Feb. 25, 1941. F. W. SPENCER 2,232,889

HIGH-SPEED FORGING PRESS

Filed March 13, 1939 3 Sheets-Sheet 1

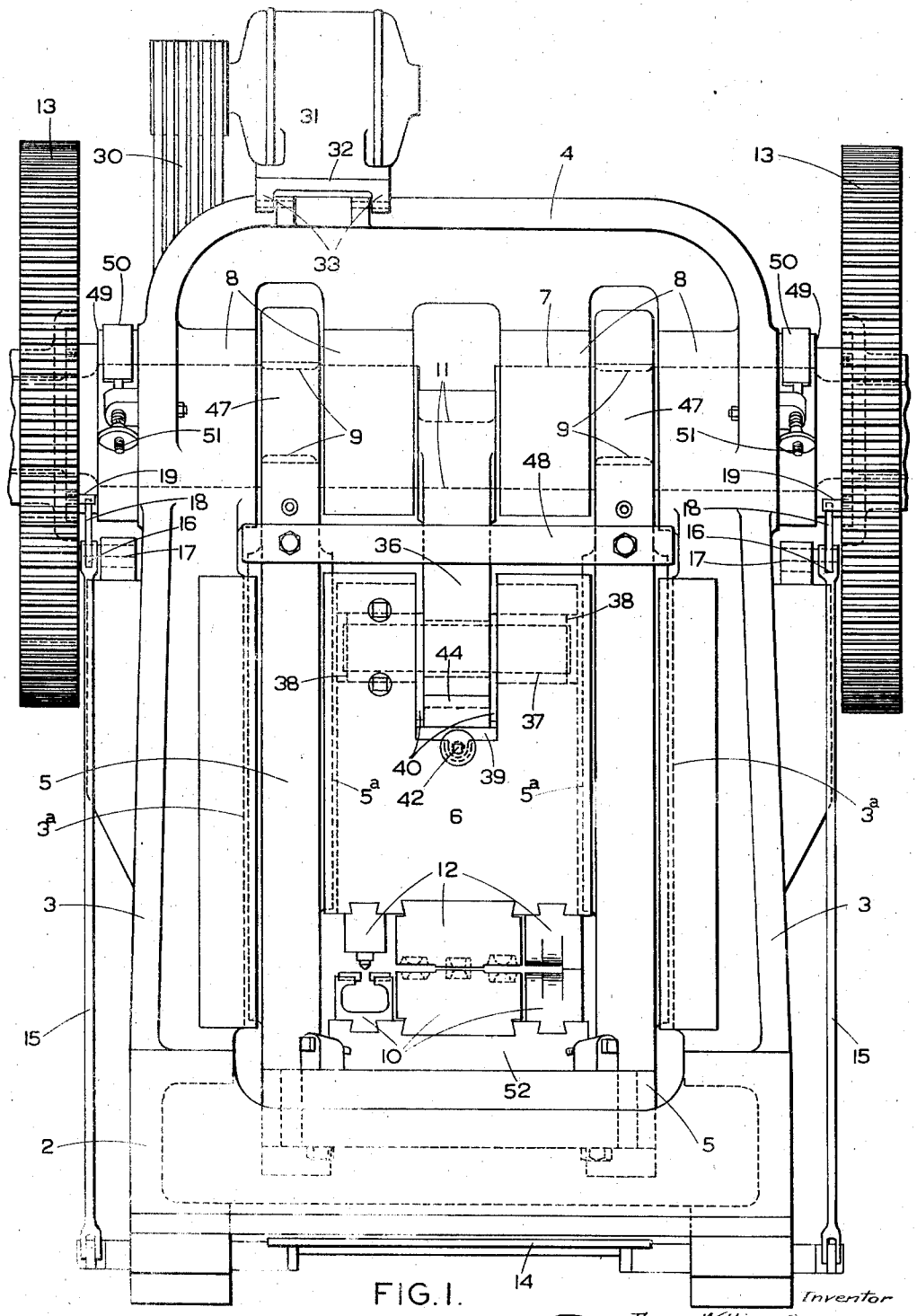


FIG. 1.

