

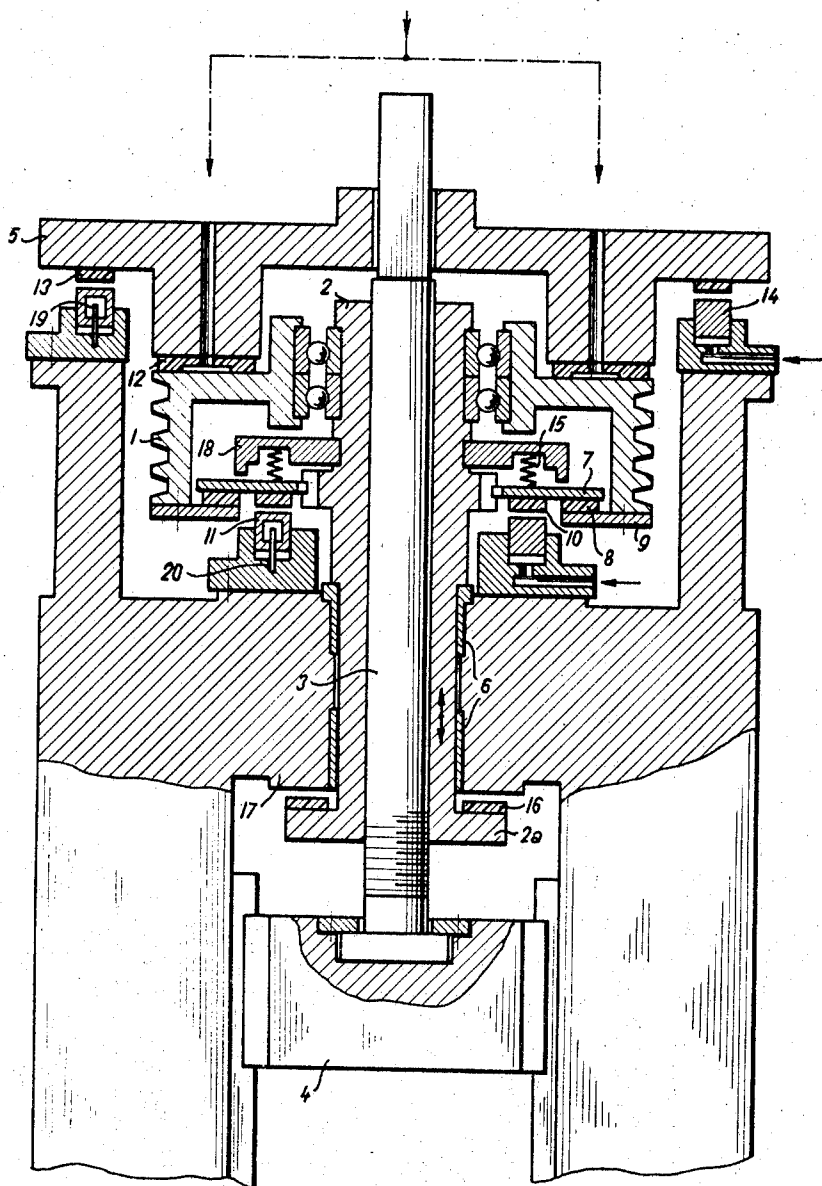
Feb. 11, 1969

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3,426,574

PERCUSSION PRESS

Filed Nov. 7, 1966



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3,426,574

PERCUSSION PRESS

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Filed Nov. 7, 1966, Ser. No. 592,360

Claims priority, application Czechoslovakia,
Nov. 16, 1965, 6,828/65

U.S. Cl. 72-454

Int. Cl. B21j 9/18, 7/20; B30b 1/18

9 Claims

This invention relates to screw presses and particularly to a screw press having a sleeve mounted for vertical rotation in the press frame, a flywheel axially movable on the upper end of screw and superposed on a drive wheel. The connection between the flywheel and said drive wheel being interruptable by means of an air cushion. Presses of this type are commonly referred to as percussion presses, and are normally employed for cold forming metallic workpieces.

An object of the invention is the provision of a percussion press of the type specified with a more efficient drive.

Another object is the provision of a percussion press with a drive wheel continually rotating even when the press ram is inoperative, while the flywheel, eventually the sleeve are set into rotations exclusively in order to accomplish the working stroke.

A further object is the provision of a percussion press with an increased efficiency of the sleeve brake.

A still another object is the provision of a percussion press in which an improved control of the amount of energy stored in the flywheel as well as its stepless regulation is made possible.

