

Nov. 5, 1968

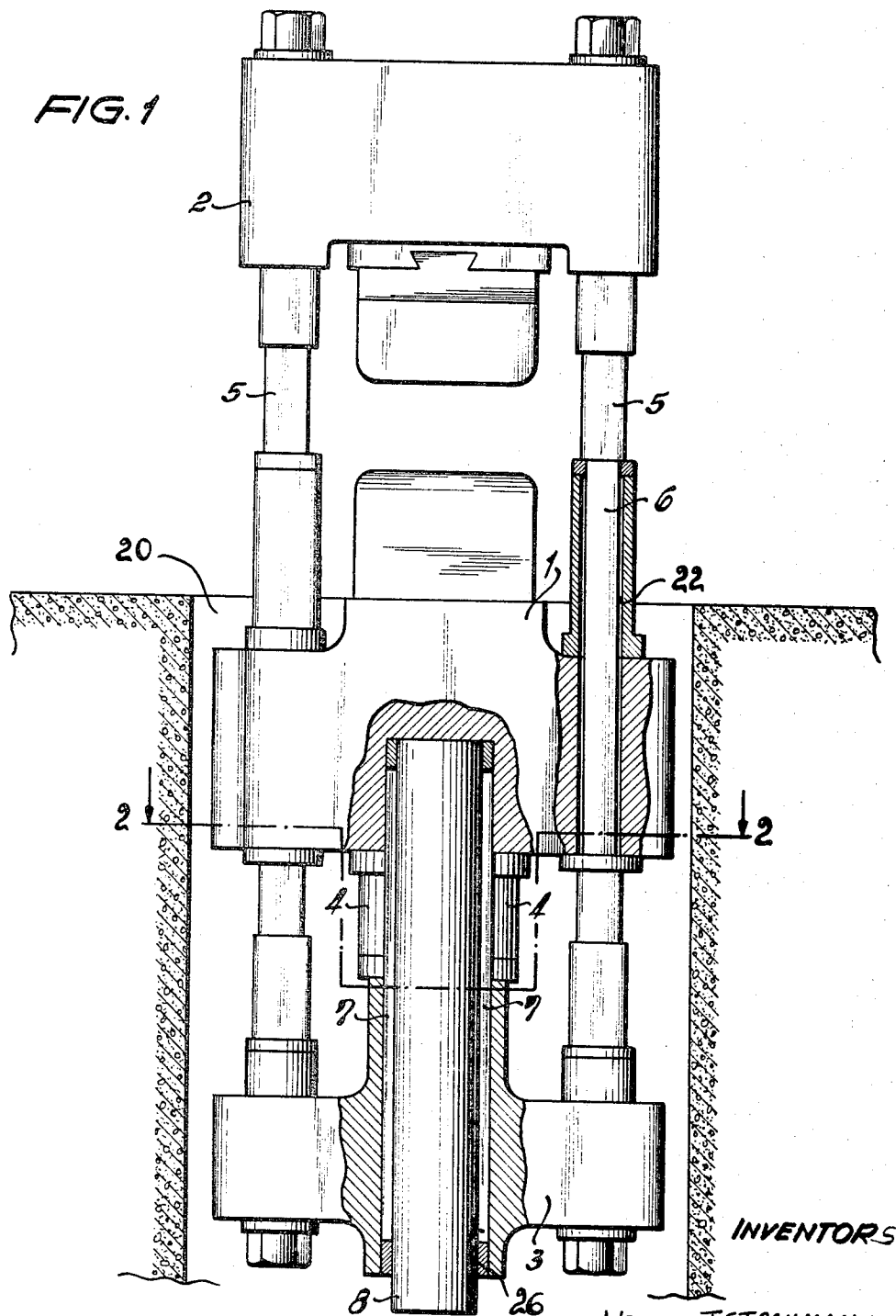
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3,408,849

