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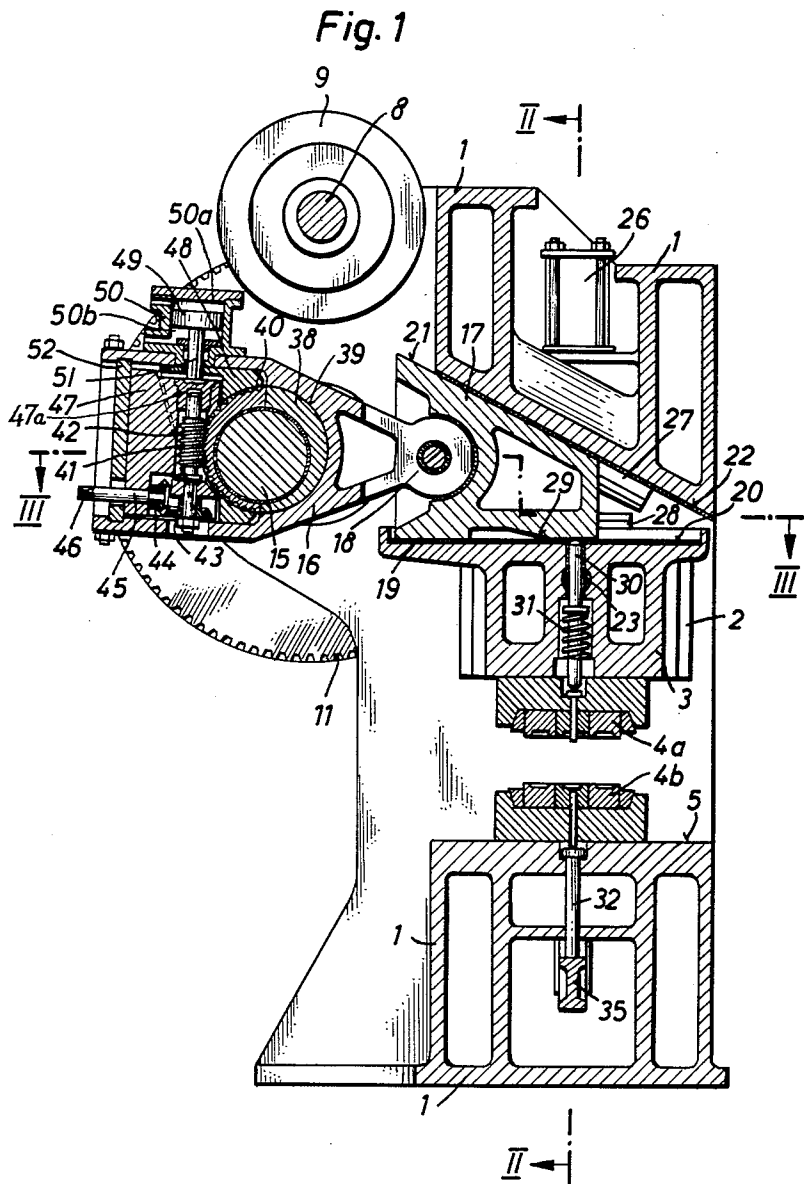
F. RIEMENSCHNEIDER ETAL

