Feb. 7, 1967 E. MÜLLER ET AL 3,302,445

HYDRAULIC DROP FORGING DEVICE

Filed Dec. 2, 1964 2 Sheets-Sheet 1

FIG. 1

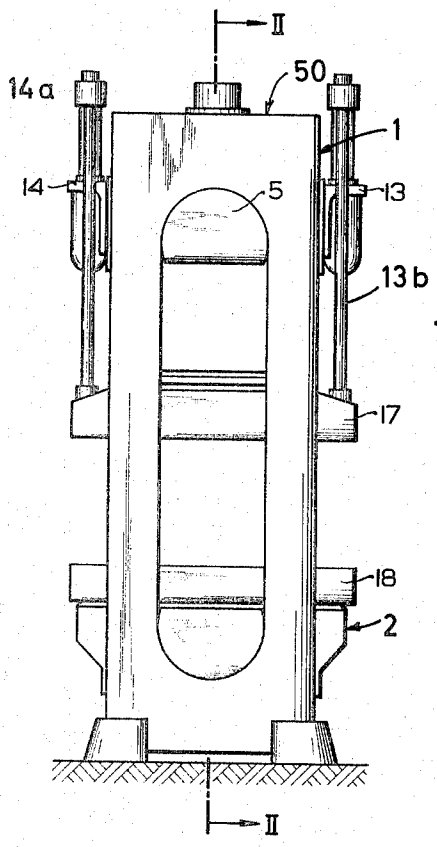
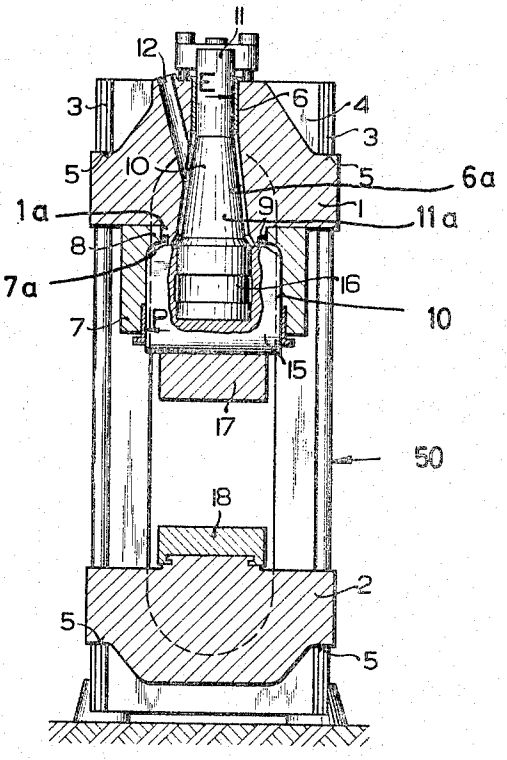