HYDRAULIC FORGING PRESS

Filed Nov. 17, 1965

3 Sheets-Sheet 1



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FIG. 2

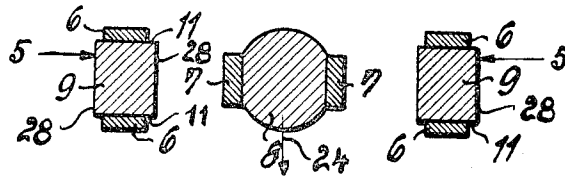


FIG. 3

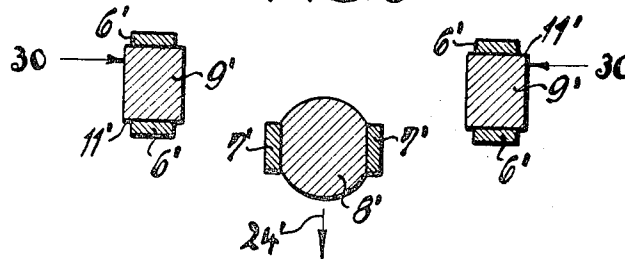
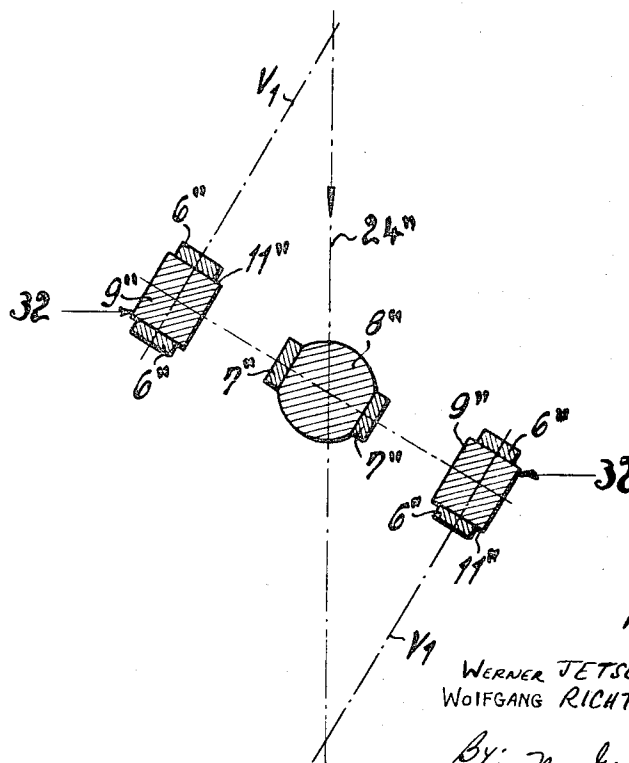


FIG. 4



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FIG. 5

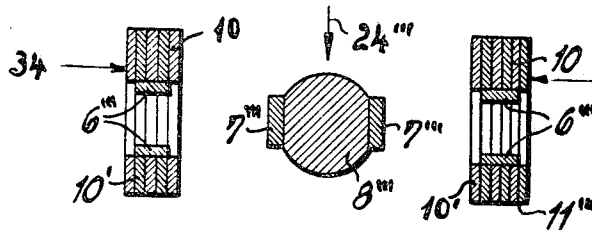


FIG. 6

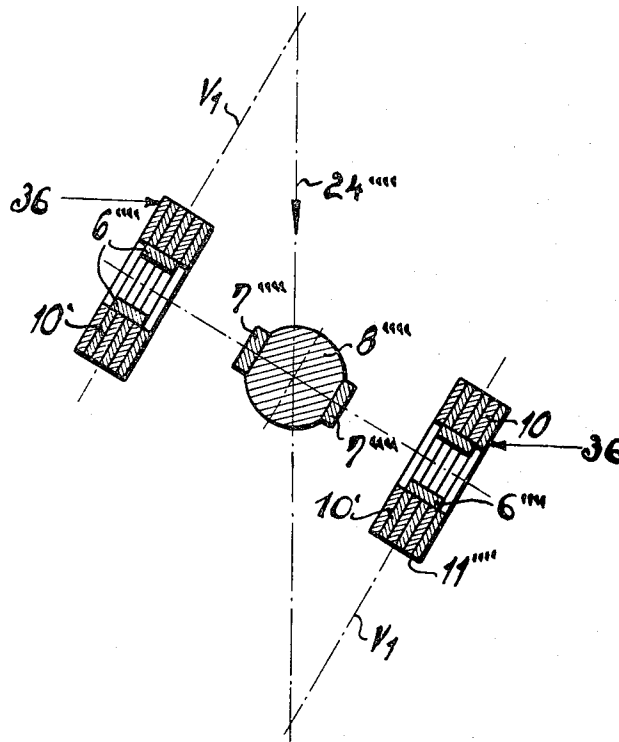
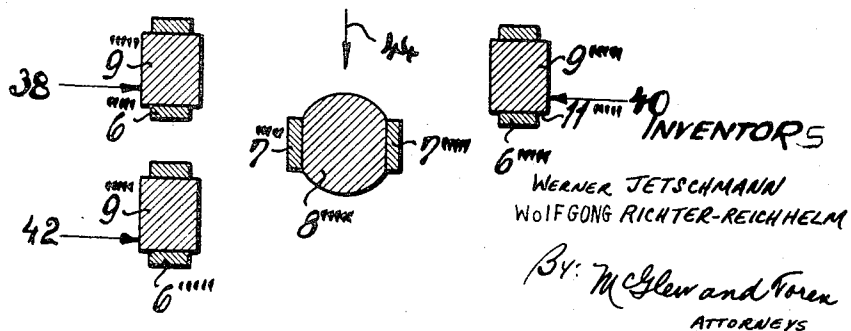