3,122,033

DIE FORGING PRESS

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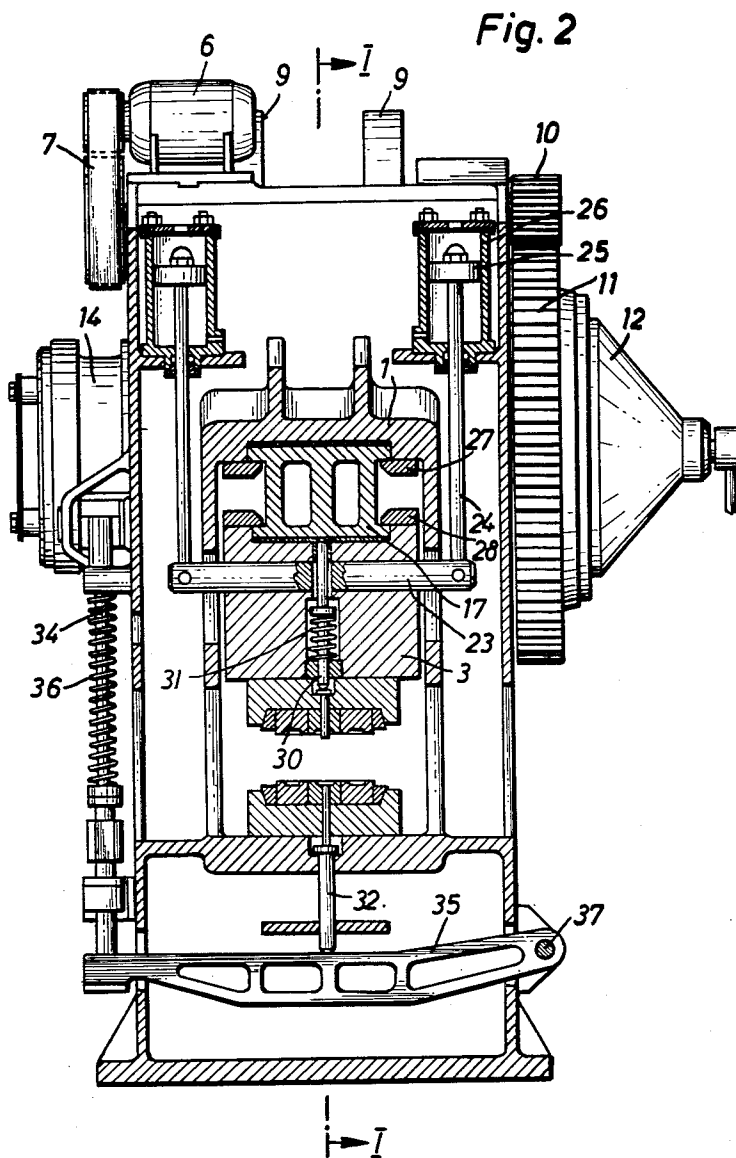
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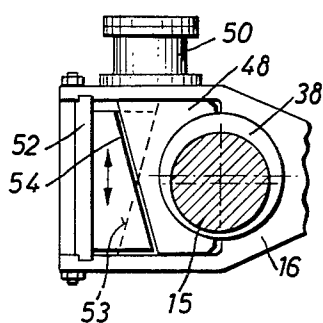
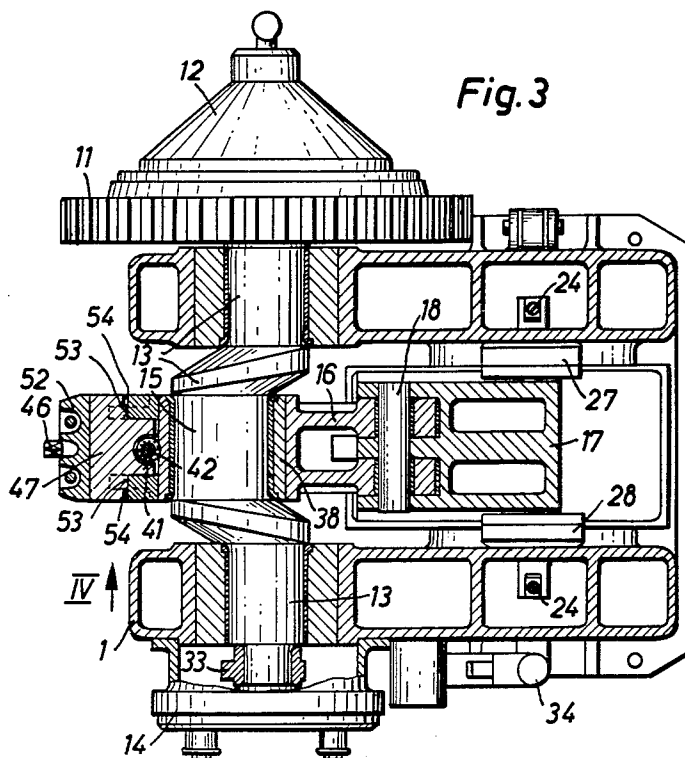
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This invention relates to a die forging press, especially a double-sided eccentric press in which the press ram is driven by means of an eccentric or a crank.