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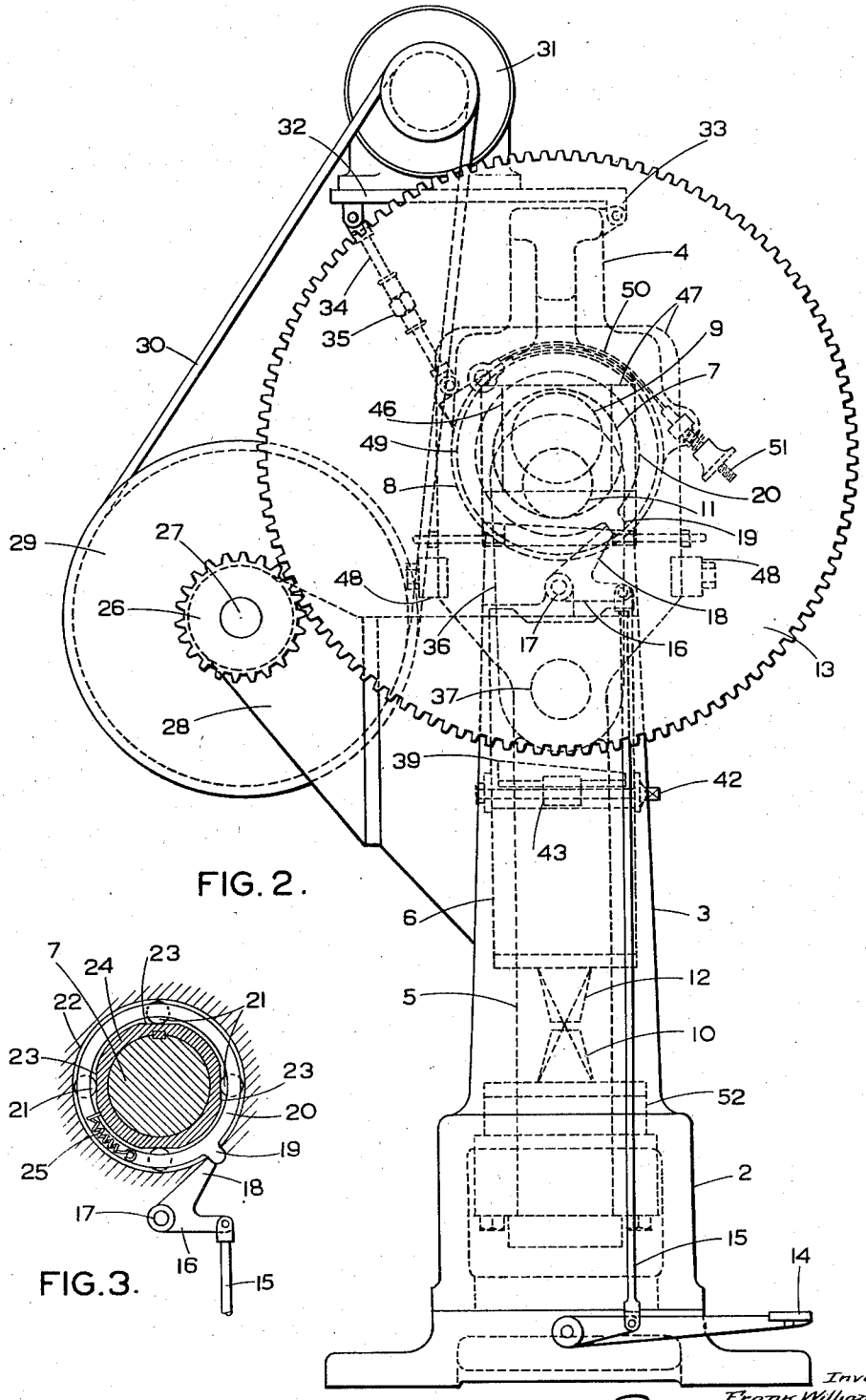


FIG. 2.

FIG. 3.

