June 6, 1967 L. G. DEAN 3,323,347

HYDRAULIC PRESS OF THE PULL-DOWN TYPE

Filed Feb. 2, 1965 2 Sheets-Sheet 1

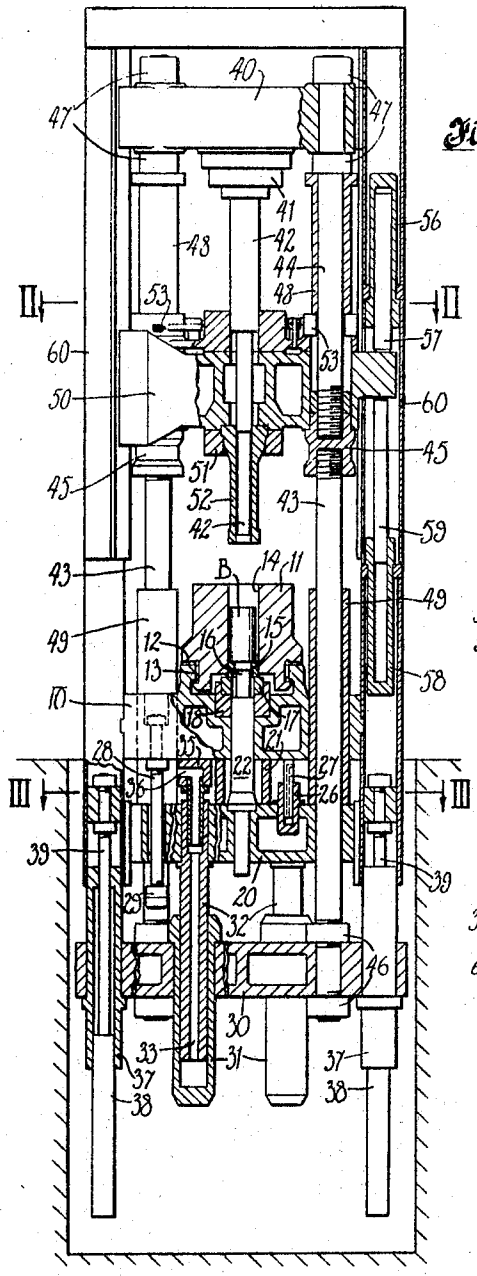


Fig. 1

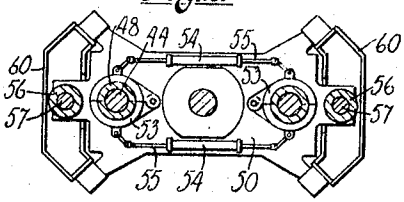


Fig. 2

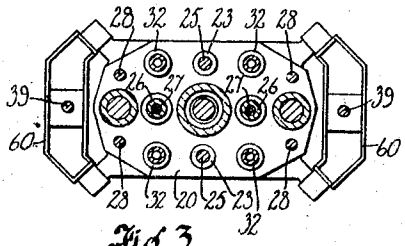


Fig. 3

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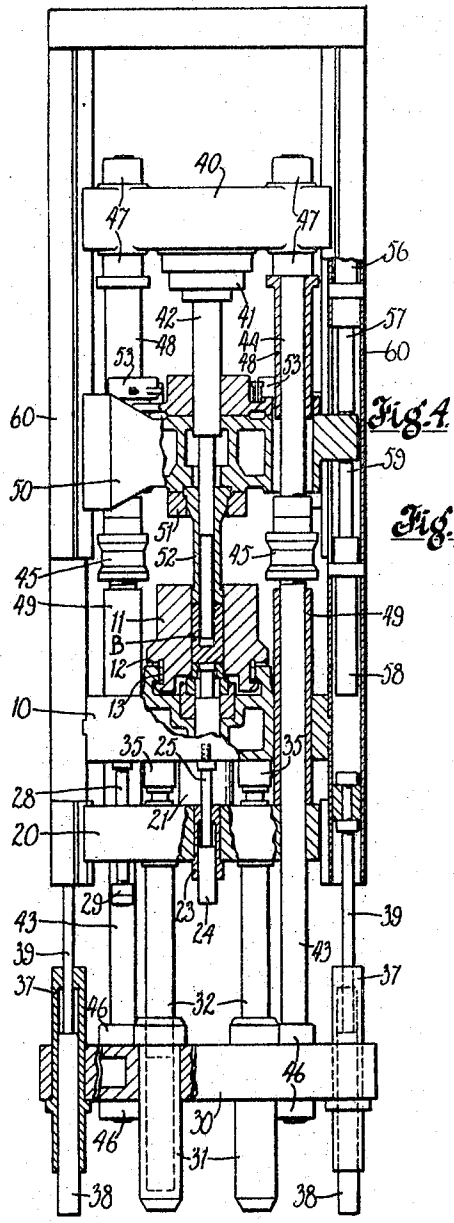


