United States Patent

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[33] **Germany**
[31] **B 96807**

[54] **PUNCHING PRESSES**
12 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **83/132,**
83/142, 83/389, 83/459, 83/552
[51] **Int. Cl.** **B26d 7/06,**
B26d 5/42
[50] **Field of Search** 83/129,
135, 460, 552, 124, 132, 138, 140, 142, 459, 389

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ABSTRACT: A punching press comprising transmission means having an energy-absorbing resilient portion adapted to be compressed during a punching operation after the stripper assembly contacts a workpiece to be punched.

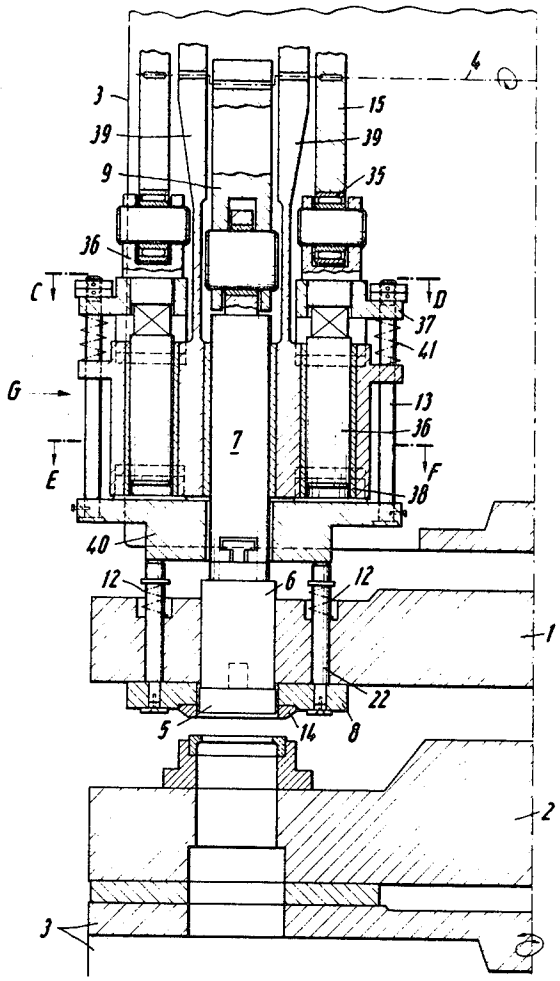
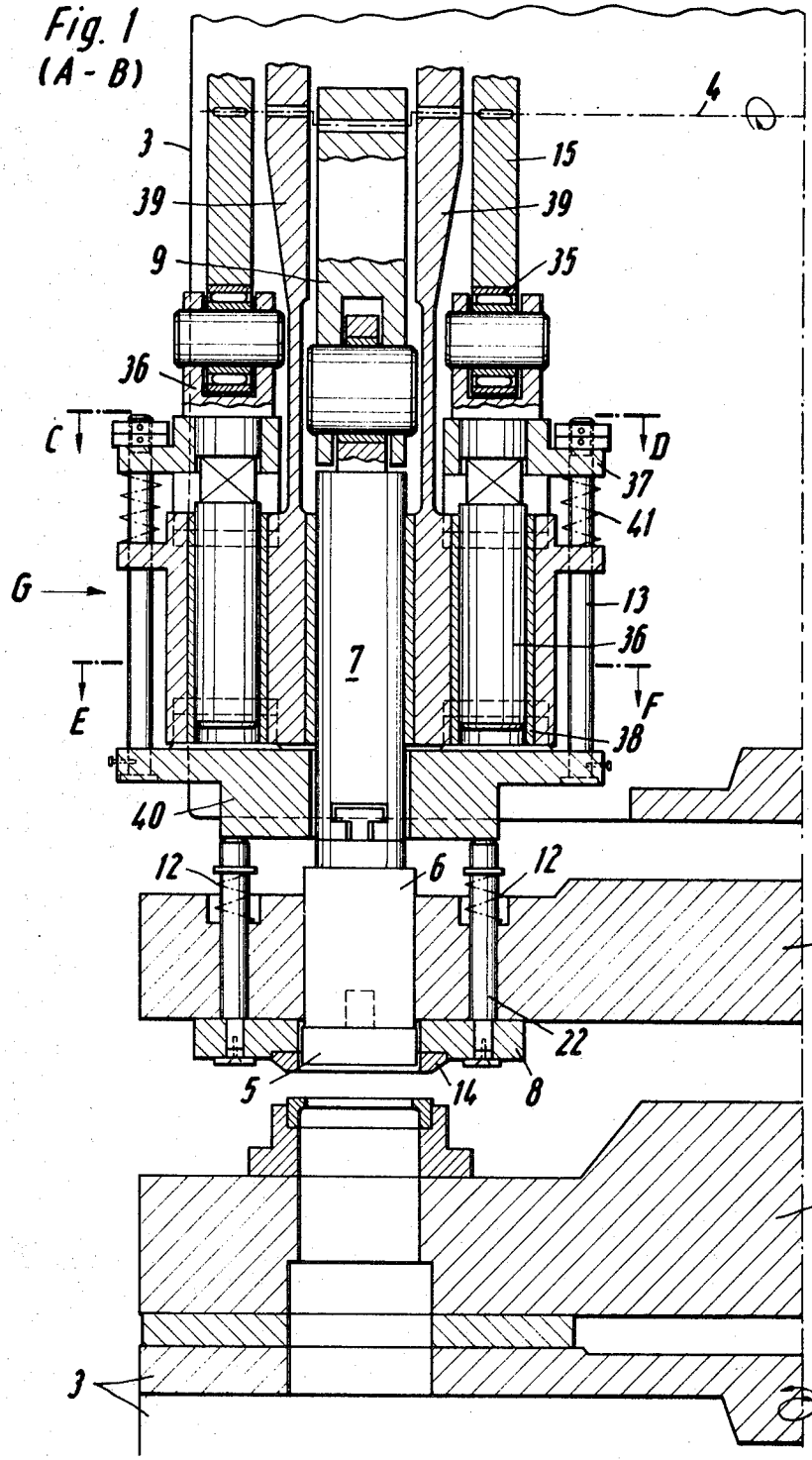
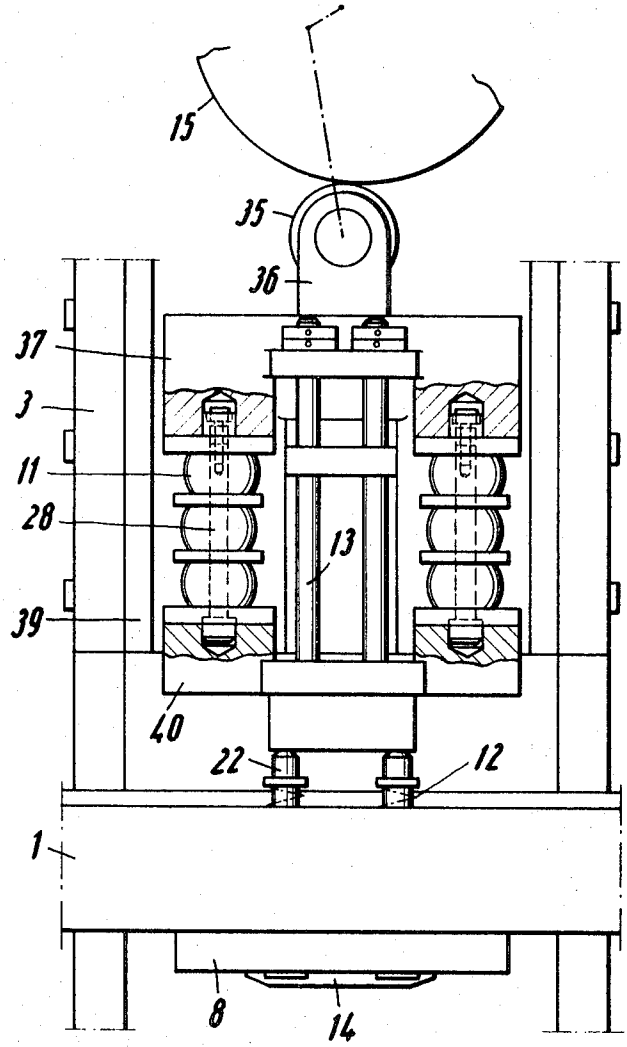