FIG. 7



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HYDRAULIC FORGING PRESS

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11 Claims. (Cl. 72—453)

ABSTRACT OF THE DISCLOSURE

A forging press of a type having less than four tension elements or guiding columns is constructed to have sufficient rigidity for forging but provides a construction with improved sight conditions and easier accessibility. The press is made rigid by using two or three tension elements and in addition a central guide shaft which extends downwardly from the foundation cross member. The guide shaft increases the stability of a two or three tension element press and the construction is made to have optimum stress absorption in a forging direction by employing tension elements with rectangular cross section which are provided with flat guides in the direction of the load or which are inclined in the direction of the load. In addition, the guide shaft is provided with a flat guide and the position of the guide is selected to be at right angles to the position of the guides on the tension elements.

This invention relates, in general, to the construction of hydraulic forging presses and, in particular, to a new and useful hydraulic forging press of the underfloor type and which includes a fixed lower tool carrier forming a foundation beam and a movable upper tool carrier which is part of a movable frame including a lower traverse which is connected to the upper tool carrier by tension elements and wherein the tension elements are guided by a flat guide formation extending into guideways in directions at an angle to the forging direction.

Due to the eccentric forces which occur in forging, the press is subjected to relatively high bending stresses, particularly the moving press parts. The invention is concerned particularly with a forging press in which the lower tool carrier is fixed or forms a foundation beam having guideways on each side thereof for the guiding reciprocation of tension elements which interconnect an upper tool carrier forming an upper cross beam and a lower traverse connecting the tension elements below the foundation beam. It is therefore necessary that the bending stresses be absorbed by a suitable design in order to prevent the moving press frame from bending under eccentric load. The ordinary column guides which have been provided heretofore for the reciprocation of the moving press frame cannot adequately absorb such bending stresses. The present invention is based on the finding that in a forging press of an underfloor type with four or more beam-connecting tension elements for the moving frame a rigid arrangement is provided insuring the stability of the press. In this case, the moment of force appearing in an eccentric forging must be kept off the beam connecting the tension elements of the moving press frame by one or more fully effective circular guides which are arranged on the lower fixed tool carrier and extend therebelow. By the provision of such a central guide, the dynamic behavior of the entire press is further improved and swinging of the press is practically impossible. However, in forging presses of the underfloor type with only two or three beam-connecting tension elements for the moving frame, the bending stresses resulted from eccentric loads can no longer be effectively absorbed by one or more circular guides arranged to depend from the lower tool carrier.

It is known to provide a guide for a press frame of a

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double column press using a three point system according to the principle of the central shaft guidance in which a piston is rigidly secured to the lower tool carrier and is guided in a central shaft arranged thereabove. The inclination of the two columns of the moving frame is taken into account by a support of the column guide bushings in calottes.

In a three column press having columns arranged as in a four column press, but omitting one column, the moving press frame is only guided on the beam connecting columns. Flat guides or formations arranged parallel to the forging direction are provided on the column and oriented diagonally to the forging direction. On a third column, the guides or formations are staggered by 90° to absorb the bending stresses resulting from eccentric loads. When using flat guides which merely support the column, the optimum absorption of the bending stresses is not ensured.

