March 5, 1963 R. E. SANFORD 3,079,817

WORK HANDLING DEVICE

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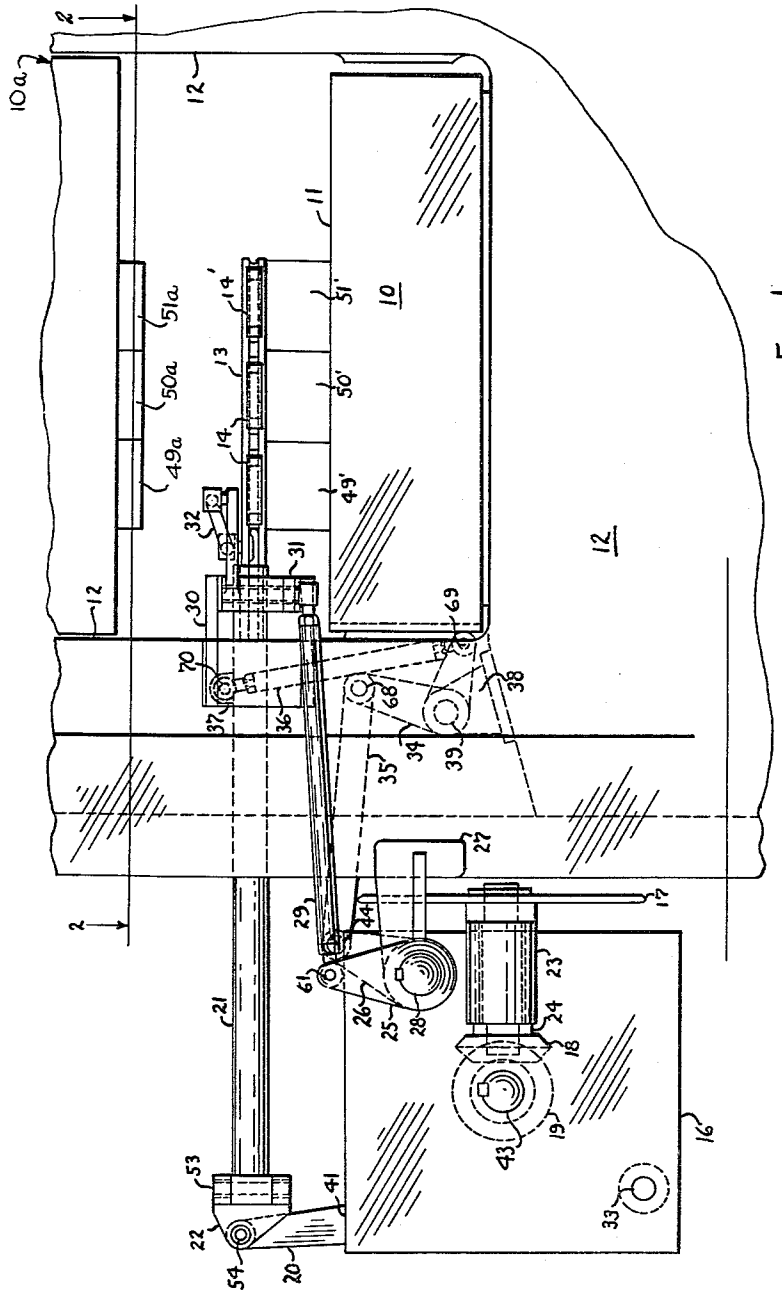