FIG. 2



INVENTORS

ERNST MÜLLER

ALBERT HERTL

By McGlew and Toren

ATTORNEYS

Feb. 7, 1967 E. MÜLLER ET AL 3,302,445

HYDRAULIC DROP FORGING DEVICE

Filed Dec. 2, 1964 2 Sheets-Sheet 2

FIG. 3

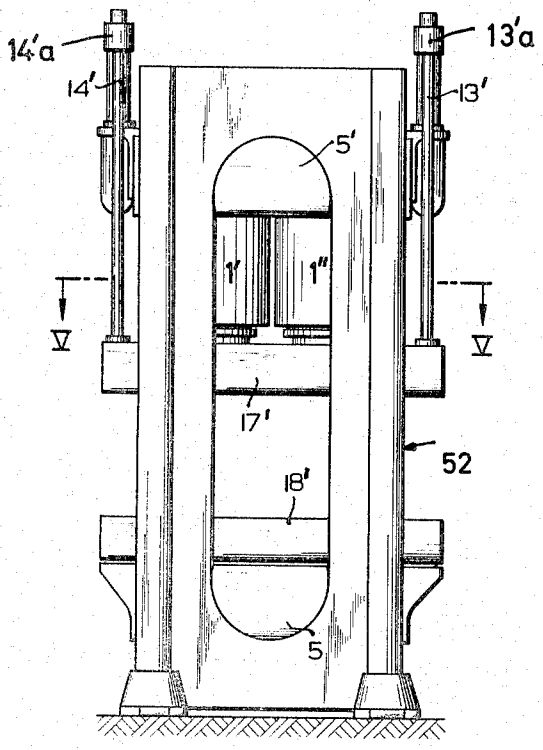


FIG. 4

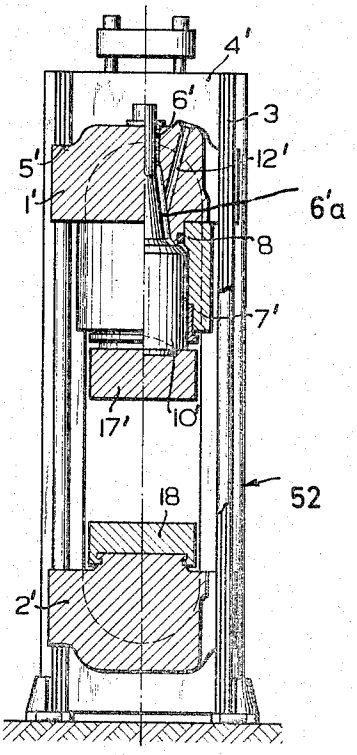
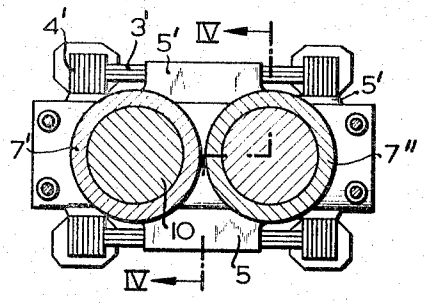


FIG. 5



INVENTOR
ERNST MÜLLER
ALBERT HERTL

By McGlew and Toren

ATTORNEYS

United States Patent Office 3,302,445 Patented Feb. 7, 1967

3,302,445

HYDRAULIC DROP FORGING DEVICE

Ernst Müller and Albert Hertl, both of Duisburg, Germany, assignors to Hydraulik G.m.b.H., Duisburg, Germany

Filed Dec. 2, 1964, Ser. No. 415,334
11 Claims. (Cl. 72—453)

This invention relates in general to hydraulic drop forging presses and in particular to a new and useful hydraulic drop forging press for extremely high pressure forces, particularly for the manufacturing of drop forged parts from light metal.

The over-all volume of a drop forged press of the type with which the present invention is concerned sometimes referred to as air-lift presses, is extremely great. For manufacturing reasons, a multi-part construction of the cross beams is usually employed and the various beam parts are generally made of cast steel joined by screw, tie rods, etc. into a unit. This method of construction of a multi-part cross beam is very expensive and the resultant press occupies a considerable space. The forging industry generally requires a press which is capable of producing very high forces in a relatively small space. Because such presses are subjected to eccentric pressure forces, the connecting elements between the upper and lower cross beams are subjected to bending stresses. In addition, oscillation of the press may be caused in this manner.

In accordance with the present invention, there is provided a press capable of satisfying all of the conditions set forth above by providing a construction in which the cross beam absorbs the bending moments and only tensile forces are transmitted to the connecting elements between the upper and lower cross beams. The eccentric forces which are introduced through the driving piston to the frame connected between the upper and lower cross beams are instead absorbed by the cross beams. This is accomplished by connecting a ring-shaped cylinder jacket to the upper cross beam.

In accordance with one embodiment of the invention, the cross beam is constructed as a cylinder member or cylinder bottom which accommodates a connecting rod extension for the main piston of the press cylinder. In this manner, the cast cross beam provides a bottom for the main press cylinder and a separate forged ring is attached onto the beam as a cylinder jacket for the pressure piston. The transmission of eccentric forces from the ring to the cross beam is effected by the internal pressure prevailing in the main press cylinder, which acts on a collar of the forged ring projecting on the inside of the cylinder.

According to the invention, a hydraulic forging press for extremely high pressure forces is so designed that a forged ring is arranged as a jacket of the working cylinder secured to the cross beam. The ring has an inwardly projecting collar with which it bears against and is connected to the cross beam. Internal pressure in the pressure cylinder causes the distribution of unbalancing or lateral forces through a shoulder of the forged ring and a driving piston which is guided with a shaft extension in the cross beam and in the pressure cylinder jacket. The design is such that the driving piston transmits the transverse forces acting on the working beam to the cylinder jacket and then to the cross beam. The effect of the inventive construction is that the making of the cross-beam as a cylinder beam permits a very advantageous production of a high force on a relatively small space and permits a balancing of the moments acting between the transverse forces in the upper cross beam and in the attached cylinder jacket as well as an absorption of any tensile forces in the connecting elements between the upper beam and the lower beam.