In presses of this kind, which are to be used for the manufacture of die pressings, one requirement is that changes in the frame dimensions of the machine be as small as possible. Temperature and volume of the starting material cannot always be kept uniform, producing variations in the pressing power requirements. The resulting tolerances in the thickness of the die forgings often are inadmissible.

From the power requirements of a press, the structural dimensions and the dimensional changes during operation are calculated. Frame distortions or changes due to friction and/or internal stresses during the application of pressure must be kept within certain limits in order to obtain the degree of accuracy and stay within the dimensional tolerances for the forged parts being produced. In the past, it has generally been necessary to construct huge and massive forging press frames in order to utilize certain maximum pressures, and the height of the press frame has been a considerable factor, i.e., the dimension changes of the frame during operation are a significant factor in the production of accurate forgings.

It is an object of the invention to provide a new and improved press frame to reduce the inaccuracies in the forgings caused by frame dimension changes in the machine. The invention is characterized in that between the eccentric or crank drive and the press ram a driving wedge movable in a transverse direction to the direction of movement of the press ram is provided; the driving wedge being arranged in the upper part of the machine frame and being slidably displaceable on a horizontal surface of the press ram. Preferably, the wedge angle of the driving wedge is greater than the angle which corresponds to the so-called friction angle.

By this arrangement of the driving device for the press ram, there is obtained a considerable reduction of the linear extension of the frame and, therewith, of the structural height of the press, which results in more accurate forgings. Since the driving wedge is arranged in the upper part of the machine frame, there is obtained, thereby, the possibility that the driving wedge and the device for adjusting the press ram and the tools may be kept free of contaminations which result from the process of forging. The lubrication of the surfaces of the driving wedge remains readily accomplished, reducing wear. The provision of a horizontal sliding surface at the underside of the driving wedge is advantageous as no force resulting from the inclination of the wedge is exerted on the guides of the press ram. In addition, the driving wedge covers the whole pressing surface of the tools, and the whole pressing power may be exerted on each point of the press table without producing forces acting on the guides.

According to a further object of the invention, the formation of the driving device of the eccentric press makes it possible that, in a forging hammer, during the last forging operation (during the calibration) the dies strike hard upon one another so that accuracy in size of the forging is dependent only on the accuracy of the tool.

While in the forging hammer the forging is deformed by several blows until the dies strike one another since the length of the stroke and the position of the ram at the

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beginning of the stroke are variable, the eccentric press has a fixed stroke defined by its construction. In prior structures of eccentric presses it is possible to adjust the position of the ram at the beginning of the stroke by shifting the dies in such a manner that the dies are prestressed by the nominal load of the press. In each forging operation, the press must then be loaded to its nominal value. In a die forging press, the manufacture of a forging normally comprises some preparatory operations as well as calibration and trimming so that the fact that the dies strike upon one another on each stroke soon causes considerable wear of the tools and of the machine.

According to the invention, the driving wedge is not only provided as a drive for the press ram and is adjustable to shift the press ram or the tools from their initial position, but the position of the ram at the beginning of the stroke may be quickly shifted between two forging operations to compensate for the amount of the frame dimension changes in the machine. According to a further feature of the invention, the driving wedge is adjustable by means of an eccentric on the crank pin of a push-rod for shifting the press ram from its initial position, the eccentric being formed as an eccentric bushing enclosing the crank pin. The eccentric press is adjusted in its initial position by shifting the tools by means of this eccentric bushing in such a manner that, when idling, the dies contact one another without power at bottom dead center. During the forging operation dimensional changes of the machine frame may occur and the dies no longer contact one another. So that the dies may strike one another during the last forging operation, there is provided a further adjusting device by which the eccentric bushing may be adjusted additionally and quickly an amount which corresponds to the dimensional changes of the machine frame. The eccentric bushing locked by a wedge part is released by another wedge surface, the eccentric bushing is rotated through an angle and is locked again. By this rotation of the eccentric bushing, the driving wedge is shifted horizontally and the press ram is shifted vertically downward to compensate for the amount of dimensional change in the press frame.