The problem of the present invention is to ensure the optimum absorption of the bending stresses in a forging press of the underfloor type with two or three beam-connecting tension elements both in the directions of forging and transverse thereto and in making tilting of the tension elements practically impossible. In accordance with the invention, this is achieved by the use of tension columns or frame plates and a central guide shaft and wherein each of the tension columns and guide shafts are provided with outwardly extending flat guide formations. The guide formations are so arranged that the maximum resistance moment exists in the direction of the forging. In accordance with one embodiment of the invention it has been found that this may be accomplished by providing flat guide projections on the narrow sides of the columns and frame plates which face the forging direction. One each of these sides is arranged a flat guide or projection which extends outwardly along a length of the associated column to provide sufficient ruggedness to absorb the component of the bending moment acting in the forging direction. It has also been found advantageous to provide a central guide shaft with a rugged outwardly extending flat guide formation which extends at a right angle to the main guides arranged on one side of the central guide. This guide formation absorbs the component of the bending moment which acts transversely to the forging direction. By using the above-mentioned arrangement, the bending stresses are absorbed in a most favorable manner and tilting of the beam-connecting elements and swinging is practically impossible.

Accordingly, it is an object of the invention to provide a hydraulic forging press having a lower tool carrier arranged in a fixed location forming a foundation beam and with a movable frame guided by the foundation beam including an upper tool carrier beam, a lower transverse beam arranged below the foundation beam, and connecting tension elements which are slidable in columns formed on the lower tool carrier foundation beam, and further including a central guide shaft for guiding the movement of the lower traverse of the frame and wherein guide formations are formed on the tension elements and the guide shaft which engage in suitable guideways formed on the foundation and the lower transverse beam and are oriented to absorb the bending stresses which may act on the movable frame.

A further object of the invention is to provide a drop forge press of the underfloor type having means for guiding a movable frame carrier in a manner to avoid undue bending stresses.

A further object of the invention is to provide a forging 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 advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

In the drawings:

FIG. 1 is a partial elevational and transverse sectional view of a double column drop forge press and constructed in accordance with the invention;

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

FIGS. 3 to 7 are sections similar to FIG. 2 of alternate embodiments of the invention.

Referring to the drawings in particular, the invention embodied therein includes an underfloor type forging press comprising a lower tool carrier or foundation beam 1 which forms the foundation for the press and is fixed in a ground excavation 20. An upper tool carrier or moving press beam 2 is part of a moving frame which also includes a lower traverse 3 arranged below the lower tool carrier 1 and inter-connecting tension elements or guide shafts generally designated 5 between the press beam 2 and the lower traverse 3. The upper tool carrier 2 and the lower traverse 3 are interconnected by the tension elements 5, 5 at each end which are constructed in the form of columns of frame plates. The frame assembly is guided for reciprocal movement by guideways 22 formed in the foundation beam 1.

In accordance with the invention, the bending stresses resulting from the eccentric load (in forging presses having either the two tension elements 5, 5 or three such beams (38, 40 and 42 in FIG. 7) which connect the upper tool carrier 2 and the lower traverse 3) are absorbed in a forging direction as indicated by the arrow 24 in FIG. 2. In order to effect this, the foundation beam 1 is provided with a depending guide shaft 8 which moves in guideways 26 formed on the lower traverse 3.

In one embodiment of the invention, the guide shaft 8 and the tension elements 5, 5 are all provided with flat guide formations or projecting guides designated 6, 6 for the tension elements 5, 5 and 7, 7 for the guide shaft 8.

In the embodiment of FIGS. 1 and 2, the flat guides 6 are arranged to face the forging direction or to extend parallel to the forging direction and the flat guides 7 on the central guide shaft 8 are arranged at right angles thereto. The arrangement of the flat guides on the tension elements 5 and 5 and on the guide shaft 8 ensures the optimum absorption of the bending stresses resulting from the eccentric load of the moving press frame. In the embodiment indicated in FIGS. 1 and 2, the tension elements 5 advantageously include central rectangular cross sectioned frame plates 10 with the guide elements 6 on the narrow dimension faces forming rectangular projections of lesser width and which extend away from a side which is facing the forging direction and the opposite side. The columns 9 are advantageously formed with sides 11 which are slightly narrower than sides 28. By orienting the longer side 28 in this manner, the maximum resistance moment of the column will exist in the forging direction and the flat guides 6 absorb the component of the bending stresses appearing in the forging direction. In some instances it is also desirable to include flat guides similar to the guides 6 on the long sides 28, 28.