In accordance with one feature of the invention, the main pressure cylinder is divided into a bottom formed in the cross beam and a depending cylindrical jacket or ring which makes it possible to keep the over-all volume of the cylinder beam within economical limits and still effect a working with maximum pressure forces. The dropped forging press comprising a unit consisting of the cross beam, the attached cylinder jacket and the driving piston with a guide shaft make it possible to absorb the transverse forces, which occur frequently by the eccentric forces which appear during operation to be absorbed through the novel cylinder and beam construction. In this manner, the elements for connecting the upper and lower cross beams remain free of bending stresses because any bearing on the working beam will not cause a bending stress.

In accordance with a further modification of the invention, the cross beam may be designed to form the bottoms of two cylinders with two separate cylinder elements or rings being connected to the bottoms thereof. The rings form cylinder jackets under the cross beam for the separate pressure pistons.

According to another feature of the invention, the supporting shoulder pairs of the cross beams for the elements connecting the cross beams with each other, similar to columns or laminated frames are arranged in two planes forming an angle with each other. The shoulders are relatively simple and easy to produce and have the advantage of extremely high form stability. They also permit space saving and savings in cost for the manufacture in constrast to other known feed heads.

In a preferred arrangement, laminated frames are employed as beam connecting elements. The stability of such a press for extremely high pressure forces is particularly good if the laminated frames are arranged at angles, that is in two intersecting planes which form preferably a right angle with each other. Due to such an angular arrangement of the laminated frames, a rigid arrangement of the entire press is obtained.

Accordingly, it is an object of this invention to provide an improved hydraulic dropped forged press capable of operating to produce extremely high pressure forces in relatively small areas, and constructed such that any bending stresses produced are principally absorbed by the cross beam and pressure cylinder and are not transmitted to the parts connecting the upper and lower cross beams.

A further object of the invention is to provide a drop forge press in which the upper cross beam is formed as a cylinder for the pressure piston and has a connected part formed with lateral portions for absorbing any bending stresses so that they are not transmitted to the supporting frame elements.

A further object of the invention is to provide a drop forge press formed with the upper cross beam formed as one or two pressure cylinders preferably with an additional separate forged ring member forming the lower portion of the cylinder and constructed so that any lateral or bending stresses are absorbed by the cross beam and not distributed to the connecting frame members.

A further object of the invention is to provide a drop forge press having frame members connected between the upper and lower cross beams, which are preferably formed of a laminated steel in a plurality of individual sections advantageously arranged at an angle to each other.

A further object of the invention is to provide a drop forge press, which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating ad-

vantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and drescribed embodiments of the invention.

In the drawings:

FIG. 1 is a side elevational view of a drop forge press having a single cylinder constructed in accordance with the invention;

FIG. 2 is a section taken on the line 2—2 of FIG. 1;

FIG. 3 is an elevational view similar to FIG. 1 of another embodiment of the press;

FIG. 4 is a section taken on the line 4—4 of FIG. 5; and

FIG. 5 is a section taken on the line 5—5 of FIG. 3.

Referring to the drawings in particular, the invention embodied therein comprises in FIGS. 1 and 2 a drop forge press generally designated 50, which includes an upper cross beam generally designated 1 and a lower cross beam generally designated 2, which are connected with each other by laminated frames 3 and 4, which bear on similar shoulder portions 5, 5 of each of the cross beams 1 and 2.

In accordance with the invention, the upper cross beam 1 is constructed as a cylinder beam and is provided with an upper cylindrical bore 6 for slidably guiding a cylindrical extension 11 of the main pressure piston or driving piston generally designated 10. In addition, the upper cross beam 1 is provided with an intermediate cylindrical portion, having diverging side walls 6*a* for guiding an intermediate portion 11*a* of the driving piston 10. The underside of the cross beam 1 is provided with a threaded projection 1*a*, which is threaded to a ring or cylinder jacket 7 which forms the lower pressure cylinder for the driving piston 10.

The driving piston 10 can advantageously be made of a single piece together with the extension 11*a* and 11 or can be made in one or more parts. In the case illustrated, the outer or lower end of the piston 10 is provided with a cylindrical extension 16. In addition, a cylindrical head portion 15 is inserted over the extension 16.

A feature of the construction is that the ring 7 is provided with an internal ledge portion 7*a* and the cylinder head 15 is shaped so that any unbalancing forces acting on the piston head 16, such as when the head is operated to move the working beam 17 positioned therebelow, will be distributed to the ring and thence to the beam 1. The ring 7 is provided with an inwardly projecting collar which is threaded for the threaded engagement with the projecting portion 1*a* of the cross beam 1 and a packing 9 is advantageously provided to seal the cylinder at the upper end.