Fig. 4

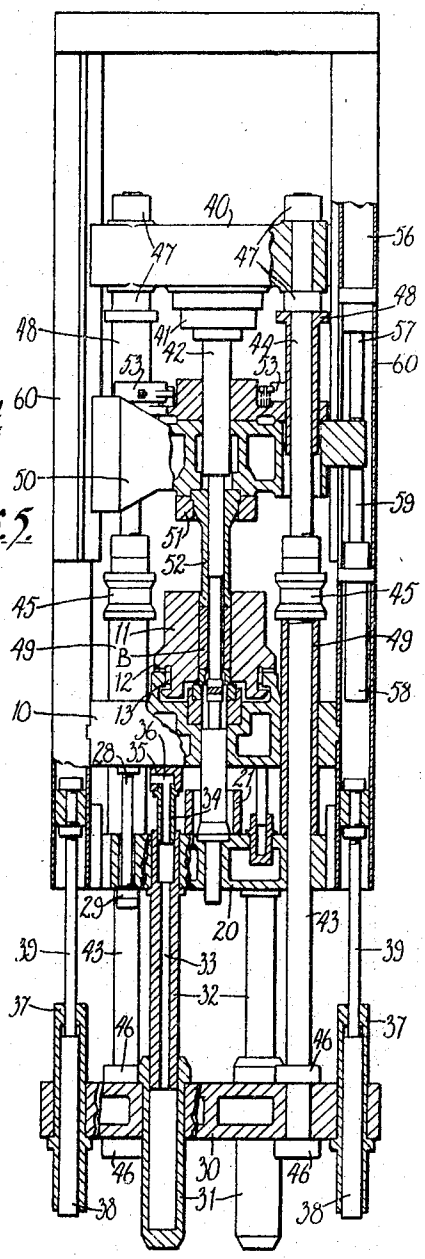


Fig. 5

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HYDRAULIC PRESS OF THE PULL-DOWN TYPE

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8 Claims. (Cl. 72—453)

This invention relates to a huardycil press of the pull-down type. These presses generally comprise a stationary base arranged at floor level and supporting a holder for a workpiece, a movable upper crosshead for a tool which, on lowering of the crosshead, engages a workpiece and acts on it by being pressed on or into it, a movable lower crosshead connected to the movable upper crosshead by columns, and a main hydraulic drive acting on said movable lower crosshead, so that upon the downstroke of said drive, the movable upper crosshead is pulled down and performs its working stroke.

Pull-down presses have several advantages over the more conventional types of presses, the push-down presses, inasmuch as their weight and their height above floor is reduced as compared with that of push-down presses of comparable capacity.

It is an object of the present invention to provide a hydraulic press of the pull-down type which is particularly suitable for the piercing of hot billets. In normal practice, billets are pierced in the following manner: a hot billet is placed in the bore of a container, and a piercing tool in the shape of a stem and a tubular upsetting tool surrounding the piercing tool are both caused to contact and to press on the top of the billet, whereby the latter is compacted so as to fill the container bore completely. In the next step, the piercing tool is forced through the billet, while the upsetting tool remains in contact with the billet top but does not descend further. This is continued until almost the whole of the billet is pierced, whereupon the centre part of the bottom of the container, which is made as a separate piece, is withdrawn downwards, thus allowing the remaining length of the billet to be pierced. After completion of the piercing stroke, both tools are retracted and the billet taken out of the container. The latter step in many modern presses is carried out at a station outside the press, the container being then mounted on a movable carrier or slide.