The central guide shaft 8 is similarly provided with sufficiently long and strong flat guides 7, 7 on each side. The guides 7 are arranged on the shaft 8 so that they are always disposed or project at a right angle to the flat guides 6. The flat guides 7 absorb the component of the bending stresses acting transverse to the forging direction.

In the embodiment of FIG. 3, two columns 30, 30 are provided on each side of a central guide shaft 8'. Guide shaft 8' is not arranged centrally between the columns 30, 30 but is offset in respect thereto. The flat guides 6'

and 7' are provided on the columns 30, 30 and central shaft 8' in the manner similar to the embodiment of FIGS. 1 and 2.

In the embodiment of FIG. 4, the columns 32, 32 are arranged on each side of the central guide shaft 8'' with the center line of all three being disposed at an angle to the forging direction indicated by the arrow 24''. The flat guides 6'' and 7'' are shown inclined to the forging direction and their extension lines intersect the forging axis.

In the embodiment of FIG. 5, tension elements or columns 34, 34 are provided on each side of a central guide shaft 8'''. In this embodiment, the columns 34 comprise spaced column elements 10 and 10' each made up of a plurality of flat plates which are bonded together. Flat guides 6''' and 7''' are arranged in a manner similar to the embodiments of FIGS. 1 and 2.

FIG. 6 is similar to FIG. 5, with the exception that the centers of the shaft 8'''' and the columns 36 and 36 are on a line which extends at an angle from the forging direction 24''''.

In the embodiment of FIG. 7, three separate columns are employed 38, 40 and 42. Columns 38 and 40 are arranged on each side of a central shaft member 8''''' but are offset from the axis thereof. The column 42 is offset from the axis, but on the opposite side from the columns 38 and 40. The forging direction is indicated by the arrow 44. The columns 38, 40 and 42 are all provided with central column portions 9''''' and with projections 6''''' as in the other embodiments. The central column 8''''' is also provided with projections 7''''' as in the other embodiments.

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. A hydraulic forging press of the underfloor type comprising a lower tool carrier foundation beam having a plurality of tension element guideways in a number in excess of one but less than four defined therethrough, a movable frame including an upper tool carrier beam above said foundation beam, a lower transverse beam below said foundation beam and having a central shaft guideway, a tension element guided in each of said guideways and connected between said upper tool carrier beam and said lower transverse beam, and a guide shaft depending centrally below said lower tool carrier foundation beam and guided in said central shaft guideway, said guide shaft and said tension elements having a projecting flat guide formation on at least one face with at least one flat guide formation extending in a direction substantially parallel to the forging direction and at least one flat guide formation extending at an angle to the forging direction.

2. A hydraulic forging press according to claim 1, wherein there is a single tension element arranged on each side of said central guide shaft.

3. A hydraulic forging press according to claim 1, wherein there is a single tension element on each side of said central guide shaft in alignment with said guide shaft.

4. A hydraulic forging press, according to claim 1, including a single tension element on each side of a central guide shaft in alignment with said central guide shaft, said central guide shaft having a projecting flat guide formation extending outwardly from each side thereof in a direction substantially perpendicular to the forging direction.

5. A hydraulic forging press according to claim 4, wherein each of said tension elements have narrow sides arranged to face parallel to the forging direction, said narrow sides having said flat guide formations projecting outwardly therefrom.

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6. A hydraulic forging press according to claim 1, wherein said tension elements are offset laterally from said central guide shaft.

7. A hydraulic forging press according to claim 6, wherein said tension elements have an axis in alignment with said central shaft, the axis being at an angle to the forging direction. 5

8. A hydraulic forging press according to claim 1, wherein there is a single tension element on each side of said central shaft member, each of said tension elements comprising a block of a plurality of connected flat plate elements. 10

9. A forging press according to claim 8, wherein said flat plate elements of each tension element are arranged in two opposed sets each having opposing faces having said flat guide formations projecting toward the other element. 15

10. A hydraulic forging press according to claim 9, wherein said tension elements are disposed with their central axis in alignment with the axis of said central shaft member and at an angle to the forging direction. 20

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11. In a hydraulic forging press according to claim 1, wherein there are three tension elements with two of said elements being arranged on one side of the central line of said central shaft member and the other on the opposite side and all of said tension elements having flat guide projections extending outwardly from each side thereof in a direction substantially parallel to the forging direction.

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