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[54] **PRESSES**  
**9 Claims, 2 Drawing Figs.**

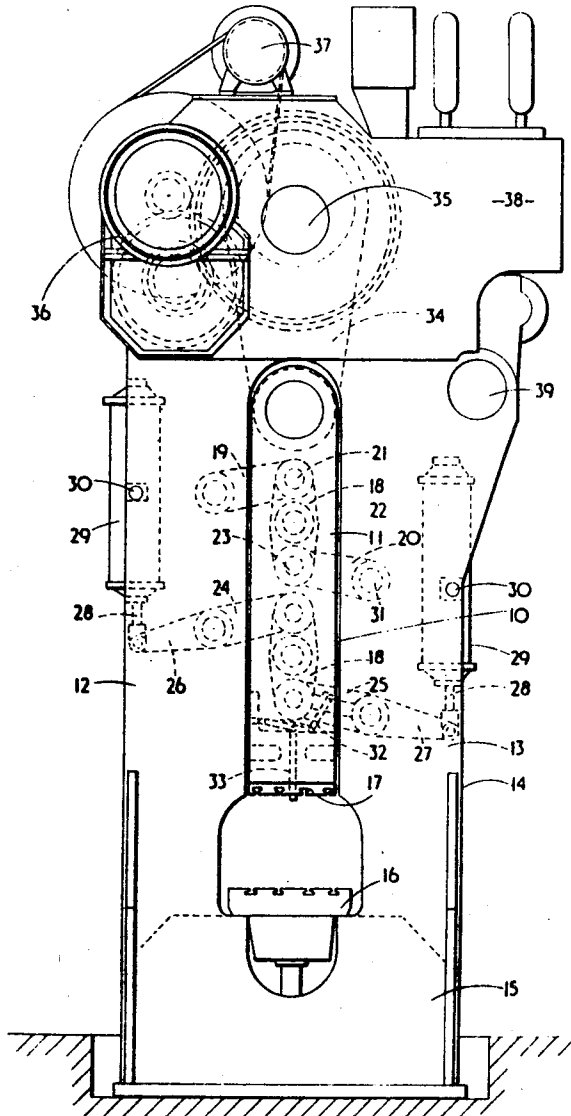
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[51] Int. Cl..... **B21j 9/02**

[50] Field of Search..... **72/450,**  
**456, 455; 100/53, 214**

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**ABSTRACT:** A press in which the ram is mounted for rectilinear movement between a pair of frame members of the press and in which a linkage system is provided operative between the ram and the frame members of the press to ensure that the ram moves rectilinearly or substantially so.