During operation of the press, fluid under pressure is delivered from a source (not indicated) connected to the pressure line 12 to the interior of the cross beam 1 at the location of the wall 6*a*. Admission of fluid under pressure will cause the downward movement of the piston 10 to effect the downward movement of the top saddle or working beam 17 toward a bottom saddle 18, which is retained on the top of the cross beam 2. Pull back elements or cylinders are mounted on each side of the frames 3 and 4 and are connected via piston 13*a* and 13*b* and 14*a* and 14*b*, respectively, to opposite ends of the working beam 17. The pull backs 13 and 14 operate in a known manner to cause the lifting of the working beam 17 during the operation and prior to admission of pressure fluid through the pressure fluid line 12 to cause the downward working movement of the working beam 17.

The construction of the ring 7 and the working beam 1 is such that any bending forces or laterally acting forces E will be absorbed by the cross beams so that no bending forces will be distributed to the connecting elements 3 and 4. Because all internal pressure generated in the ring cylinder above the piston head portion 15 is distributed to the ledge portion 7*a* and the flange 8 to the cross beam 1, the jacket or ring 7 provides a counter balance for the maximum torque against the cross beam 1 forming the cylinder bottom. Any laterally acting forces P are distributed to the driving piston 10 by the action of the working beam 17.

In FIGS. 3, 4 and 5, there is indicated a hydraulic drop forge, generally designated 52, having two operating cylinders formed by ring members or jackets 7′ and 7″, respectively. As indicated in the drawings, the remaining parts are quite similar and are similarly designated, but with a prime designation. As best indicated in FIG. 3, the cylinders 7′ and 7″ are arranged closely together and the driving pistons 10′ and 10″ therein act directly on a working beam 17′. Particularly, in FIG. 5, there is indicated the manner in which the laminated frames 3′ and 4′ are arranged at an angle to each other and (see FIG. 4) are connected to the associated beams 1′ and 2′.

It should be appreciated that, while in the embodiments illustrated the top working beam 1 has been indicated as forming at least the bottom portion of a pressure cylinder for the driving of the piston, in some instances, it is preferable to form the bottom working beam in this manner. Such arrangement may be advantageous, for example, in a so-called underfloor construction. While the laminated frames 3 and 4 provide a highly desirable construction, the upper and lower cross beam members may be connected together by other suitable connecting elements such as conventional columns arranged therebetween.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a hydraulic forging press for high pressure forces having a driving piston, a working beam attached to said piston, an upper and lower cross beam connected with each other by tension elements, the improvement comprising: a forged ring connected to said upper cross beam and arranged as a jacket of the working cylinder, said ring having an inwardly projecting collar at the interior thereof and being connected to said upper cross beam to distribute pressures from said working piston directly to the cross beam, said working piston being slidable in said ring and having a portion extending into said upper cross beam and being guided thereby.

2. A hydraulic forging press comprising a first cross beam, a second cross beam, frame means connecting said first and second cross beams together, at least one of said first and second cross beams being formed as a cylinder having a cylinder bore, a ring extending outwardly from the cross beam formed as a cylinder, said ring forming a pressure cylinder extending outwardly from the cylinder bore of the associated cross beam, a pressure piston having a working beam at its outer end and having a portion slidable in said pressure cylinder and having an extension slidable in said cylinder bore, said ring being shaped and being connected to the assocated cross beam in a manner to absorb forces produced by the action of the working beam and acting on said piston and transmitted through the fluid in the cylinder defined by said ring to distribute said forces to the associated cross beam, and fluid pressure means for reciprocating said piston.

3. A hydraulic forging press comprising a first cross beam, a second cross beam, frame means connecting said first and second cross beams together, at least one of said first and second cross beams being formed as a cylinder having a cylinder bore, a ring extending outwardly from the cross beam formed as a cylinder, said ring forming a pressure cylinder extending outwardly from the cylinder bore of the associated cross beam, a pressure piston having a working beam at its outer end and having a portion slidable in said pressure cylinder bore, said

ring being shaped and being connected to the associated cross beam in a manner to absorb forces produced by the action of the working beam and acting on said piston and transmitted through the fluid in the cylinder defined by said ring to distribute said forces to the associated cross beam, and fluid pressure means for reciprocating said piston, said ring being formed separate from said cross beam and being connected thereto and having an internal collar provided for distributing unbalancing forces to the associated working beam.

4. A hydraulic forging press, according to claim 3, including two rings arranged side-by-side and connected to the same cross member, each of said rings forming a pressure cylinder and each having a pressure piston with a working beam at one end slidable therein.

