

April 9, 1968

L. NEMESSÁNYI
PERCUSSION PRESS

3,376,728

Filed March 31, 1966

2 Sheets-Sheet 1

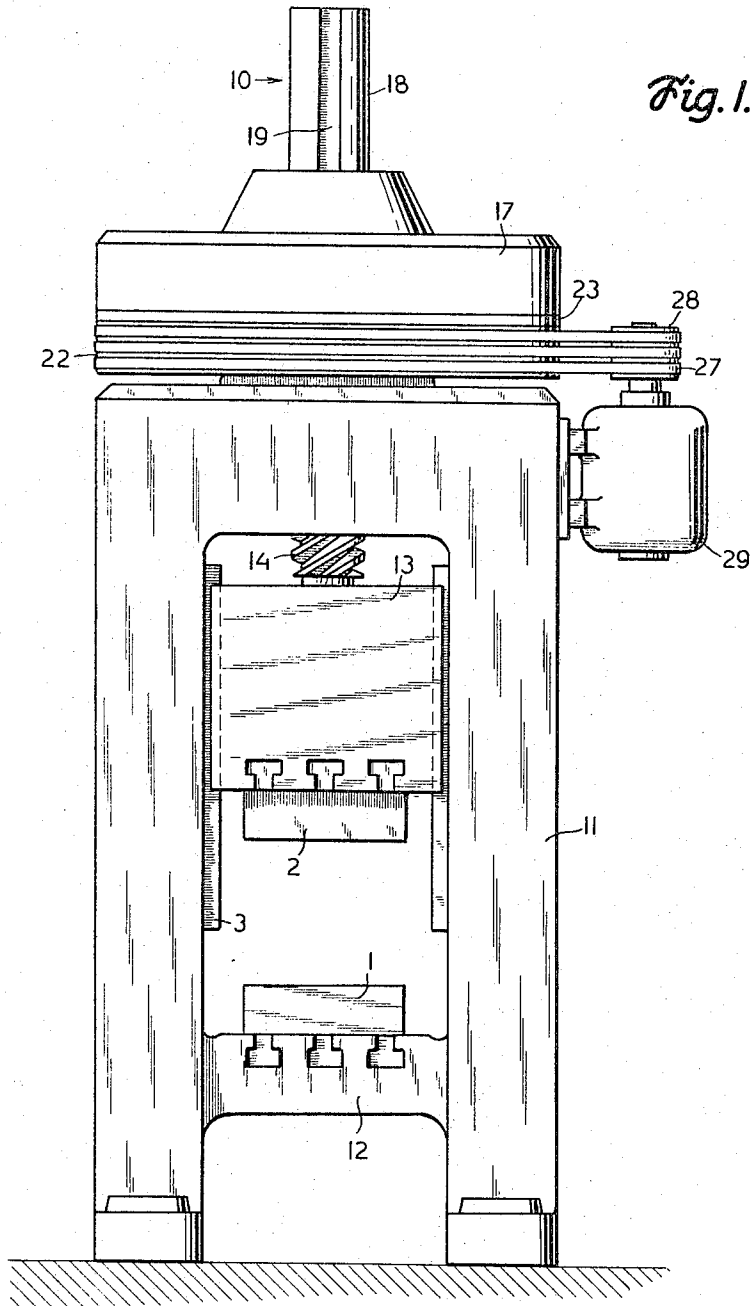


Fig. 1.