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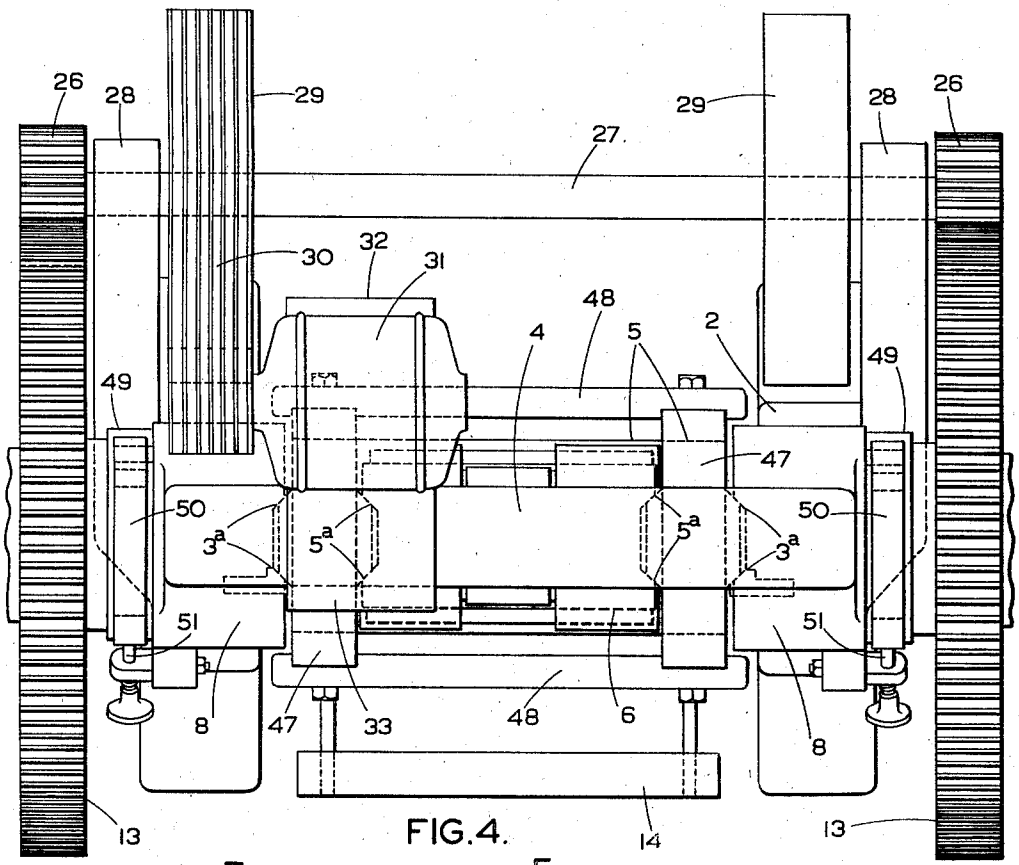
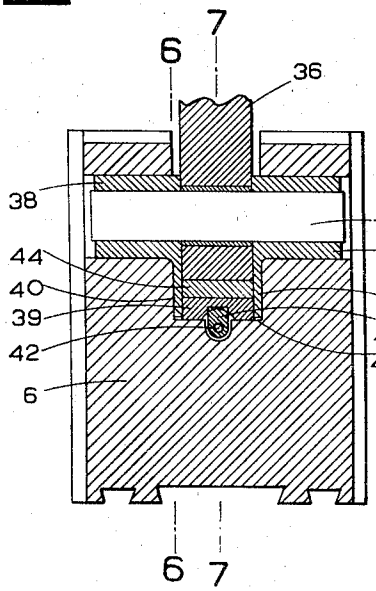
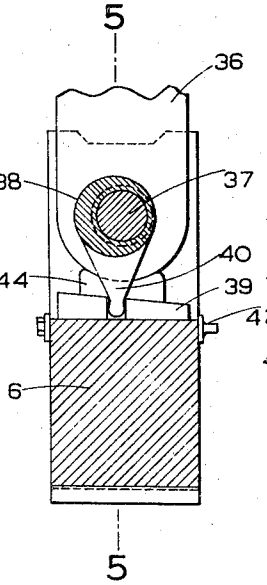


FIG. 4.



6 7

FIG. 5.



5

FIG. 6.

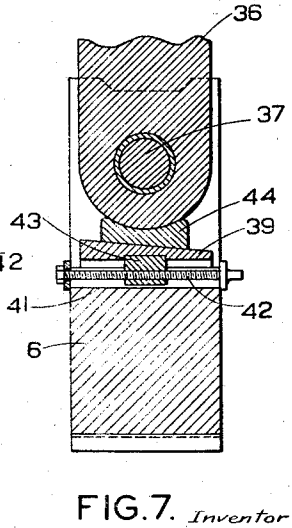


FIG. 7.