A preferred form comprises a piston displaceable in a cylinder which may be operated pneumatically or hydraulically, the piston acting upon the wedge part. In this manner, the initial position of the press ram may be adjusted quickly, readily and securely according to requirements even between two forging cycles. For adjusting the initial position of the press ram, the eccentric bushing may be adjusted by means of a gear or worm to bring the eccentric bushing into the desired initial position.

The drawings illustrate by way of example one embodiment of the invention, in which:

FIG. 1 shows a double-sided eccentric press in longitudinal section on the line I—I of FIG. 2;

FIG. 2 shows the eccentric press in longitudinal section on the line II—II of FIG. 1;

FIG. 3 is a cross-section on the line III—III of FIG. 1; and

FIG. 4 is a side elevation of a detail seen in the direction of arrow IV in FIG. 3.

The die forging press has a double-sided machine frame 1. A press ram 3 is movable in the vertical direction in the guides 2 of machine frame 1. The dies 4a and 4b are fixed in the usual manner below press ram 3 and on the press table 5. Power from a driving motor 6 is transmitted by means of a belt 7 to a shaft 8 on which two flywheels 9 are mounted. On the shaft 8 is fixed a pinion 10 which mates with a gear wheel 11. The latter is connected by means of a clutch 12 with a crankshaft 13. At the other end of the crankshaft 13 is provided a brake 14. The clutch 13 and the brake 14 are formed in the usual manner. From the crankpin 15 of crank-

shaft 13, motion is transmitted by means of a push rod 16 to a driving wedge 17 which reciprocates press ram 3 carrying top die 4a. The push rod 16 pivots around pin 18 mounted in the driving wedge 17. A horizontally sliding surface 19 of the driving wedge 17 rests on a corresponding horizontally sliding surface 20 of press ram 3 while the wedge surface 21 of the driving wedge 17 rests against the wedge surface 22 of machine frame 1.

To prevent free play between the press ram 3, the driving wedge 17, and the sliding surfaces 19, 20 and 21, 22, the press ram 3 may be continuously subjected to the action of an upwardly directed force. In the illustrated embodiment, the transverse bar 23 passing through press ram 3 performs this function. Bar 23 is connected by means of connecting rods 24 with pistons 25 which may be displaced in the cylinders 26. These pistons 25 may be operated pneumatically or hydraulically to thereby press ram 3 against driving wedge 17 which is pressed against the wedge surface 22 of the machine frame 1. Additionally, connection of the driving wedge 17, on the one hand with press ram 3, and on the other hand with machine frame 1, is effected by means of ledges 27 and 28. The driving wedge 17 may be provided with a curved recess 29 which operates the ejector 30 for the top die 4a, the ejector 30 being pressed by means of a spring 31 against driving wedge 17. The operation of the ejector 32 for the bottom die 4b may be effected in the usual manner by means of a cam disk 33 which actuates an independently operable lifting rod 34 acting by means of a lever 35. Rod 34 is subjected to the action of a spring 36 while lever 35 is pivotally mounted on a pin 37.

For the adjustment of press ram 3, and thereby of dies 4a and 4b relative to one another, the crank pin bearing enclosing crank pin 15 is eccentrically formed. For this purpose there is provided an eccentric bushing 38 which may consist of two halves. This eccentric bushing 38 is rotatably mounted in the push rod bearing 39. For this purpose a worm gear 40 mates with a worm 41 mounted on a shaft 42. The rotation of shaft 42 is effected by means of bevel gears 43, 44 and of a shaft 45 which is provided with a square portion 46 at the end. By rotation of shaft 45, the initial position of push rod 16, of driving wedge 17 and of press ram 3 may be varied.

To be able to effect before the final forging operation a quick change of the wedge stroke to compensate for the amount of change in the vertical dimensions of the press frame to provide forging precision, the device described in the following paragraphs is provided.