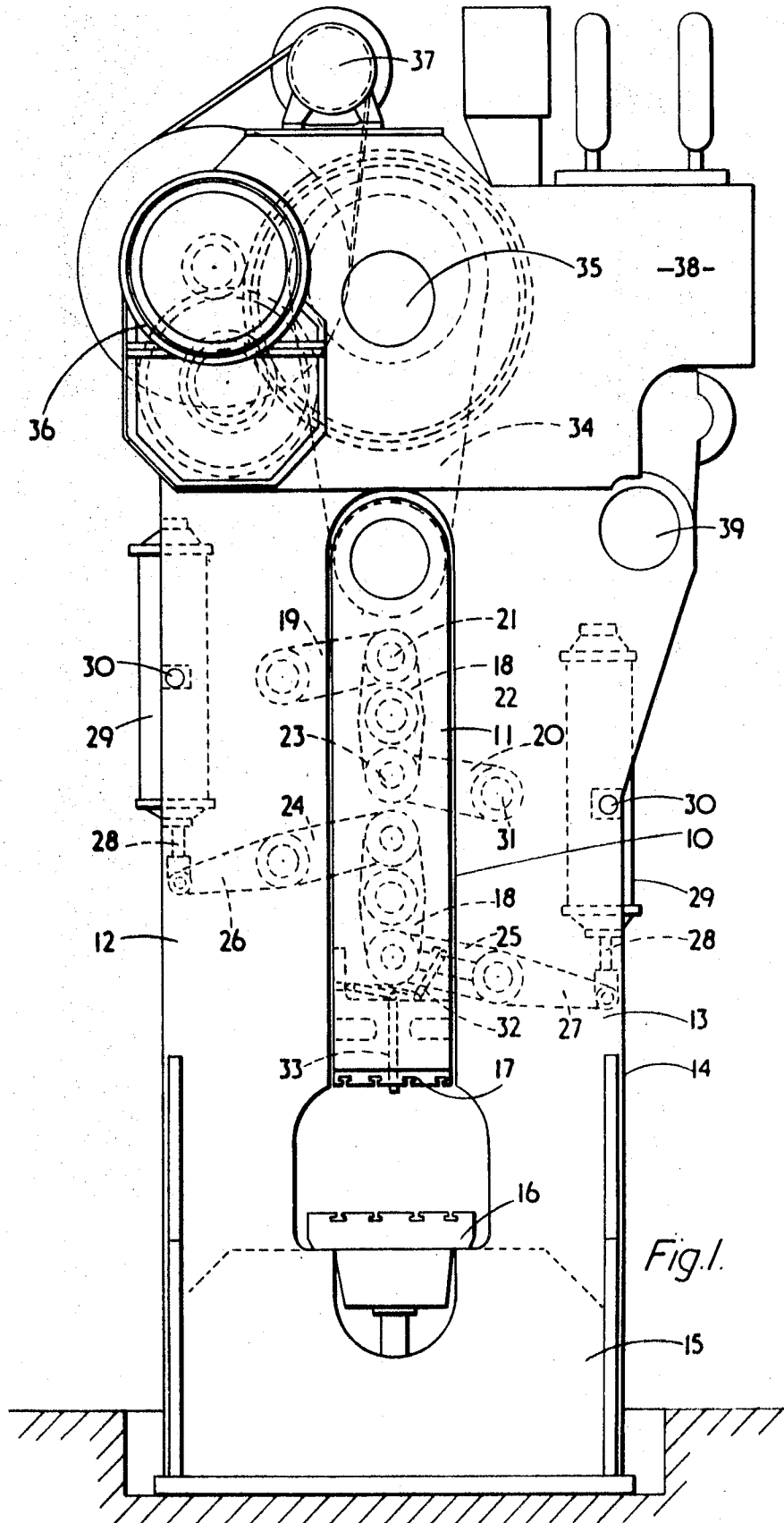
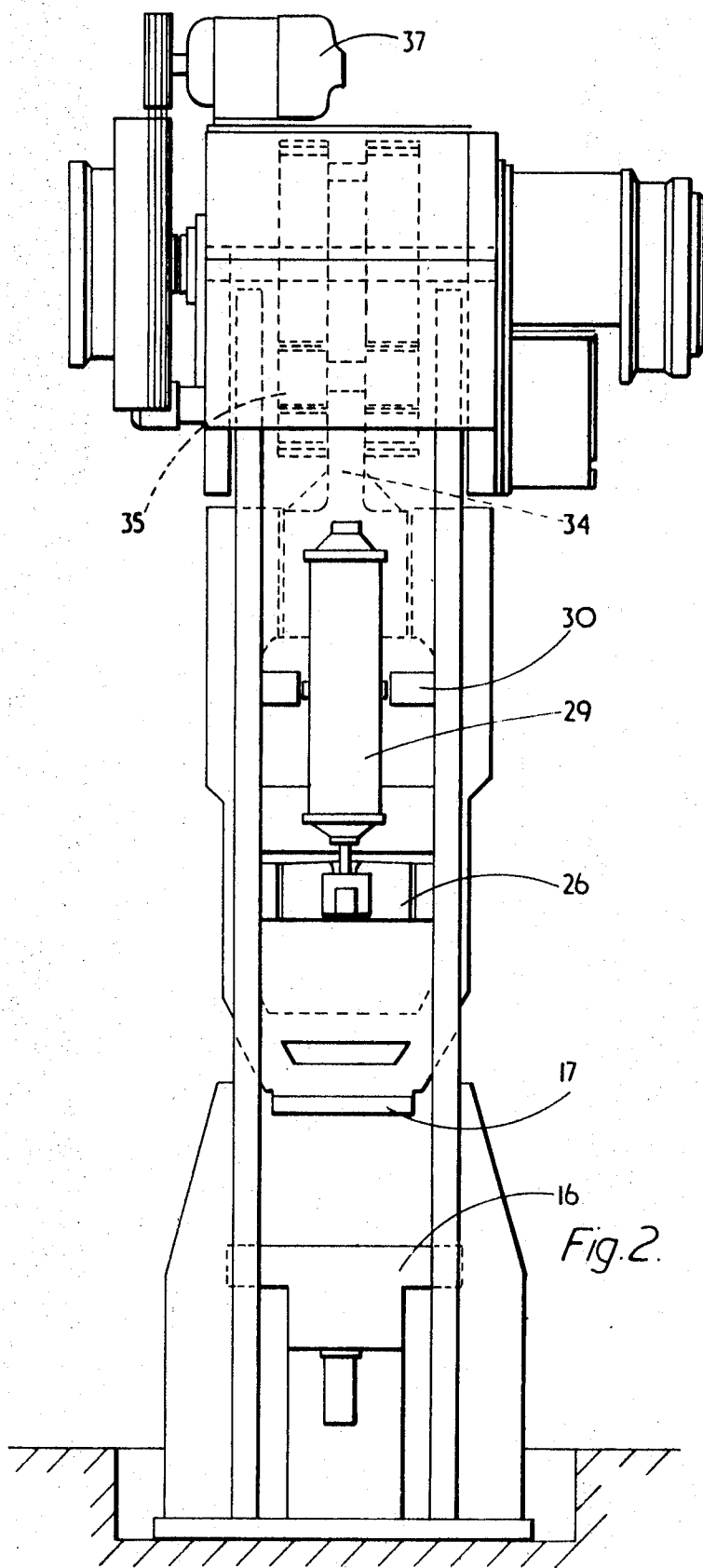