FIG. 1

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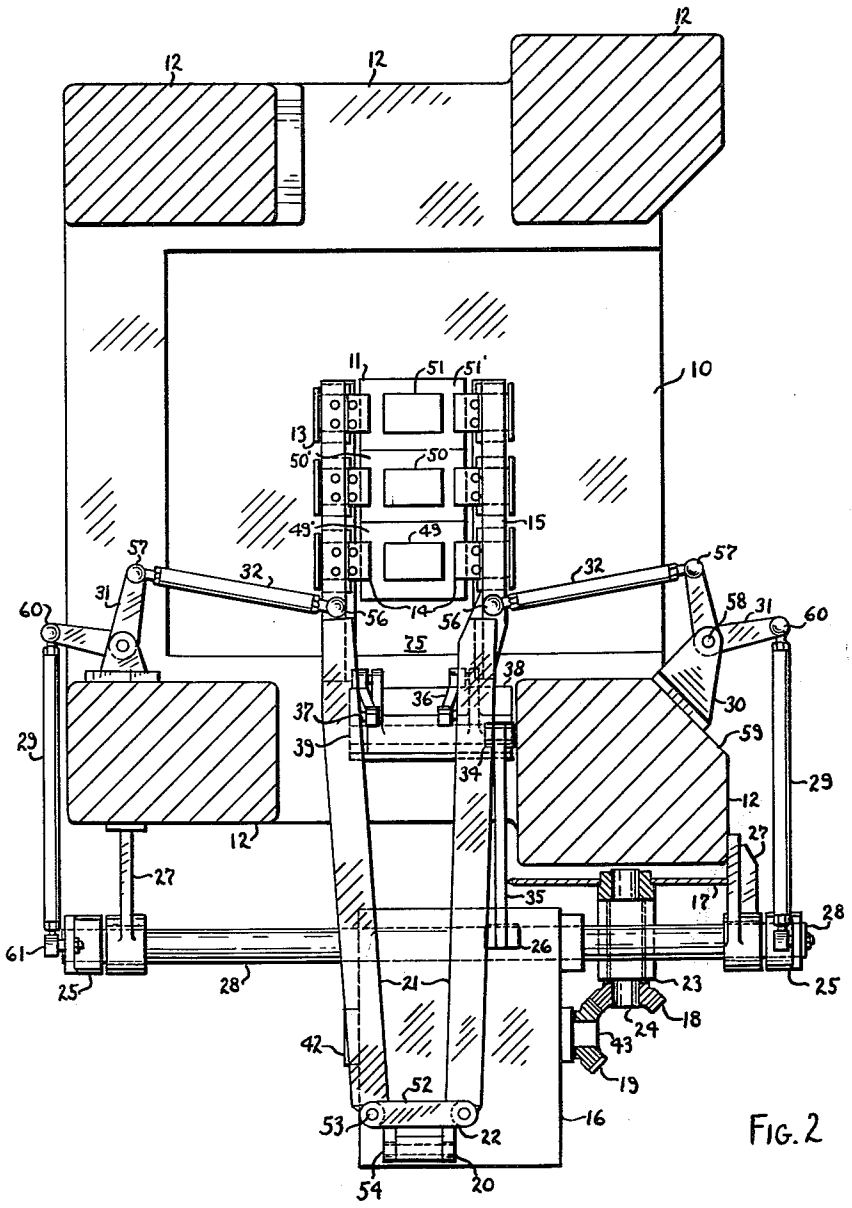