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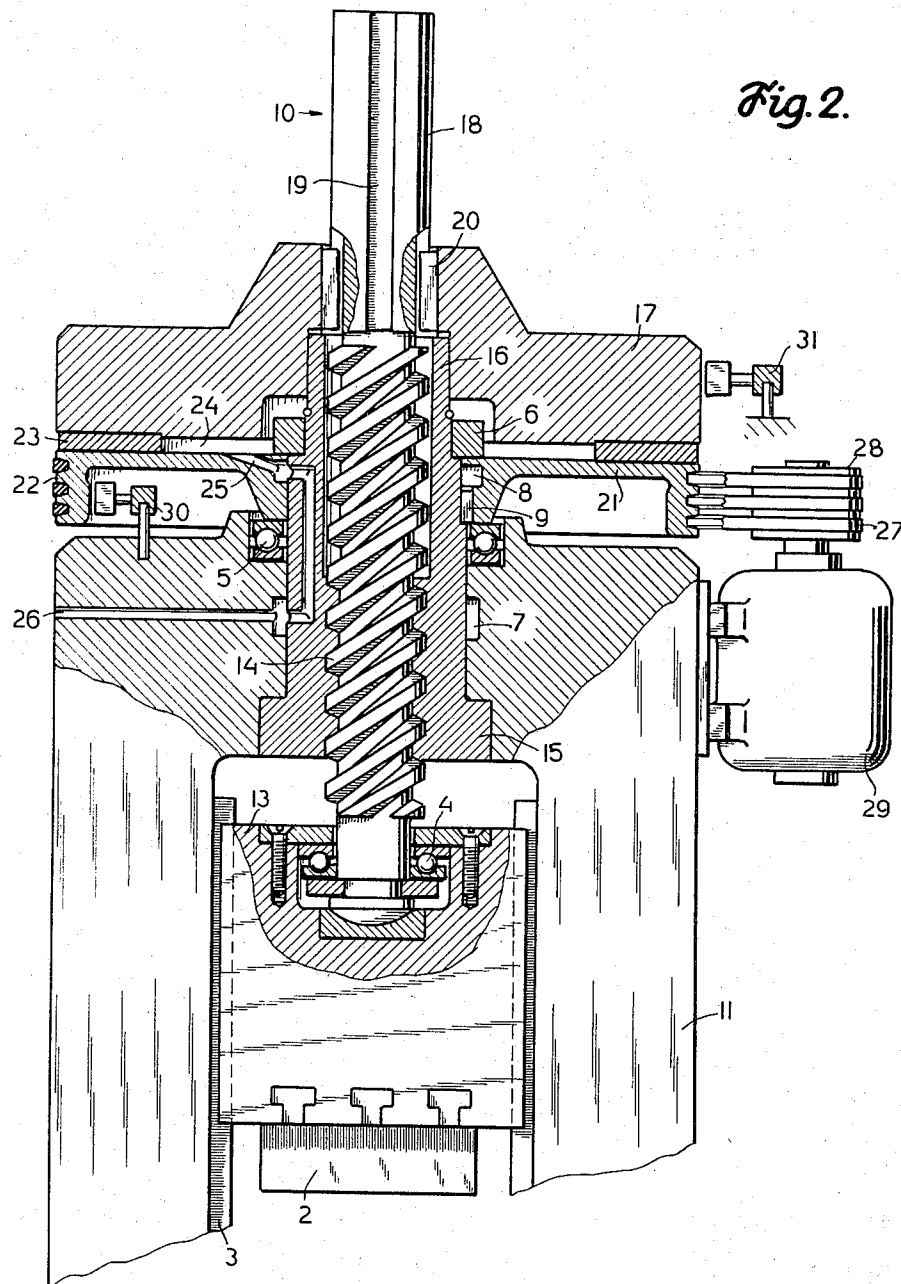
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PERCUSSION PRESS

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2 Sheets-Sheet 2



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Filed Mar. 31, 1966, Ser. No. 539,044

Claims priority, application Czechoslovakia, Apr. 5, 1965,

2,223/65

6 Claims. (Cl. 72-454)

This invention relates to screw presses, and particularly to a screw press with a heavy flywheel at the upper end of the screw which builds up momentum as it turns and strikes a heavy flow on the work at the end of its travel. Presses of this type are commonly referred to as percussion presses, and are normally employed for cold forming of metallic work pieces.

An object of the invention is the provision of a percussion press in which the kinetic energy stored in the flywheel is more effectively utilized than in similar known presses.

Another object is the provision of a press which is simple in design and can be operated in a simple manner.

A further object is the provision of a percussion press which is safer than known presses even if its screw or spindle should fail in torsion during operation.

With these and other objects in view, the press of the invention has a sleeve mounted on the press frame for rotation about its vertical axis in an axially fixed position. The spindle of the press which is fastened to the press ram for joint movement toward and away from the press bed has a threaded portion threadably received in the sleeve. A flywheel is secured against rotation relative to the spindle and is superposed on a drive member secured to the sleeve for rotation therewith. The flywheel is axially movable on the spindle 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 detailed description of a preferred embodiment when considered in connection with the accompanying drawing in which:

FIG. 1 shows a percussion press of the invention in front elevation; and

FIG. 2 is a fragmentary, front-elevation, and partly sectional view of the press of FIG. 1.