The worm 41 with the shaft 42 is mounted in a wedge part 47 which also contains gears 43 to 46. Wedge part 47 is provided with two wedge surfaces 53 and 54 which cooperate with the counter surfaces of a pressure part 48 resting against the outer surface of eccentric bushing 38. Wedge part 47 is displaceable in the longitudinal direction of worm shaft 42. For this purpose, a pneumatically or hydraulically operated piston 49 is mounted in a cylinder 50 and includes a depending rod 51. The rod 51 is connected by a bushing 47a to the wedge part 47. The wedge part 47 is fixed with respect to the worm shaft 42. Movement of the rod 51 axially results in corresponding movement of shaft 42, i.e. as wedge part 47 moves with respect to a fixed plate. It will be noted that shaft 42 may rotate independently about its longitudinal axis but is displaceable with wedge part 47. The pitch angle of worm 41 mounted on shaft 42 is so small that self-locking is effected. By means of piston 49, the worm shaft 42, and also the wedge part 47, are displaceable in an axial or longitudinal direction between a fixed plate 52 and the pressure part 48 i.e. normal to the direction of relative movement between part 48 and plate 52 so that the eccentric bushing 38 is rotated by the worm gear 40. The wedge surfaces 53 and 54 extend under an oblique angle opposite to the direction of displacement of wedge part 47 (FIG. 4). While the cooperating wedge surfaces 53 of wedge part 47 and pressure part 48 are tightly

pressed upon one another by means of piston 49, there is a predetermined play between the other wedge surfaces 54. By this action, the eccentric bushing 38 is clamped in its final positions. In the intermediate positions in which both wedge surfaces 53 and 54 do not tightly contact one another, the eccentric bushing 38 is released and may be rotated.

For the calibration (the final forging step), the shifting of the wedge stroke for dimension changes of the press frame is effected as follows:

In the initial position, the chamber 50a of cylinder 50 is filled with fluid under pressure, while chamber 50b is relieved of pressure. Thereby piston 49 and wedge part 47, in which are mounted worm shaft 42 and worm 41, are pressed downwardly. By means of wedge surface 53, wedge part 47 presses pressure part 48 against eccentric bushing 38 and clamps the same.

Immediately before the calibration of the forging, chamber 50a is relieved of pressure and chamber 50b is filled with pressure fluid. Piston 49 moves upwards together with wedge part 47. Thereby part 48 is released, and eccentric bushing 38 is rotated clockwise by the axial displacement of worm shaft 42. Wedge part 47 moves upwards until wedge surface 54 contacts pressure part 48, whereupon eccentric bushing 38 is clamped again. By this predetermined rotation of the eccentric bushing 38, the push rod 16 and the driving wedge 17 are shifted toward the right, while the press ram 3 is shifted downwards for the amount of the dimension changes of the press frame. After the stroke, the initial position may immediately be restored by reversal of the pressure in the cylinder 50. The initial position of the parts regarding the adjustment of the dies which is effected by rotation of shaft 45, is not affected by the displacement by means of piston 49.

The above specification has described a new and improved die forging press in which means are provided for compensating the elongation of the press frame during the final forging stroke. It is realized that this specification may indicate to those skilled in the art other ways in which the invention may be used, and it is therefore intended that this invention be limited only by the scope of the appended claims.

What is claimed is:

1. A forging press comprising a double-sided frame including a lower press table portion and upper fixed abutment portion forming a lateral opening therebetween, a press ram reciprocally supported in a rectilinear path of travel on said frame in said lateral opening, intermediately of said press table and fixed abutment portions, said fixed abutment portion having a planar surface in angular relation to the path of travel of said press ram, said press ram having a planar abutment surface normal to the rectilinear path of travel thereof, cooperating forging die means secured in opposed relation on opposed surfaces of said press table and ram, a driving wedge displaceably connected to said frame and said press ram in a path of travel normal to the path of travel of said press ram, said drive wedge including angularly related planar abutment surfaces complementary to and corresponding to said planar surfaces of said fixed abutment portion and said press ram, and adjustable drive means on said frame connected to said drive wedge for adjusting the stroke of and reciprocating said drive wedge normal to the path of travel of said press ram.