Fig. 1
(A - B)



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Fig. 2
(G)



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Fig. 3
(C - D)

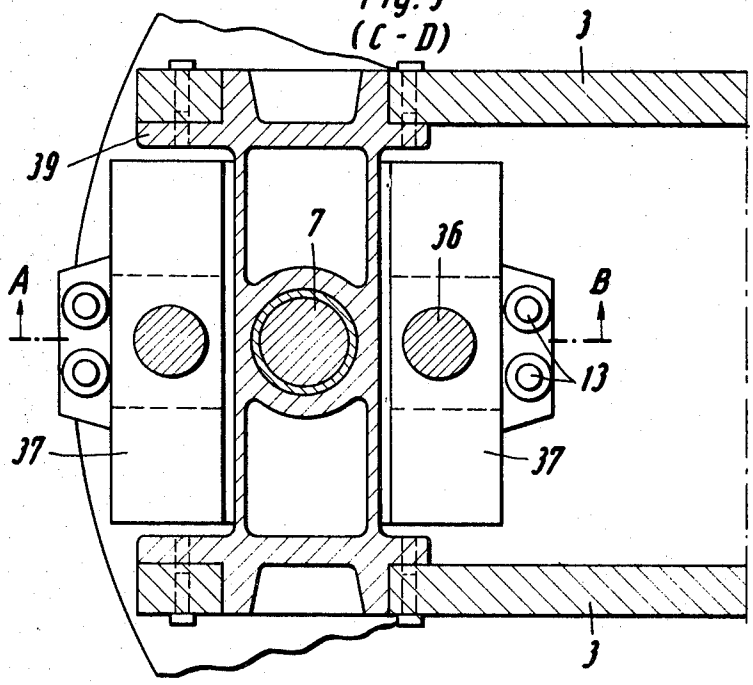
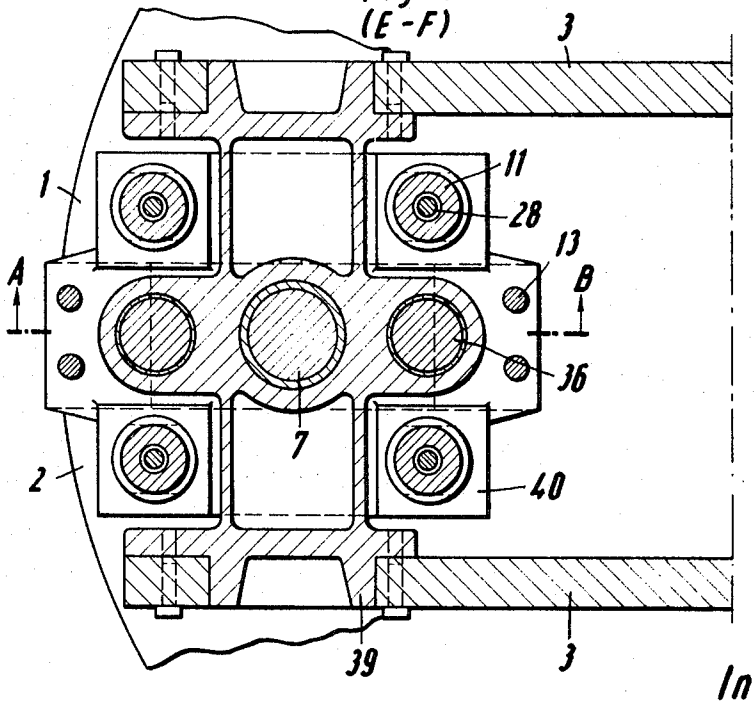


Fig. 4
(E - F)