The hydraulic press according to the present invention comprises essentially a stationary base arranged at floor level and supporting a holder for a workpiece, a movable upper crosshead on which a piercing tool is mounted, a movable lower crosshead connected to said movable upper crosshead by columns, a movable back-up crosshead arranged between said base and said movable lower crosshead and mounting a back-up stem, and a hydraulic drive for the piercing tool, which drive is partly arranged on said backup crosshead and partly on said movable lower crosshead, so that upon the downstroke of said drive, the upper movable crosshead with the piercing tool is pulled down and performs its working stroke. In this way, a separate hydraulic pressure unit for resisting the downward pressure on the back-up stem during the working stroke is unnecessary, the resisting force being supplied to the back-up stem by the reaction in the main hydraulic drive during that stroke.

The back-up crosshead is preferably stationary during most of the piercing stroke and carried along by the downward movement of the upper and lower movable crossheads towards the end of the piercing stroke.

The hydraulic drive for the piercing tool consists preferably of an even number of hydraulic cylinders and rams disposed symmetrically about the main axis of the press, there being no cylinder and ram in this axis, as this has to be kept free for the arrangement of the back-up stem thereon. The supply of pressure fluid to the cylinders of this drive may be effected through stationary pipes over which the rams of these cylinders can be telescoped.

The press may have a separate upsetting tool mounted on an intermediate crosshead arranged between the base and the upper movable crosshead.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a sectional elevation of a pull-down press for the piercing of hot billets, the section being taken along line I—I of FIG. 3.

FIG. 2 is a transverse section along line II—II of FIG. 1.

FIG. 3 is a transverse section along the line III—III of FIG. 1.

FIGS. 4 and 5 are sectional elevations similar to that of FIG. 1, showing two stages in the piercing operation.

The press illustrated in the drawings has a stationary main base **10** arranged at floor level and supporting in its centre a container **11** for a billet B. In the embodiment shown, the container can be slid in and out of the press along horizontal and vertical rails **12** and **13** respectively provided on the base **10**. The container has a bore or chamber **14** which can receive a billet. This bore is closed at its bottom by a ring-die **15** and a back-up stem **16**. The ring-die rests on a pressure piece **17**, and the latter on a bolster **18** which is supported in the base **10**. The back-up stem **16** can be retracted into the base **10** by means presently to be described.

Arranged below the base **10** and separated from it by a clear distance is a back-up crosshead **20**. A space ring **21** is interposed between base **10** and back-up crosshead **20** and attached to the latter. The crosshead **20** supports in its centre an upwardly projecting shaft **22** which passes through ring **21** and terminates at its top and in back-up stem **16**. Cylinders **23** in crosshead **20** are displaceable, as shown in FIG. 4, over stationary rams **24** attached by rods **25** to base **10**, and cylinders **26** in the same crosshead are displaceable over rams **27** directly attached to base **10**. The cylinders **23** and rams **24** are so arranged as to return the back-up stem **16** from a retracted position seen in FIG. 5 to the upper position seen in FIG. 1. The cylinders **26** and rams **27** are so arranged as to hold down the back-up crosshead **20** in its lower position. The back-up crosshead is guided during its up and down movements on rods **28** which depend from base **10** and carry at their lower ends stops **29** limiting the downstroke of the back-up crosshead.

Arranged below and spaced-apart from back-up crosshead **20** is a lower movable crosshead **30**. Fitted into the crosshead **30** are the cylinders **31** of the main hydraulic drive of the press. In the embodiment shown, there are four such cylinders, but it must be understood that any other number of cylinders may be provided. The cylinders **31** are displaceable relative to rams **32** attached to the underside of back-up crosshead **20**. The rams **32** have longitudinal axial bores **33** through which hydraulic fluid can pass on its way to or from cylinders **31**. The diameter of these bores is slightly enlarged at their upper ends so as to allow telescope pipes **34** to enter into these enlargements, the pipes being attached to blocks **35** on the underside of base **10** and being provided with ducts **36** for the admission to or discharge of hydraulic fluid from the cylinders **31**. Provided on crosshead **30** are also return cylinders **37** which are displaceable over pistons **38**, the latter being secured by rods **39** to a stationary part of the press, to be referred to later.

