with a great force and the cycle of operation starts to proceed as described above. Motion of the gripping slide 16 can be stopped by cutting off the inflow of pressurized fluid into the cylinder 21 and by opening the fluid control valve 24. When manipulating the locking pin 22, by rotating it around the cylinder 21 center line and suitably displacing the cam 14 on the lever 15, one of the number of available rates of die openings for the forging machine can be obtained. The horizontal forging machine according to the herein-described embodiment can be provided with a vertically-operating (as shown in FIG. 1) or horizontally-operating gripping slide.

What I claim is:

1. A horizontal forging machine comprising a frame, a gripping slide and a heading slide mounted on said frame for movement normal to each other, a fixed die mounted on said frame, a movable die mounted on said gripping slide to engage with said fixed die, said heading slide being movable to cooperate with said dies, drive means to move said heading slide, lever means mounted on said frame to raise and lower said gripping slide, cam means mounted between said lever and said heading slide to move the former in response to movement of the latter, fluid actuated clamping means on said frame connected to said gripping slide for clamping said dies together, fluid pumping cylinder means mounted on said heading slide and said frame and responsive to relative movement therebetween, and means to transfer pressurized fluid from said pumping cylinder means to said clamping means.

2. A horizontal forging machine as set forth in claim 1 further comprising a fluid supply tank, a prefill and exhaust valve located between said fluid actuated clamping means and said tank, cam means operatively connected to said drive means to open and close said prefill and exhaust valve.

3. A horizontal forging machine according to claim 1 further comprising locking pin means mounted on said frame to engage said lever to hold said gripping slide in an upper position, and means to actuate said locking pin.

4. A horizontal forging machine according to claim 1 further comprising ejector means associated with at least one of said dies.

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