5. A hydraulic forging press, according to claim 3, wherein said frame means connecting said first and second cross beams include a plurality of laminated frame elements arranged at an angle to each other.

6. A hydraulic forging press, comprising an upper cross beam, a lower cross beam, frame means connecting said upper and lower cross beams, said upper cross beam having a bore, a forged ring connected to the underside of said upper cross beam and defining a pressure cylinder in alignment with the bore of said upper cross beam, a pressure piston slidable in said pressure cylinder and having an extention portion slidable in the bore of said cross beam, means on the interior of said ring and said pressure piston defining a chamber for the absorption of laterally acting forces acting through said piston and effective to distribute such forces to said cross beam, and fluid pressure means for reciprocating said piston.

7. A hydraulic forging press, comprising an upper cross beam, a lower cross beam, frame means connecting said upper and lower cross beams, said upper cross beam having a bore, a forged ring connected to the underside of said upper cross beam and defining a pressure cylinder in alignment with the bore of said upper cross beam, a pressure piston slidable in said pressure cylinder and having an extension portion slidable in the bore of said cross beam, means on the interior of said ring and said pressure piston defining a chamber for the absorption of laterally acting forces acting through said piston and effective to distribute such forces to said cross beam, fluid pressure means for reciprocating said piston, said fluid pressure means comprising means for directing fluid under pressure to the bore of said cross beam, and separate fluid actuated means for returning the working beam and said piston.

8. A hydraulic forging press, comprising an upper cross beam, frame means connecting said upper and lower cross beams, said upper cross beam having a bore, a forging ring connected to the underside of said upper cross beam and defining a pressure cylinder in alignment with the bore of said upper cross beam, a pressure piston slidable in said pressure cylinder and having an extension portion slidable in the bore of said cross beam, means on the interior of said ring and said pressure piston defining a chamber for the absorption of laterally acting forces acting through said piston and effective to distribute such forces to said cross beam, and fluid pressure means for reciprocating said piston, said cross beam having a relatively uniform bore portion in which the extension of said piston is slidable and further including a bore portion with diverging walls, said piston having an intermediate portion between the portion in said ring and the extension portion which is slidable in the intermediate bore of said cross beam.

9. A hydraulic forging press, comprising an upper cross beam, a lower cross beam, frame means connecting said upper and lower cross beams, said upper cross beam having a bore, a forged ring connected to the underside of said upper cross beam and defining a pressure cylinder in alignment with the bore of said upper cross beam, a pressure piston slidable in said pressure cylinder and having an extension portion slidable in the bore of said cross beam, means on the interior of said ring and said pressure piston defining a chamber for the absorption of laterally acting forces acting through said piston and effective to distribute such forces to said cross beam, and fluid pressure means for reciprocating said piston, said cross beam having a relatively uniform bore portion in which the extension of said piston is slidable and further including a bore portion with diverging walls, said piston having an intermediate portion between the portion in said ring and the extension portion which is slidable in the intermediate bore of said cross beam, said fluid pressure means for reciprocating said piston including means for directing fluid under pressure to the intermediate bore portion of said cross beam.

10. A hydraulic forging press, comprising an upper cross beam, a lower cross beam, frame means connecting said upper and lower cross beams, said upper cross beam having a bore, a forged ring connected to the underside of said upper cross beam and defining a pressure cylinder in alignment with the bore of said upper cross beam, a pressure piston slidable in said pressure cylinder and having an extension portion slidable in the bore of said cross beam, means on the interior of said ring and said pressure piston defining a chamber for the absorption of laterally acting forces acting through said piston and effective to distribute such forces to said cross beam, and fluid pressure means for reciprocating said piston, an additional forged ring extending outwardly from said cross beam and forming a pressure cylinder, said cross beam having a second bore in alignment with the pressure cylinder of the additional ring, and an additional pressure piston slidable in said additional pressure cylinder and having an additional extension slidable in said additional cylinder bore.

11. A hydraulic forging press, comprising an upper cross beam, a lower cross beam, frame means connecting said upper and lower cross beams, said upper cross beam having a bore, a forged ring connected to the underside of said upper cross beam and defining a pressure cylinder in alignment with the bore of said upper cross beam, a pressure piston slidable in said pressure cylinder and having an extension portion slidable in the bore of said cross beam, means on the interior of said ring and said pressure piston defining a chamber for the absorption of laterally acting forces acting through said piston and effective to distribute such forces to said cross beam, and fluid pressure means for reciprocating said piston, said frame means comprising separate frame elements extending at an angle from each other.

No references cited.

WILLIAM W. DYER, JR., *Primary Examiner.*

HARRISON L. HINSON, *Examiner.*