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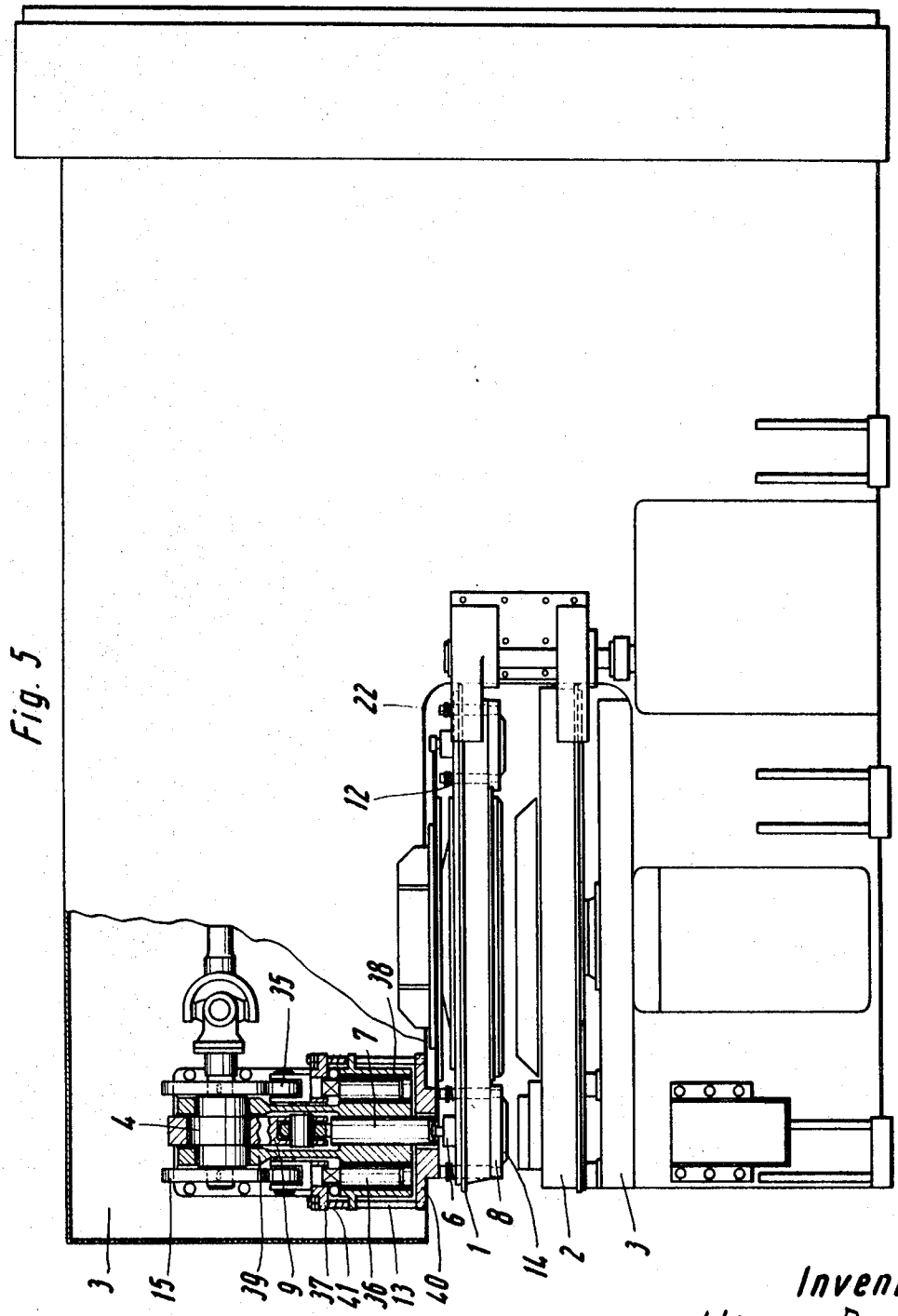


Fig. 5

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Fig. 6

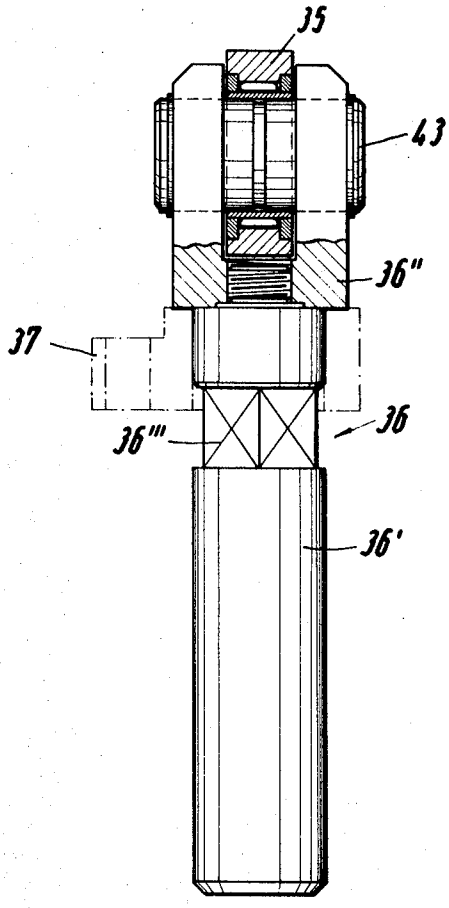
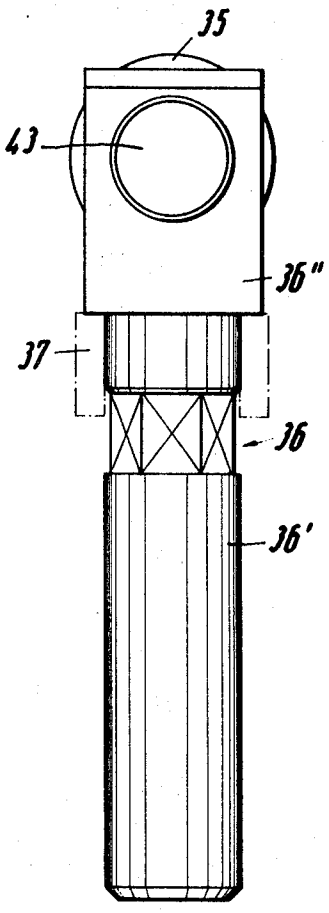