With these and other objects in view, the press of the invention has a sleeve mounted in the press frame for rotation about its vertical axis and for being displaced in the direction of said vertical axis. The screw of the press, which is fastened to the press ram for joint movement and away from the press bed, has a threaded portion threadedly received in the sleeve. A flywheel is secured against rotation relative to said screw and superposed on a drive member provided on the sleeve. A friction clutch is provided between the drive member and the sleeve for transmitting the rotations of said drive member to said sleeve. A pressure-medium actuated piston is provided in the frame for both lifting the sleeve in the axial direction and engaging the friction clutch coupling the sleeve with the drive member. The flywheel is axially movable on the screw toward and away from a position of weight transmitting frictional engagement with an upwardly directed face of the drive member. The flywheel may be lifted from this position by a pneumatic device which includes means for admitting a gas under pressure to a normally sealed chamber axially defined between the face of the drive member and the flywheel. The drive member may be rotated about the aforementioned axis by a motor.

Other features, additional objects, and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following description of a preferred embodiment when considered in connection with the accompanying drawing, in which is illustrated a drive mechanism of a percussion press of the invention in section.

Referring now to the drawing in detail, there is seen

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a heavy rigid upright press frame, partly broken off, including a press bed not illustrated. Mounted for rotation in bearings 6 is a sleeve 2, axially movable in said bearings 6. The axial movement of the sleeve 2 in the frame 17 is limited by a flange 2a shaped on the bottom end of the sleeve 2. A friction lining 16 is provided on the upper surface of the flange 2a and intended for friction contact with a thrust surface on the frame 17. The screw 3 is threadedly received in the sleeve 2, and mounted to freely rotate in the ram 4. The top portion of the screw 3 is profiled in order to receive the flywheel 5 having for this purpose an aperture of identical section. Below the flywheel 5 is situated the drive wheel 1 rotatably mounted on the sleeve 2. The drive wheel 1 is provided with an annular disc 9. On the periphery of the sleeve 2 are formed teeth carrying the disc 7 movable thereon in the axial direction. The disc 7 is provided with a friction lining 8 and 10. The disc 7 is subject to pressure exerted by springs 15 leaning against the disc 18 fixedly connected with the sleeve 2. The springs 15 are forcing this disc 7 on to the annular disc 9. Below said disc 7 is a ring-shaped piston 11 secured against radial movement by the pin 20.

The flywheel 5 is movable in the axial direction on the profiled end of the screw 3, and on its bottom portion it is provided with a friction lining 12, by means of which it is superposed on the contact surface of the drive wheel 1. The friction lining 12 is of a trough-like shape, thus forming between the contact surface of the drive wheel 1 and the flywheel 5 an annular pressure chamber provided with inlet orifices for compressed air. On the peripheral portion of the bottom side of the flywheel 5 is another annular friction lining 13, under which is situated a ring-shaped piston 14 moving in a cylinder supported on the frame 17. The piston 14 is secured against radial movement by the pin 19. The piston 14 is also pressure-medium actuated, such as with compressed air. The direction of the compressed air admission into the individual pressure spaces of the press is illustrated by arrows in the drawing.

The drive wheel 1 is driven by V-belts from a motor not illustrated. Before the motor is started, the ram 4 is in its starting position. Then the press is connected to the compressed-air source. Thereby compressed air is admitted under the ring-shaped pistons 11 and 14. The piston 14 is thus pressed on to the friction lining 13 and starts lifting the flywheel 5. Thus the flywheel 5 is braked and separated from the drive wheel 1. Also the ring-shaped piston 11 is pressed on to the friction lining 10 of the disc 7 and lifts the same on the toothing of the sleeve 2. In this way both the sleeve 2 is braked against being turned and the friction connection between the drive wheel 1 and sleeve 2, constituted by disc 7, friction lining 8, and annular disc 9, is interrupted. After having pressed the disc 7 on to the disc 18, the piston 11 continues its operative movement, lifts the disc 18 and simultaneously also the sleeve 2 to which the disc 18 is fixedly connected, together with all other parts connects, i.e. the screw 3 and drive wheel 1. At the same time the springs 15 force the disc 7 against the ring-shaped piston 11, thus braking the sleeve 2 against being turned. The sleeve 2 is lifted until its bottom flange 2a has contacted by its friction lining 16 the respective thrust portion of the frame 17. During the lifting of the sleeve 2 the braking moment is a function of the weight of the parts lift-

ed. After the clearance between the flange 2a and the thrust surface of the frame 17 has been taken up, the braking effect is intensified on two friction surfaces and is proportional to the pressure of air below the ring-shaped piston 11.

The motor is started after the flywheel 5 and sleeve 2 have been uncoupled from the drive wheel 1, and braked. Thereby the drive wheel 1 is started to rotate as long as the press is in service.

The course of the periodically repeated individual operating cycles is as follows:

Compressed air is discharged from the space below the ring-shaped piston 14. Thereby the flywheel 5 is unbraked, and by action of its own weight it bears by its friction lining 12 on the surface of the rotating drive wheel 1. Thus the flywheel 5 is started to rotate. Consequently, the screw 3 travels down in the braked sleeve 2 and sets the ram 4 into working movement. As soon as the flywheel 5 has accumulated the desired amount of energy, prior to starting the effective stroke proper of the ram 4, the connection between the flywheel 5 and the drive wheel 1 is interrupted by compressed air admitted under the friction lining 12. Accordingly, the flywheel 5 is lifted continuing its rotations on an air cushion formed by compressed air escaping from the space under the friction lining 12. The screw 3 continues its rotation by action of kinetic energy stored in the flywheel 5 until the ram 4 has contacted the material to be formed and completed the forming operation desired. Thereby the energy accumulated in the flywheel 5 is discharged and the motion of flywheel 5 stopped.