Referring to the drawing in detail, there is seen a heavy, generally A-shaped, rigid upright press frame 11 which includes a stationary press bed 12. A ram 13 is guided vertically toward and away from the bed 12, and secured against rotation by guide ribs 3 on the frame engaging corresponding grooves (not shown) in the ram 13. The bed 12 and ram 13 respectively carry platens or dies 1, 2.

A vertical passage in the frame 11 above the ram 13 receives a sleeve 15 which is freely rotatable in the passage about its vertical axis. A spindle 10 is coaxially received in the sleeve 15. The main portion 14 of the spindle 10 has steep-pitched threads which engage mating threads in the lower end portion of the sleeve 15. The bottom end of the spindle is secured to the ram 13 by a thrust bearing 4. The top end 18 of the spindle has axial

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grooves 19 which are uniformly distributed about the spindle axis.

The hub of a thin drive disc 21 is secured against rotation on the sleeve 15 by keys 9, and against axial displacement by a collar 6 on the sleeve and a thrust bearing 5 interposed between the drive disc 21 and the top of the press frame 11. An integral collar at the lower end of the sleeve 15 received in a conforming enlargement of the vertical passage in the frame 11 prevents upward axial displacement of the sleeve 15.

A heavy flywheel 17 coaxially superimposed on the drive disc 21 is freely rotatable and axially slidable on a cylindrical face 16 of the sleeve 15 and has a hub portion equipped with keys 20 engaging the grooves 18 so that the flywheel rotates with the spindle 10, but the spindle is free to move axially relative to the flywheel. The bottom of the flywheel 17 normally rests on a flat annular friction facing 23 on the peripheral portion of the drive disc 21 and is centrally recessed to define an annular chamber 24 with the sleeve 15 and the drive disc 21. The chamber is sealed outwardly by the friction facing 23 in the illustrated position of the press.

A discharge orifice 25 in the drive disc 21 which communicates with an inlet opening 26 in the press frame 11 through bores in the frame 11, the sleeve 5, the disc 21 and annular grooves 7, 8 permits air to be fed to the chamber 24 from a non-illustrated compressor or other source of compressed air.

A dependent cylindrical flange 22 on the peripheral portion of the disc 21 is grooved to receive multiple V-belts 27 which are also trained over the drive pulley 28 of an electric motor 29 attached to the frame 11. Brakes 30, 31 mounted on the frame 11 and shown in a conventional manner may be swung into frictional engagement with the inner cylindrical face of the flange 22 and with an outer cylindrical face of the flywheel 17 respectively.

The controls in the electrical circuit of the motor 29 and individual controls of the brakes 30, 31, and the valves in the air supply to the opening 26 have not been shown since they may be entirely conventional, and their structure will be evident from the following description of the press operation, starting with the illustrated condition of the apparatus.

When the motor 29 is energized, the disc 21 and the flywheel 17 which is coupled to the disc by the friction facing 23 are rotated. The disc 21, the flywheel 17, and the spindle 10 are accelerated as a unit by the motor 29 until enough energy for the power stroke of the press is stored in the flywheel 17. The position of the ram 13 remains unchanged during this phase of press operation.

Compressed air is admitted to the chamber 24 from the orifice 25 to lift the flywheel from the friction facing 23. The friction facing, in effect, is the basic element of an air-operated friction clutch which is disengaged by the pressure of the air in the chamber 24. Air is released from the chamber 24 through a peripheral gap opening between the flywheel 17 and the facing 23 and having a width determined by the relationship between the weight of the flywheel and the amount and pressure of the supplied air. Frictional contact between the flywheel 17 and the drive disc 21 is sharply reduced.

When the motor 29 is deenergized and the brake 30 is applied to the disc 21 to slow its rotation or to stop the same, rotation of the flywheel 17 and of the spindle 10 continues at a practically undiminished speed, and the resulting threaded movement of the spindle 10 in the sleeve 15 causes the ram 13 to move toward the press bed 12. The stored energy of the flywheel 17 is absorbed in the impact of the moving die 2 on the fixed die 1 and on a work piece contained therein. The flywheel 17 may

be stopped. It is at least slowed down if the ram 13 is lifted rapidly enough from the position of impact.