Fig. 7



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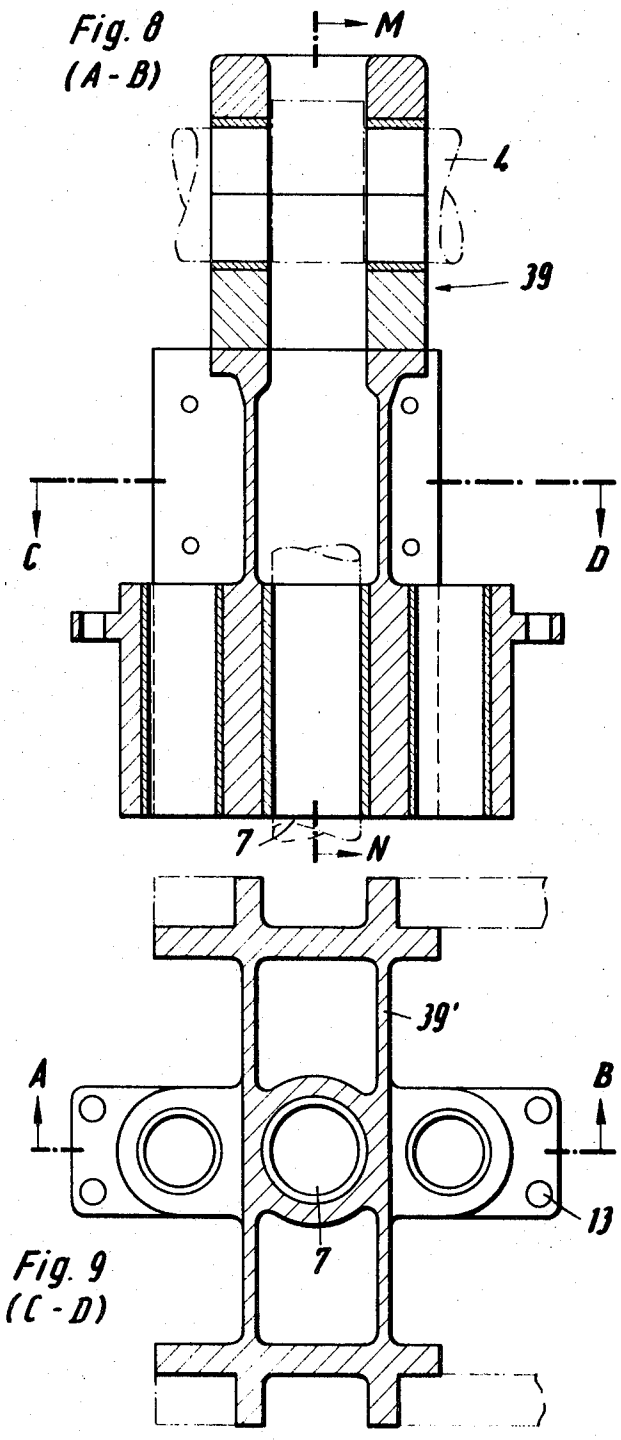


Fig. 8
(A-B)

Fig. 9
(C-D)