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Patented Feb. 25, 1941 2,232,889

UNITED STATES PATENT OFFICE

2,232,889

HIGH-SPEED FORGING PRESS

Frank William Spencer, Hayle, England

Application March 13, 1939, Serial No. 261,599
In Great Britain December 23, 1938

8 Claims. (Cl. 78—20)

This invention relates to an improved forging press and has for its object to provide a construction and mode of operation which combines all the advantages of the existing type of crank press with those of a drop hammer, breaking down hammer and trimming press.

A further object of the invention is to provide a forging press capable of a high speed of operation so that the output per machine can be considerably increased.

Another object of the invention is to provide a mechanically operated forging press capable of performing a plurality of different operations on a wide variety of work.

The improved machine may be defined as a double-action twin-drive forging press and comprises briefly a stationary rigid frame, a bottom-die-carrying member slidably arranged therein, a top-die-carrying member slidably mounted in the first member, and a crank-shaft rotatably mounted in said frame and operatively connected with said members for simultaneously reciprocating the latter in opposite directions towards and away from each other.

In the accompanying drawings,

Figure 1 is a front elevation of the improved forging press.

Figure 2 is a side elevation thereof.

Figure 3 is a detail view of one of the roller clutches.

Figure 4 is a plan view of the machine.

Figure 5 is a detail sectional view on the line 5—5 of Figure 6 showing the fine adjustment means for the ram.

Figure 6 is a vertical sectional view on the line 6—6 in Figure 5.

Figure 7 is a vertical sectional view on the line 7—7 in Figure 5.

Throughout the drawings like parts are designated by similar reference characters.

Referring to the drawings the stationary rigid frame of the machine is of heavy section cast-iron comprising a box-section transverse base member 2 open at the top, a pair of vertical T-section side members 3, 3 and a transverse girder-section top member 4.

The bottom-die-carrying member consists of a forged steel U-shaped frame 5 and is arranged to slide vertically between guides 3a carried by the vertical members 3, 3 of the main frame.

The top-die-carrying member consists of a ram 6 which is either forged or made of cast steel and is arranged to slide vertically between guides 5a on the inner faces of the limbs of the U-shaped frame 5.

The crank-shaft 7 is rotatably mounted in bearings 8 carried by the upper part of the main frame and is of large diameter with three cranks machined out of the solid, none of the crank pins extending beyond the periphery of the shaft. The outer cranks 9, 9 are connected one to each limb of the U-shaped frame 5 carrying the bottom dies 10. The centre crank 11 is connected with the ram 6 carrying the top dies 12 and is arranged at 180° to and has a greater throw than the outer cranks.

The operation of the machine is such that as the crank-shaft rotates the top and bottom dies carried respectively by the ram and the U-shaped frame advance towards and recede from each other, the bottom dies having half the travel of the top dies.

The crank-shaft is preferably driven from both ends for which purpose each end where it protrudes from its adjacent bearing 8 in the main frame is fitted with a gear wheel 13 of large diameter. Each of these gear wheels is mounted upon a clutch which in view of the large diameter of the crank-shaft may be of the roller type shown in Figure 3. By employing a sufficiently large number of rollers the load per roller is reduced and the machine may be started instantaneously without shock. The said clutches are under the control of the operator by means of a pedal 14 which is connected by means of rods 15 with bell crank levers 16 pivoted on the main frame at 17. One arm 18 of each of these levers abuts against a projection 19 carried by a cage 20 carrying the rollers 21. The rollers work between a hard steel ring 22 in the gear wheels and the flat cam faces 23 of a hard steel ring 24 fixed to the crank shaft 7. The cage is connected with a part rotating with the crank-shaft, such as the ring 24, or a brake drum, by means of a tension spring 25 which normally tends to turn the cage in the direction of rotation of the gear wheel to bring the clutch into operation. When the machine is at rest the arms 18 of the bell crank levers engage the projections 19 and hold the cages 20 in the position shown in Figure 3 in which the rollers 21 are in their inoperative positions allowing the gear wheels 13 to rotate idly. In starting the machine the operator depresses the pedal 14. This moves the arms 18 of the bell crank levers out of engagement with the projections 19 on the roller cages which are then turned by their springs 25 to bring the rollers into their operative positions between the rings 22 and 24 and establishing an

instantaneous drive between the gear wheels and the crank-shaft.