Fig. 1.



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## PRESSES

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The invention relates to presses in which the ram of the press operates either in a vertical or substantially vertical plane or, as in the case of an upsetting press, in a horizontal or substantially horizontal plane.

#### 2. Description of the Prior Art

In conventional presses the ram is pivotally connected to its driving member such as a connecting rod from a crank shaft and is guided by guide surfaces formed on or carried by the ram which engage cooperating guide surfaces or pillars on or carried by the frame of the press. With such an arrangement it is necessary to provide working clearances between the engaging surfaces on the ram and frame and, in the case of a press which is intended for carrying out hot forging operations, such clearances must also allow for expansion of the ram and/or the frame due to the high temperature of the workpieces being operated on.

If the ram is pivotally connected to a single connecting rod, the ram, and thus the tool carried thereby, can cock or tilt during its working stroke with the result that inaccuracies can occur in the operation performed on a workpiece. Such inaccuracies, since they arise from known limitations in press operation, do not necessarily result in workpieces which are rejects but necessitate workpieces being designed so that inaccuracies or "tolerances" can be removed by a subsequent machining operation with a consequent wastage of material. Whilst the amount of material which has to be removed to correct the inaccuracies of a press is of course small in any one workpiece, the total amount which has to be removed can be substantial when, as is generally the case, large quantities of workpieces are being produced.

Although various proposals have been made to overcome this problem of cocking, the mounting of the ram has remained such that the pivotal connection between the ram and the driving means remains between the guide surfaces on the ram and the frame, some transverse movement of the ram relative to the frame will still occur, whether this be as a result of cocking or swinging of the ram.