2. The structure of claim 1 including adjustable force-transmitting means on said press frame above said drive wedge and secured to said press ram for normally urging said planar surfaces into juxtaposed relation frictional contact.

3. The structure of claim 2 in which said adjustable force-transmitting means comprises at least one fluid motor including a piston rod connected to said driving press ram.

4. The structure of claim 1 in which said press ram in-

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cludes ejector pin means reciprocally mounted thereon transversely of and extendable through the die means thereon, spring means on said press ram normally urging said ejector pin means away from the die means, said drive wedge including a recess portion intermediately of the planar surface engaging said press ram for receiving the ejector pin means therein when pressure is applied to said press ram during a forging cycle.

5. The structure of claim 1 in which said adjustable drive means comprises a crank pin journaled on said press frame on an eccentric axis of rotation normal to and spaced from the path of travel of said press ram, and a push rod journaled at opposite ends to said crank pin and said drive wedge.

6. The structure of claim 5 including an eccentric bushing circumposed about said crank pin and interposed between said crank pin and said push rod and operating means for rotating said bushing with respect to said crank pin.

7. The structure of claim 6 in which said bushing includes a peripheral worm gear portion, an adjusting worm journaled on said push rod in driving engagement with said bushing worm gear portion, and said operating means including a control shaft having a portion extending from said push rod and drivingly connected to said adjusting worm for adjusting the position of said eccentric bushing and the throw of said drive wedge.

8. The structure of claim 6 including second wedge means on said push rod, said operating means being mounted on said second wedge means, said second wedge means including a portion clampingly engageable on said eccentric bushing for preventing rotation thereof on said crank pin.

9. The structure of claim 8 including fluid pressure operating means connected to said second wedge means for displacing said operating means and alternatively rotating said bushing or locking the bushing in an adjusted position.

10. A double-sided eccentric forging press comprising a press ram, eccentric means for driving said ram in forging operations, and means for adjusting the initial position of said ram, said adjusting means comprising a driving wedge having a horizontal surface bearing against a portion of said press and a wedge surface bearing against an upper portion of said ram, said driving wedge being horizontally slidably movable in a direction transverse to the direction of motion of said ram to drive said ram, an operating crank, means for mounting said driving wedge on said crank, and wherein said adjusting means comprises an eccentric bushing surrounding said means for mounting said driving wedge on said crank, said eccentric bushing is rotatably mounted on said crank, and worm means for rotating said bushing to position said ram, a worm gear for rotating said worm and means for exter-

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nally rotating said worm gear, clamping means for said bushing, said clamping means comprising a wedge part, and a pressure part bearing against said wedge part to force said wedge part against said bushing, means for releasing said clamping means, said releasing means comprising a second cylinder, a second piston mounted for longitudinal movement in said second cylinder, means for connecting said second piston with said wedge part, and means for applying differential pressures in said cylinder on opposite sides of said piston to move said piston to lock and to release said clamping means, said wedge part and said pressure part having wedge surfaces arranged parallel to each other with a predetermined play therebetween, said surfaces contacting each other when said bushing is clamped.

11. In a forging press or the like including an eccentric crank drive shaft drivingly connected by a push rod to a driving wedge reciprocable normal to the path of movement of a reciprocable pressure member, a lockable eccentric bushing on said push rod circumposed about said crank drive shaft for adjusting the throw of said push rod, adjusting means on said push rod connected to said bushing for rotating said bushing with respect to said drive shaft, a wedge member on said push rod including a portion engageable with said bushing and upon which said adjusting means is mounted, said adjusting means comprising cooperating drive gears.

12. The structure of claim 11 including fluid pressure operating means connected to said wedge member for displaceably controlling the operative positions of said wedge member and said adjusting means.

13. The structure of claim 11 in which said wedge member includes a first part engageable on the periphery of said bushing, and a second part wedgingly engageable on said first part for urging said first part into force transmitting relation.

14. The structure of claim 13 in which said first part includes wedge surfaces disposed at opposed oblique angles, and said second part includes wedge surfaces disposed at opposed oblique angles with respect to each other and complementary to the corresponding wedge surfaces of said first part.

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