The two gear wheels 13 are driven simultaneously by means of pinions 26 keyed to a countershaft 27 carried in bearings in brackets 28 formed on or attached to the rear of the main frame. The said countershaft carries a pair of fly-wheels 29 one of which is arranged to be driven by means of a belt 30 from an electric motor 31 mounted on a platform 32 at the top of the machine. The said platform is pivoted at one end 33 to the top transverse member 4 of the main frame and is supported at the other end by a pair of adjustable stays 34 pivotally secured at their other ends to the main frame. By means of this arrangement the tension of the driving belt 30 can be adjusted by lengthening or shortening the length of the stays by turning the nuts 35.

Friction slipping devices of any well known and suitable kind are introduced between the fly wheels and the countershaft so that in the event of displacement of the billet outside the die impression, or through excessive overload caused in any other way, the fly wheels 29 can slip on the countershaft and in this way release the kinetic energy of the fly wheels and prevent damage to the machine.

Alternatively, the two gear wheels may be keyed to the crankshaft, in which case a single flywheel constantly rotating on a sleeve is coupled to the pinion shaft by means of a pedal controlled friction clutch.

The centre crank 11 of the crank shaft is connected with the ram 6 by means of a connecting rod 36 and pin 37 and provision is preferably made for fine adjustment of the stroke of the ram carrying the top dies 12 relatively to that of the U-shaped frame 5 carrying the bottom dies 10. For this purpose, as shown in Figures 5, 6 and 7, two eccentric sleeves 38 are introduced between the pin 37 and its bearing in the ram 6 and are adapted to be partially rotated simultaneously and to an equal extent to raise or lower the ram by means of an adjustable block 39 which is recessed to receive the ends of arms 40 on the eccentric sleeves and is arranged to slide in a direction at right angles to the axis of said sleeves in a recess 41 in the ram under the influence of a rotatable screw 42 carrying a nut 43 engaging the block 39. The upper surface of the latter is inclined in the direction of its length and co-operates with a metal pad 44 engaging the end of the connecting rod 36, the arrangement being such that, when the block 39 is adjusted to raise or lower the ram, the pad is maintained in contact with the connecting rod thereby providing a solid abutment between the latter and the ram at all positions of adjustment.

The outer cranks 9, 9 of the crank-shaft engage blocks 46 which are free to slide laterally in housings 47 formed or attached to the limbs of the U-shaped member 5 which are preferably braced together at their upper ends by means of a pair of transverse bars 48.

The crankshaft is provided at each side with a brake drum 49 having an adjustable brake band 50 embracing the top portion thereof and anchored at each end to the main frame. The pressure of these bands on their drums is adjusted by means of the screws 51. The said brake drums are preferably slightly eccentric and arranged so that the maximum braking effect occurs when the ram is at the top of its stroke.

There may be any desired number of top and bottom dies. In the example shown in Figure 1 the centre dies have three impressions of progressive depths, the finishing impression being preferably in the middle. In the case shown there is also a set of dies at the right hand side for fullering, flattening and cutting off and a trimming punch and die at the left hand side.

Major adjustments of the height of the bottom dies can be made by using bolsters 52 of varying thicknesses or by means of a wedge plate under the bolster.

The improved machine has many advantages apart from its primary function. For example, it is possible by balancing the masses of the oppositely reciprocating parts to operate the machine at high speeds and to eliminate the use of air cylinders and other devices, such as are required to balance the ram in the usual type of press. Moreover, since part of the stroke of the press is provided by the two outer cranks it is possible to obtain more daylight between the top and bottom dies for a crank-shaft of a given size. Again, since the stresses set up during the forging operation are carried by the crank-shaft and the U-shaped frame there is no necessity to brace the main frame as is the case in an ordinary press in which only the top dies are operated.

The improved machine is particularly useful in cases where components of non-ferrous and light alloys require gradual reduction and a squeeze rather than a blow such as is given by a drop hammer. It is also an advantage for the operator to be able to trim the flash and examine for defects without leaving the machine particularly in the case of alloy steels that have to be trimmed hot.

I claim:

1. A forging press comprising a stationary rigid frame, die-carrying members movable therein, a crank-shaft operatively connected with said members and adapted to move the latter simultaneously in opposite directions to cause the respective dies of said members to approach and recede from each other, eccentric bushes between one of said members and its connection with said crank-shaft, and means for rotating said bushes for adjusting said member in relation to the other.