Further disadvantages of the conventional methods of mounting the ram of a press are:

- a. the cooperating guide surfaces on the ram have to be machined and are thus expensive,
- b. such cooperating guide surfaces have to be lubricated,
- c. due to cocking or swinging or other misalignment of the ram, uneven wear can occur on the guide surfaces leading to the necessity for replacement and such wear can be accentuated by the fact that scale and other displaced matter will adhere to the lubricant and will thus cause an abrading action on the guide surfaces, and
- d. the ram is normally supported by guide pillars which are themselves supported on the bed of the press and the provision of these guide pillars limits the size of the tools that can be accommodated in the press.

In the case of an upsetting press where the ram is operating in a horizontal plane, the ram is firmly supported by pillars or like surfaces disposed below the ram but the problem of misalignment can still arise particularly when the upsetting ram is operating under high loads such that the ram may lift off its lower supporting surfaces.

It is accordingly an object of the present invention to provide an improved construction of press in which the inaccuracies and disadvantages referred to above are either substantially reduced or completely eliminated.

### SUMMARY OF THE INVENTION

The present invention provides a press having a bed, a pair of frame members, a ram mounted for movement between said frame members towards and away from said bed and the means mounting the ram including first and second primary

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members coupled to the ram for pivotal movement relative thereto about axes of rotation spaced apart along the axis of movement of the ram and a pair of secondary links pivotally connected to each of said primary members, one link of each pair of secondary links being pivotally connected to one of said frame members and the other link of each pair of secondary links being pivotally connected to the other of said frame members.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a front elevation of a press and

FIG. 2 is a side elevation thereof.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

In the form of our invention illustrated showing it as applied to a conventional press, i.e., one in which the ram 10 reciprocates in a vertical plane, the ram body 11 is mounted for rectilinear movement between two upstanding arms 12, 13 of the frame 14 of the press, the base 15 of the frame carrying the die 16 with which the ram tool 17 will cooperate during the formation of a workpiece. The ram body 11 has pivotally secured thereto adjacent the upper and lower ends thereof and along the center axis thereof a pair of primary links 18 which are of substantially elliptical form in elevation and which, when the ram is in its "at rest" or top-dead center position, are disposed so that the major axis is coincident with the center axis of the ram.

Pivotally connected to the upper end of the primary link 18 adjacent the upper end of the ram is one 19 of a pair of secondary links, the other 20 of which is pivotally connected to the lower end of the primary link. The one secondary link 19, being the upper, is pivotally connected at its other end to the one upstanding arm 12 of the frame of the press whilst the other secondary link 20 of the pair is pivotally connected at its other end to the other upstanding arm 13 of the frame. With the ram in its "at rest" or top-dead center position the pivot axis 21 between the link 19 and the link 18, the axis of rotation 22 of the link 18 and the pivot axis 23 between the link 20 and the link 18 all lie in a plane passing through the central axis of movement of the ram body 11.

The lower primary link 18 is pivotally connected to its associated secondary links 24 and 25 in a similar way. Additionally the links 24 and 25 are provided with extensions 26 and 27 which are pivotally connected to the pistons 28 of pneumatic counter balance cylinders 29 which are themselves pivotally mounted as at 30 to their respective arms of the frame of the press.

It will be appreciated that the linkage system is duplicated on both sides of the press so that the press is thus constrained against rocking movement in a fore and aft direction.

The secondary link 25 associated with the lower primary link 18 is connected by a suitable link assembly 32 to a top knockout pin 33 which may conveniently be provided with a removable tip.

With such an arrangement the ram is constrained to follow a virtually true straight line during reciprocal movement thereof so that errors arising as a result of misalignment between the ram tool and the workpiece are substantially, if not wholly, eliminated.