Arranged well above the base **10** is an upper movable crosshead **40** which in its centre carries a holder **41** for a piercer stem **42**. The holder may be of any known design

and needs no further description, except that it maintains the stem 42 in alignment with the axis of the bore 14 in container 11. The two crossheads 30 and 40 are connected to each other by two columns which consist of a lower section 43 and an upper section 44 joined together by flanged connectors 45 and secured to the lower and upper moving crossheads 30 and 40 respectively by means of nuts 46 and 47. Sleeves 48 are secured to the upper sections 43, while further sleeves 49 attached to back-up crosshead 20 encircle the lower column sections 44 and pass through openings in the base 10.

Arranged between the base 10 and upper moving crosshead 40 is a moving intermediate crosshead 50. Mounted onto the lower side of this crosshead and in its centre is a holder 51 for a tubular upsetting tool 52 into which the piercing stem 42 is retracted when in its nonoperative position. Gags 53 can be moved by means such as hydraulic cylinder-and-piston assembly 54 and articulated piston rods 55 into the space between the lower ends of the sleeves 48 and the top of crosshead 50, so that this crosshead, together with the upsetting tool 52, is carried along during the descent of crosshead 40 and tool 42. Additional cylinders 56 and rams 57 respectively are provided for holding down crosshead 50 when crosshead 40 is lifted. Cylinders 58 and rams 59 are provided for the return of that crosshead.

The cylinders 37, 56 and 58 are mounted on the side members of an upright and substantially rectangular frame 60 of the press, the frame being mounted on the base 10 or connected therewith.

Arranged outside the press may be a station to which the billet container 11 can be moved. At this station, a pierced billet is ejected from the container by a pusher which enters the bore 14 from below, and a new billet can subsequently be placed into the bore 14. In between, the container may be cleaned, cooled and lubricated, or in any other way prepared for another operation. The ejecting station does not form part of the present invention and is therefore not illustrated in the drawings.

At the beginning of an operation, the parts of the press are in the position shown in FIG. 1, with the exception of back-up crosshead 20 which, with its shaft 22 and back-up stem 16, is in its lower position. The tools 42 and 52 are retracted and telescoped inside each other. The gags 53 are advanced into the gaps between the sleeves 48 and the intermediate crosshead 50. The container 11 with the billet B therein is now moved into the press from the outside station so as to be in axial alignment with the tools 42 and 52. The back-up crosshead 20 is then raised by the action of the cylinders 23 and rams 24, so that the stem 16 enters the ring die 15 and closes the bottom of the container bore. The billet B in the container now rests both on the ring die and the back-up stem.

Hydraulic pressure fluid is admitted to the cylinders 31 of crosshead 30 by way of ducts 36, pipes 34 and bores 33. This causes crossheads 30 and 40 and columns 43, 44 to descend. As the gags 53 are in their "in" position, crosshead 50 is carried along by this movement. Back-up crosshead 20, however, remains in the upper position as the cylinders 23 are pressurised. (Hydraulic pressure fluid may also be admitted at the same time to the hold-down cylinders 56). The tools 42 and 52 descend together and press on the top of the billet B so as to compact and upset it, thereby causing the billet to fill completely the cross-section of the bore 14. After this has been accomplished, the gags 53 are withdrawn.

The crossheads 30 and 40 and the columns 43, 44 continue their descent under the action of the pressure in the cylinders 31, but without the crosshead 50. Stem 42 enters the billet B and pierces it. As the bottom of bore 14 is closed by ring 15 and stem 16, the displaced billet material is forced to flow towards the wall of the bore 14, causing the pierced billet to increase in length, whereby the upsetting tool 52 is lifted slightly. Piercing continues

until only a relatively thin web of material is left at the bottom of the container 11. By this time, the crosshead 40 has descended so far that the lower flanges of the connectors 45 contact the upper ends of the sleeves 49. After sufficient pressure has been built up in the cylinders 31, the sleeves, and thereby the back-up crosshead 20, are pushed down, taking with them the shaft 22 and the stem 16. The piercer tool 42 continues its stroke and in doing so punches out the left-over web of billet material from the bottom of the pierced hole, thereby completing piercing. Descent of crosshead 20 is limited by the stops 29 on the rods 28. In practice, the piercing of the billet proceeds without any substantial interruption, including the punching-out of the web, as the starting-up of the back-up crosshead causes no appreciable delay.