2. A forging press comprising a stationary rigid frame, die-carrying members movable therein, a crank-shaft operatively connected with said members and adapted to move the latter simultaneously in opposite directions to cause the respective dies of said members to approach and recede from each other, one of said members being adjustable in relation to the other, and means for maintaining a solid abutment between said adjustable member and its connection with said crank-shaft.

3. A forging press comprising a stationary rigid frame, die-carrying members movable therein, a crank-shaft operatively connected with said members and adapted to move the latter simultaneously in opposite directions to cause the respective dies of said members to approach and recede from each other, means for adjusting one of said members in relation to the other and for automatically maintaining a solid abutment between said adjustable member and its connection with said crankshaft comprising a connecting rod, adapted for operation by a crank of said crank-shaft, a pin connecting said rod with said adjustable member, a pair of ec-

centric bushes between said pin and said rod, a pad between the end of said rod and said member and means for rotating said bushes and at the same time for adjusting the position of said pad.

4. A forging press comprising a rigid stationary main frame; a crank shaft journalled in the upper part of said frame for rotation in a horizontal plane, said crank shaft being formed with a pair of outer cranks and a center crank medially disposed between said outer cranks, said center crank being disposed at 180 degrees to said outer cranks; a bottom die carrying member comprising a substantially U-shaped frame disposed for vertical reciprocation in said main frame, housings formed in the respective limbs of said U-shaped frame, and bearing blocks disposed for lateral sliding movement in said respective housings, said bearing blocks being journalled about said respective outer cranks; in combination with a top die carrying member comprising a ram disposed for vertical reciprocation between and guided by the limbs of said U-shaped frame, and a connecting rod journalled to said center crank at one end and pivotally connected at its other end to said ram, whereby simultaneous vertical reciprocation in opposite directions of said respective die carrying members is produced by rotation of said crank shaft.

5. A forging press comprising a rigid stationary main frame, a crank shaft journalled in said frame for rotation in a horizontal plane, said crank shaft being formed with a pair of outer cranks and a center crank disposed at 180 degrees to said outer cranks, a substantially U-shaped frame disposed for vertical reciprocation in said main frame, housings formed in the respective limbs of said U-shaped frame, and bearing blocks disposed for lateral sliding movement in said housings, said bearing blocks being journalled about said respective outer cranks, in combination with a ram disposed for vertical reciprocation between and guided by the limbs of said U-shaped frame, and a connecting rod journalled to said center crank at one end and pivotally connected at its other end to said ram.

6. A forging press comprising a rigid stationary main frame, a crank shaft journalled in said frame for rotation in a horizontal plane, said crank shaft being formed with a pair of outer cranks and a center crank disposed at substantially 180 degrees to said outer cranks, a substantially U-shaped frame disposed for vertical reciprocation in said main frame, and bearing blocks disposed for lateral sliding movement in the respective limbs of said U-shaped frame, said bearing blocks being journalled about said respective outer cranks, in combination with a ram disposed for vertical reciprocation between and guided by the limbs of said U-shaped frame, and a connecting rod operatively connecting said center crank and said ram to produce vertical reciprocation of said ram during rotation of said crank.

7. A forging press comprising a rigid stationary main frame, a crank shaft journalled for rotation in said frame and formed with a pair of outer cranks and a center crank disposed at substantially 180 degrees to said outer cranks, a substantially U-shaped frame disposed for reciprocation in said main frame, and bearing blocks disposed for lateral sliding movement in the respective limbs of said U-shaped frame, said bearing blocks being journalled about said respective outer cranks, in combination with a ram disposed for reciprocation between and guided by the limbs of said U-shaped frame, and a connecting rod operatively connecting said center crank and said ram to produce reciprocation of said ram during rotation of said crank.

8. A forging press comprising a rigid stationary main frame, a crank shaft journalled for rotation in said frame and formed with a pair of outer cranks and a center crank disposed at substantially 180 degrees to said outer cranks, a substantially U-shaped frame disposed for reciprocation in said main frame, and means connecting said U-shaped frame to receive reciprocatory motion from the outer cranks during rotation of said crank shaft, in combination with a ram disposed for reciprocation between and guided by the limbs of said U-shaped frame, and means operatively connecting said center crank and said ram to produce reciprocation of said ram during rotation of said crank.

FRANK WILLIAM SPENCER.