To obtain this desired virtually true straight line movement the ratio of the distance between the centers of the two pivotal connections of each of the secondary links to the distance between the center of the pivotal connection between a primary link and the ram body and the center of a pivotal connection between said primary link and a secondary link must be determined geometrically so that, at the "at rest" or dead center positions and at a position equidistant between the "at rest" positions, axis 23 will lie on the central axis of movement of the ram body 11.

The pivotal connections between the links and their associated members are supported by a coned thrust bearing

which is capable of automatic continuous adjustment to compensate for radial wear.

With a linkage arrangement as described above the frame construction for the press can be extremely simple and because there are no mating guide surfaces between the ram body and the frame no expensive machined surfaces have to be provided. Furthermore, since no guide pillars or the like are required the full area of the ram body and the die face can be used for carrying tools so that the tool area for a given size of press is greater than has heretofore been available. For example, with a 600 ton capacity press capable of operating at 35 strokes per minute and having an 8-inch stroke the overall height of the press would be approximately 21 feet and one could provide a tool-carrying slide for the ram, some 23 inches wide and a 34 inch wide bolster for the die.

The ram 10 is driven through a connecting rod 34 from a crank shaft 35 which is itself driven through conventional gear train 36 from an electric motor 37.

In order to overcome difficulties which have arisen in the past as a result of a press locking due to overloading of the ram as it concludes its working stroke, which locking can only normally be freed by burning out the press tools, the motor 37 and the other drive elements for the ram 10 are carried on a subframe 38 pivotally connected as at 39 to the main frame 14 of the press, this subframe 38 being biased into its normal operative position by a hydraulic or like ram which is associated with an adjustment screw whereby the biasing load can be adjusted to a preselected figure. With such an arrangement if the loading on the ram during a working stroke exceeds the preset biasing load then the drive and subframe will lift, thus releasing the overload and avoiding the locking and its consequent problems referred to above. Associated with this overload release mechanism is a pressure switch which is adjustable to the overload pressure and which, upon the overload release mechanism becoming operative, trips out the main motor contacts and the normal pushbutton controls for the press.

In order to achieve maximum flexibility and output, to eliminate as far as possible contamination of the working parts of the press and to keep fumes, steam and like obnoxious conditions for the operator to a minimum, the press may be provided with an indexable die unit.

I claim:

1. In a press which includes a bed, a pair of frame members, a ram mounted for movement between said frame members towards and away from said bed,

the improvement wherein the means mounting the ram includes:

- a. first and second primary members coupled to the ram for pivotal movement relative thereto about axes of rotation spaced apart along the axis of movement of the ram, and
- b. a pair of secondary links pivotally connected to each of said primary members,
- c. one link of each pair of secondary links being pivotally connected to one of said frame members and the other link of each pair of secondary links being pivotally connected to the other of said frame members.

2. A press according to claim 1 in which the axes of pivotal connection of the secondary links to each of said primary members lie in a plane containing the axis of rotation of that primary member relative to the ram.

3. A press according to claim 2 in which, when the ram is in its top-dead center position said axes of pivotal connection lie in a plane passing through the central axis of movement of the ram.

4. A press according to claim 1 wherein each primary member is a link pivotally mounted about its center on the ram.

5. A press according to claim 4 wherein each of the primary members is of elliptical form.

6. A press according to claim 1 wherein said first and secondary primary members comprise an upper primary member and a lower primary member and in which the pair of secondary links pivotally connected to the lower primary member are additionally pivotally connected to a counterbalance member.

7. A press according to claim 6 wherein one of the secondary links associated with the lower primary member is operatively connected to a top knockout pin.

8. A press according to claim 1 wherein the ram is driven through a connecting rod from a crank shaft which is driven through a gear train from an electric motor.

9. A press according to claim 8 wherein a subframe is pivotally connected to one of said frame members and the motor and the other drive elements for the ram are carried on said subframe.

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