The ram returns to its starting position when the motor 29 is started again and the brake 30 is released while the air supply into the chamber 24 is continued. The disc 21 is rotated faster than flywheel 17, and the spindle 10 therefore threadedly moves upward in the sleeve 15. When the air supply to the chamber 24 is shut off, the friction clutch between the flywheel 17 and the drive disc 21 is engaged, and the press is ready for the next cycle of operations.

The downward axial velocity of the ram 13 at a predetermined rotary operating speed of the motor 29 is determined by the deceleration rate and ultimate speed of the drive disc 21 when engaged by the brake 30. The velocity of the return stroke of the ram 13 is similarly determined by the difference in angular velocity between the flywheel 17 and the sleeve 15. If the ram 13 is lifted from its lowermost position before the flywheel 17 is completely stopped by impact of the die 2 on the die 1, the flywheel may be further slowed or braked to a standstill by the brake 31 if a fast return stroke is desired. The brake 31 may also be employed to prevent acceleration of the flywheel 17 by the drag of the air layer in the chamber 24.

If the motor 29 is reversible or equipped with dual speed windings, the press can be operated substantially as described above entirely without the use of brakes in an obvious manner.

The operation of the illustrated apparatus, whether it be controlled by brakes or by switches in the circuit of the electrical motor 29, or both, never requires reversal of the direction of rotation of the flywheel 17. When normal machine friction is disregarded, the press may be operated in such a manner that the energy stored in the flywheel is used exclusively for shaping a work piece, and none of this energy is converted to heat by brakes. Even if the brake 31 is employed for slowing the rotation of the flywheel 17, the energy spent by braking need only be very small since the ram 13 is retracted upward whenever there is even a small difference in the rotary speeds of the sleeve 15 and the spindle 10. It is preferred to operate the press in such a manner that the flywheel 17 rotates continuously, though at varying speeds, in the same direction.

When dies are set up on a press, it is usually necessary to inspect their alignment by slowly lowering the movable die on the fixed die. The necessary inching movement of the ram 13 is readily accomplished in the illustrated press by turning the disc 21 while the flywheel 17 is floated on a cushion of air admitted to the chamber 24. Depending on the dimensions of the press, the disc 21 may be turned by hand or by low-speed operation of the motor 29 which must be reversible for this purpose. Close control of ram movement is readily achieved under these conditions since the inertia of the moving parts is relatively low.

The weight of the flywheel 17 is transmitted to the press frame 11 mainly by the hub of the disc 21 and by the thrust bearing 5. The spindle 10 is practically free of axial stresses due to the flywheel, and is relieved of radial stresses caused by centrifugal forces acting on the flywheel by the journal face 16 of the sleeve 15. Torsion failure of a spindle in a percussion press of conventional design often causes the flywheel to be thrown from the machine, and resulting serious injury to personnel and damage to buildings and machinery have been reported. If the spindle 10 of the illustrated press should break, the flywheel is safely retained in its normal position. It is therefore unnecessary to equip the press of the invention with safety guards or covers for the flywheel.

The motor, brakes, and non-illustrated air valves which control the operation of the press can readily be actuated by push-button switches in a conventional manner. The

controls may be operated automatically by a timing switch, or they may be electrically interlocked in a manner well known in itself for improved speed or safety of operation. The need for an operator's effort and attention may thus be reduced to any desired extent.

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. In a percussion press, in combination:

- (a) a frame including a press bed;
- (b) a ram member slidable on said frame in a vertically extending direction toward and away from said bed;
- (c) sleeve means having an axis extending in said direction and mounted on said frame for rotation about said axis in an axially fixed position;
- (d) a spindle fastened to said ram member for joint movement in said direction, a portion of said spindle being received in said sleeve means in threaded engagement therewith;
- (e) a drive member having an upwardly directed face and secured to said sleeve means for rotation therewith;
- (f) a flywheel secured against rotation relative to said spindle, said flywheel being superposed on said drive means and axially movable on said spindle toward and away from a position of weight transmitting frictional engagement with said face of the drive member;
- (g) 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 a gas under pressure to said chamber; and
- (h) motor 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 means for reducing the rotary speed at least of one of said sleeve means and of said 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 means.

5. In a press as set forth in claim 4, said friction facing being annular and bounding said chamber in a radially outward direction.

6. In a press as set forth in claim 1, said motor means including a multiple speed electric motor and motion transmitting means interposed between said motor and said drive member.

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