The ram 4 is returned into its starting top position by admitting compressed air under the ring-shaped piston 14, lifting and braking-up the flywheel 5. By discharging the compressed air from the space under the piston 11, the sleeve 2 is then unbraked, and by axial movement of the disc 7 forced off by springs 1, connected to the rotating drive wheel 1. Thus its rotation is started. With the screw 3 braked, the rotating sleeve 2 starts the lifting ram 4. With the ram 4 lifted into its starting top position, the sleeve 2 is braked again. Thereby the starting position of the ram 4 is restored and the operating cycle can be repeated.

The stillstand of a percussion press of the invention is attained by stopping the motion of both the sleeve and the screw, not by simultaneous rotating of the sleeve and screw as common, which is unfavourable for the bearing, these being subject to excessive wear in the period between two following working strokes. This is another advantage of a percussion press of this invention.

In presses, in which the movement of the ram is interrupted by a simultaneous turning of the sleeve and the flywheel and screw, the ram-stroke energy cannot be steplessly regulated because the flywheel continually rotates with its maximum revolutions, which are decisive for its constant energy. The energy of stroke can only stepwisely be regulated in these presses, by loading and unloading of weights on to and off the flywheel.

On the contrary, in a percussion press of the invention the flywheel starts its rotation steplessly, at a simultaneous downward travel of the ram. As soon as the flywheel has attained the desired number of revolutions and thus the desired energy, the connection between the flywheel and the drive wheel is interrupted. To determine the instantaneous energy of stroke, an indication of the ram position can with advantages be applied.

A percussion press of the invention makes also possible the total energy of the flywheel to be utilized. In such a case the flywheel and screw are set into rotation together with the drive wheel and sleeve. Because of the fact that all the mentioned parts rotate in the same sense, the ram remains inoperative. As soon as the full number of revolutions have been attained, the ring-shaped piston 11 can be actuated, lifts the disc 7 and the sleeve 2, and thus perfectly brakes-up the sleeve 2. When at the same time admitting compressed air into the space of the fric-

tion lining 12 on the flywheel 5, the flywheel 5 will continue in its rotation on the arising air cushion due to kinetic energy stored, and the ram 4 will be set into movement, releasing in the workpiece the total energy stored in the flywheel 5 rotating with its maximum revolutions.

It should be understood, of course, that the foregoing disclosure relates only to a preferred embodiment of the invention, and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What is claimed is:

1. A percussion press combination:

- (a) a frame including a press bed;
- (b) a ram member slidable in said frame in a vertically extending direction toward and away from said bed;
- (c) sleeve means having an axis extending in said direction, mounted in said frame for rotation about said axis, and movable in the frame in the axial direction;
- (d) stop means for limiting the axial movement of the sleeve means in the frame;
- (e) means for axis displacement of said sleeve means with respect to said frame;
- (f) a screw fastened to said ram for joint movement in said direction, a portion of said screw being received in said sleeve means in threaded engagement therewith;
- (g) a drive member having an upwardly directed face, and provided on said sleeve;
- (h) coupling means interpolated between said drive member and sleeve;
- (i) a flywheel secured against rotation relative to said screw, said flywheel being superposed on said drive member and axially movable on said screw toward and away from a position of weight transmitting friction engagement with said face of the drive member;
- (j) pneumatic means for lifting said flywheel from said position thereof, said face and said flywheel axially defining a normally sealed chamber therebetween, and said pneumatic means including means for admitting gas under pressure to said chamber; and
- (k) motor means and motion transmitting means for rotating said drive member about said axis.

2. In a press as set forth in claim 1, said sleeve means and said flywheel having respective slidably engaged axially extending faces of circular cross section about said axis.

3. In a press as set forth in claim 1, brake and lifting means provided on said press frame below the periphery of the flywheel.

4. In a press as set forth in claim 1, a friction facing axially interposed between said flywheel and said face of the drive member.

5. In a press as set forth in claim 4, said friction facing being annually and bonding said chamber in the radial direction.

6. In a press as set forth in claim 1, said stop means including a flange formed at the end portion of said sleeve means.

7. In a press as set forth in claim 1, said coupling means being a friction clutch.

8. In a press as set forth in claim 7, said coupling means comprising a friction disc mounted on said sleeve means, secured against rotation relative to said sleeve means, and axially displaceable thereon, contacting in the engaged position at least a portion of said drive member.

9. In a press as set forth in claim 1, said means for axial displacing of said sleeve means and for operating said coupling means comprising at least one pressure-

medium actuated piston supported in the frame, and thrust means connected with the sleeve means.

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U.S. Cl. X.R.

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