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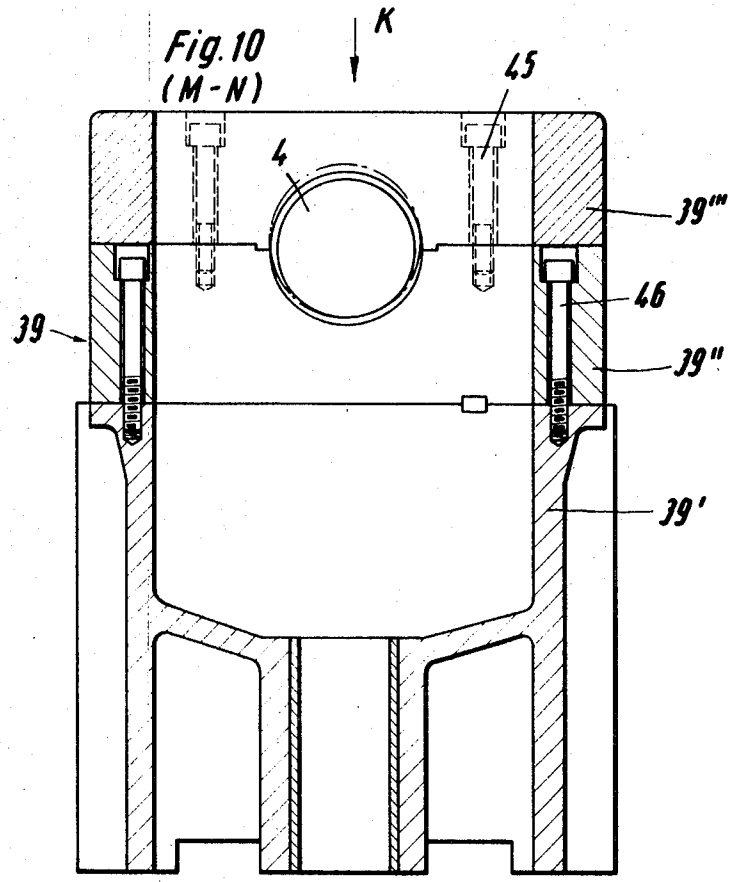


Fig. 10
(M-N)

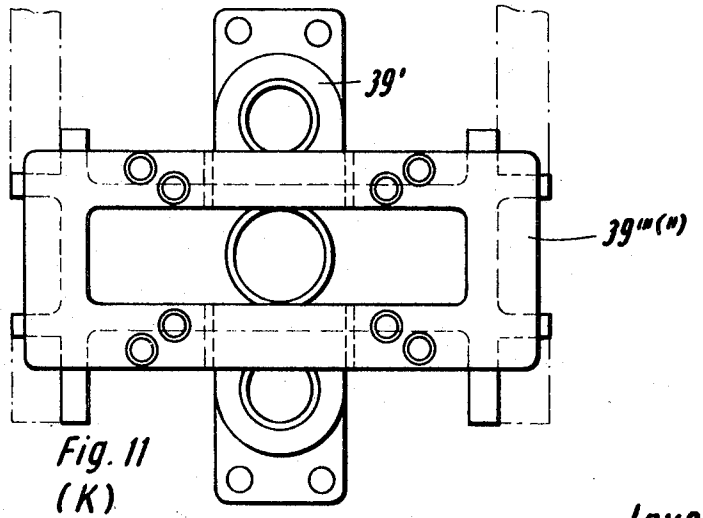


Fig. 11
(K)

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PUNCHING PRESSES

The invention relates to punching presses, particularly rotary punching presses comprising a rotatably supported punch carrier in the form of a disc and a lower die disc coaxial with the upper punch disc. The upper and lower punch discs can be rotated by a drive shaft so that the appropriate punch and die for any given punching process are there by aligned.

The present invention provides a punching press comprising a punch carrier, a reciprocatory punch mounted in said carrier, a stripper mechanism mounted on said carrier for movement independently of the punch to strip a punched article from the punch on completion of a punching operation, rotary drive means, means for converting rotation of the drive means into reciprocation of the punch, cam means drivingly connected with the drive means and transmission means for converting rotation of the cam means into reciprocation of the stripper mechanism, the transmission means having an energy-absorbing resilient portion adapted to be compressed during a punching operation after the stripper assembly contacts a workpiece to be punched.

In the case of a rotary press as outlined above, a stripper is located in the upper punch disc at each punch, and may be urged upwardly towards the disc by means of guide pins and springs.

The invention will now be described by way of an example with reference to the accompanying drawings, which illustrate the invention, but in no restrictive sense.

FIG. 1 is a section of part of a rotary press according to the invention along the line A–B of FIGS. 3 and 4;

FIG. 2 is a front view of the press in the direction of arrow G in FIG. 1;

FIG. 3 is a part section along the line C–D of FIG. 1;

FIG. 4 is a section along the line E–F of FIG. 1;

FIG. 5 is a side view of the press;

FIG. 6 shows, in greater detail, the forked pin of FIG. 1;

FIG. 7 is a side view of the forked pin shown in FIG. 6;

FIG. 8 is a section through the ram casing of the press along line A–B of FIGS. 3 and 4;

FIG. 9 is a section of the ram casing along the line C–D of FIG. 1;

FIG. 10 is a section of the ram casing along the line M–N of FIG. 8; and

FIG. 11 is a plan view of the ram casing in the direction of the arrow K of FIG. 10.