Crossheads 30 and 40 are now stopped and then returned by pressurising cylinders 37, whereby piercing stem 42 is lifted out of billet B. The next step is the stripping of the stem from the billet. This is assisted by the upsetting tool 52 being maintained in contact with the top of the pierced billet thorugh pressurising hold-down cylinders 56, while stem 42 rises. The crosshead 20 with the shaft 22 and stem 16 is held in its lower position by the cylinders 26 and rams 27.

After retraction of piercing stem 42 from the pierced billet B, the upper faces of the connectors 45 engage the lower face of intermediate crosshead 50, causing the latter to be carried along by the upper movable crosshead 40, whereupon stem 42 and upsetting tool 52 are lifted together. Crosshead 50 is assisted in this movement by the pressurisation of cylinders 58.

With tools 42 and 52 and stem 16 out of the way, the container 11 can be slid out of the press along the rails 12 and 13 and moved to the outside station for the ejection of the pierced billet, loading with a fresh billet, and for any steps preparatory to the next operation. The back-up stem 16 is now moved up again into the space vacated by the contianer 11, so that the punched-out web can be removed from the top of this stem by a suitable implement. Alternatively, the container 11 may have a separate opening or attachment with an opening which can receive the punched-out web. Upon return of the container into the press, the opening with the punched-out web is moved into a position outside the press axis for ready removal of the web. After return of the container with a fresh billet, back-up crosshead 20 is raised by pressurising cylinders 23 until spacer ring 21 abuts from below against base 10. The press is now ready for the next operation.

What is claimed is:

1. A hydraulic press of the pull-down type, comprising a stationary base arranged at floor level and supporting a holder for a workpiece, a movable upper crosshead on which a piercing tool is mounted, a movable lower crosshead connected to said movable upper crosshead by columns, a movable back-up crosshead arranged between said base and said movable lower crosshead and mounting a back-up stem, and a hydraulic drive for the piercing tool which drive is partly arranged on said back-up crosshead and partly on said movable lower crosshead, so that upon the downstroke of said drive, the upper movable crosshead with the piercing tool is pulled down and performs its working stroke.

2. A hydraulic press of the pull-down type according to claim 1, in which the back-up crosshead is stationary during most of the piercing stroke and carried along by the downward movement of the upper and lower movable crossheads towards the end of the piercing stroke.

3. A hydraulic pull-down press as claimed in claim 1, in which the hydraulic drive for the piercing tool comprises one or more cylinder-and-ram units of which the cylinders are mounted on the movable lower crosshead and the rams on the movable back-up crosshead, or vice versa.

4. A hydraulic pull-down press according to claim 1, in which the hydraulic drive for the piercing tool comprises an even number of hydraulic cylinders and rams disposed symmetrically about the main axis of the press.

5. A hydraulic pull-down press according to claim 1, in which there is provided a separate upsetting tool mounted on an intermediate crosshead arranged between the base and the upper movable crosshead.

6. A hydraulic pull-down press according to claim 2, in which sleeves surrounding the columns project from the back-up crosshead, the top ends of said sleeves being normally spaced-apart from flanged elements connected to an intermediate movable crosshead, but are engaged by said flanged parts upon descent of said intermediate crosshead, whereby the back-up crosshead is carried along.

7. A hydraulic pull-down press according to claim 1, in which return cylinders for the hydraulic drive for the piercing tool are mounted on a separate stationary frame.

8. A hydraulic pull-down press according to claim 7, in which advance and return cylinders for the intermediate crosshead are mounted on the same stationary frame as the return cylinders for the hydraulic drive for the piercing tool.

No references cited.

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