FIG. 1 shows parts of the outer machine frame 3 of a rotary punching press having an upper rotary punch disc 1 and a lower rotary punch disc 2 rotatably supported by their central spindles in an inner machine frame. This method of supporting the punch discs and respective spindles is not a substantial feature of the invention, and accordingly has not been shown in detail in FIG. 1 but can be seen in FIG. 5. Punch holders 6 are displaceably arranged in the upper rotary punch disc 1. In the punching position they are coupled to a ram 7 and moved by it downwardly for the punching operation. During the upward motion, the punch holders 6 with the punch 5 fixed thereto are pulled out of the punched blank. The machine ram 7 is driven by a connecting rod 9 connected to a suitable drive means, not shown.

A holding down and stripping disc 8, positively controlled, is connected to guide pillars 22 with return springs 12 so that the disc is held in its rest position in contact with the lower face of the rotary punch disc 1. The strippers 14, arranged to suit different types of punches, are accommodated in the stripping discs 8. When the machine is stripped and the punching stroke commences, cam discs 15 fixed on the eccentric shaft 4 supported in a ram casing 39 move, by means of follower rollers 35, forked pins 36 fixed in and resting on yokes 37 so that the pins slide downwardly in the guide bushes 38 of the ram casing 39. The forked pin 36 is rigidly secured to the guide shank sliding in the bushes 38 of the ram casing 39, the follower rollers 35 being supported in the fork. The forked pin 36 is fixed to the yoke 37 and in order to facilitate assembly it is made in two parts, that is to say, the guide shank and the fork, the parts being threaded together. The ram casing 39 is fixed to the sidewalls of the machine frame 3. This ram casing 39 also forms a support for the eccentric shaft 4 shown diagrammatically in FIG. 1. The cam discs 15 are accommodated on the eccentric shaft. They are eccentrically supported as shown diagrammatically in FIG. 2. A frame 40 moves with the yokes 37, and at the same rate, leading the machine ram 7 with the punch holder 6, but is kept at a distance therefrom by retaining bolts 13 as it moves downwardly and it applies a thrust to the guide pillars 22 of the stripping disc 8, while at the same time the stripping disc 8 with the stripper 14 is pushed downwardly by the guide pillars 22 until the stripper 14 hits the blank to be punched.

In the further course of the downward motion, the spring pillars 28 (FIG. 2) with the springs, in this example rubber springs 11, are increasingly stressed in accordance with the thickness of the blank. The stressing starts at a prestressed condition determined by the design of the arrangement. The holding down and stripping force can be obtained from these springs. Their compressive force is designed so that the maximum stripping forces required can be supplied by them.

During the upward stroke of the machine ram 7, and controlled by the ram through the cam discs 15 so as to lag behind it, the stripper disc 8 is pulled up by the two springs 12 stressed during the downward motion, against the upper rotary punch disc 1 so as to make contact with it, and to reestablish the required distance between the stripper and the die for the process, or for inserting the blank.

The springs 41 resting against the ram casing 39 hold the yoke 37 with the forked pins 36 through the follower rollers 35, during the entire punching motion (down stroke and up stroke) in surface contact with the roller track of the cam disc 15.

The forked pin 36 shown in FIGS. 6 and 7 is made in two parts. It consists of the actual guide shank 36′ with a hexagon 36‴ milled on it, and the fork 36″. The parts 36′ and 36″ are screwed together by means of the hexagon 36‴. For assembly of the parts, the fork 36″ is inserted through the bridge 37 (see FIG. 1) from the side, while the guide shank 36′ is inserted from below through the guide bores of the ram casing 39 (see FIGS. 8 to 11). A fork end pin 43 with the follower rollers 35 arranged on it is guided by the fork 36″, the rollers 35 being during the punching motion in surface contact with the roller track of the cam disc 15 (see FIG. 2).

The ram casing, illustrated in FIGS. 1 to 4 is shown separately in FIGS. 8 to 11, and consists of three parts, the guide body 39′ for the forked pin 36 with the guide bore for the ram 7, connecting part 39″ with screw connections 46 and the upper bearing cap 39‴ for guiding the eccentric shaft 4 and screw parts 45 joining the parts 39″ and 39′ together. In order to clarify the interrelations of the parts of FIG. 1, the eccentric shaft 4 has been shown as a separate part in FIGS. 8 and 10, and the ram 7 in FIGS. 8 and 9, and FIG. 9 shows also the fixing bolts 13.

During the rotary motion of the discs, before a punching operation is initiated, the stripper is held up by springs and rests against the undersurface of the upper rotary punch disc. The rotary discs are kept at the appropriate distance from each other, so that the blank can be pushed between the discs.

The guide pins connected to the stripper are loaded only in the punching position, so that the stripper can become effective by the section of the elastic means according to the invention, in the form of the closed prestressed spring stack acting at the same time as an energy store, and forcing the stripper against the blank.

The motion of the stripper and of the holder-down is brought about by the energy store in conjunction with the cams fixed to the eccentric shaft, controlling the motion in such a way that the stripper and the holder-down lead the punching motion of the tool punch, or lag behind it during the return stroke. The blank is held during the punching and stripping processes firmly on the punching die. During the punching process, the force applied to the prestressed spring stack of the energy store is raised only to a comparatively

small extent, to the stripping force required, in accordance with the spring deflection resulting from the thickness of the blank to be punched (for instance, f_{max} =10 mm.). This spring deflection (f_{max} =10 mm.) is small, in comparison with the ram stroke (for instance, 30 mm.) or with the vertical motion of the stripper as resulting from the rotation of the cams so that only comparatively little work is done on the spring (for instance, B.Pa. f_{max} =3.8 tons (metric) ×10 mm. =38 m-kgf). This has a favorable effect on the life of the spring stack or springs of the energy store. On account of the short spring deflection, the springs can be kept comparatively short so that the spring force varies only very little and below the permitted spring stress. The motion of the actual stripper, brought about by the cam discs, and leading the motion of the punching tool, takes place almost without expenditure of energy, except for the slight stressing required of the return spring, and is completed just before reaching the die surface of the blank material. The energy store becomes effective only within the thickness range of the blank (e.g. from 0 to 10 mm.) and yields the stripping and holding down force appropriate to the blank thickness in question, from the prestressing force rising to the maximum required stripping force corresponding to the maximum blank thickness, for example, 10 mm.

It is accordingly a substantial feature of the invention that the energy store for the stripping and holding down of the blank is now not connected to the upper rotary punch disc, but is held and guided in a special ram casing fixed to the outer machine frame.

We claim:

1. A punching press comprising an upper rotary punch carrier with a plurality of punches mounted thereon and a lower rotary punch carrier journaled coaxially therewith, each punch having an individual associated stripper mechanism including an individual holddown disc for movement independently of the punch movement and for movement independently of the other individual stripper mechanisms to strip a punched article from the punch on completion of a punching operation, rotary drive means, means for converting rotation of the drive means into reciprocation of a single punch, means drivingly connected with the drive means and transmission means for converting rotation of the drive means into reciprocation of the stripper mechanism, said transmission means having an energy absorbing resilient portion prestressed between yokes and a frame, said resilient portion adapted to be compressed only to a comparatively small extent corresponding to the stripping force required during a punching operation after the stripper assembly contacts a work piece to be punched.

2. A press as claimed in claim 1 wherein said transmission means for the stripper mechanism are driven by cam means which lead the motion of the punching tool just before reaching the die surface of the blank material.

3. A press as claimed in claim 1, wherein said resilient portion of said transmission means for the stripper mechanism is held and guided in a casing fixed to the outer machine frame.

4. A press as claimed in claim 1, wherein the resilient portion of the transmission means comprises a plurality of resilient members disposed symmetrically around a guide for the ram.

5. A press as claimed in claim 1, wherein the resilient portion of the transmission means includes a stack of resilient elements.

6. A press as claimed in claim 1, wherein the resilient portion of the transmission means is accommodated between a pair of relatively movable members one of which members carries a pin or pins adapted to slide during compression of said resilient portion in a guide formed in a part of the press frame.

7. A press as claimed in claim 6, wherein each pin terminates in a bearing carrying a roller for rolling a follower for a cam of said cam means.

8. A press as claimed in claim 7, further comprising spring means urging each roller into surface contact with its associated cam.

9. A press as claimed in claim 1, in which the resilient portion of the transmission means has a residual stress.

10. A press as claimed in claim 1, in which each stripper mechanism is spring-urged towards a face of the punch carrier.

11. A press as claimed in claim 2, wherein the punch carrier comprises a rotatable disc carrying a plurality of punches each having an associated stripper mechanism, the punches with their associated stripper mechanism being capable of selective alignment with a punch operating ram connected to the drive means by suitable positioning of the disc about its axis.

12. A press as claimed in claim 1, wherein the holding down and stripping disc is connected to guide pillars with return springs driven by a frame and so arranged that the disc is held in its rest position in contact with the lower face of the rotary upper punch disc.