FIG. 2

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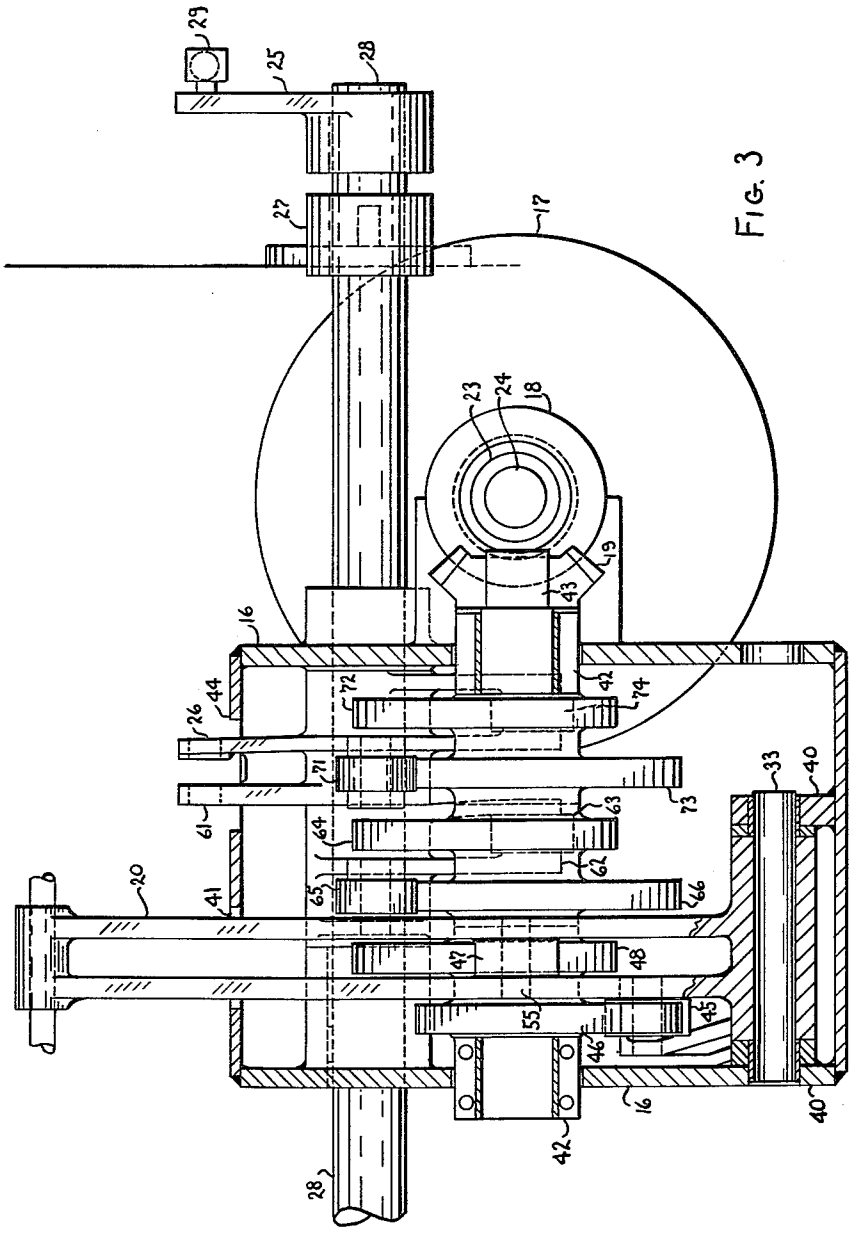


FIG. 3

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WORK HANDLING DEVICE

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10 Claims. (Cl. 78—99)

This invention relates to material handling apparatus for moving articles such as metal forging blanks and the like into a forging press or other machine preparatory to the forging or other operation thereon and subsequently lifting, advancing, and lowering the blank when partially formed to subsequent forming positions and finally discharging the blanks when formed from the press or machine.

The present invention has especial utility in the handling of articles such as hot blanks for forgings and since the device lifts, moves, and then lowers the articles, the problem frequently encountered in loading mechanisms of sliding scale into the dies and working parts of the mechanisms is obviated. One problem ever present in designing a feeding mechanism for a press is the matter of enough available space to accommodate the mechanism without obstructing the operation of the press. This problem has been solved with the present mechanism. An improved gripping device has been provided by way of fingers on the arms so designed that they grip the article itself rather than gripping the flash thereon. This gives a more positive dimension to grip since a flash on a forging varies in size from day to day and from piece to piece.

More specifically, it is an object of this invention to provide an apparatus of the above character adapted to be mounted directly on a press or machine at one end thereof and provided with suitably controlled work engaging means and shiftable in time with the ram of the press toward and away from operative positions between the press members. The apparatus is provided with means for moving the work engaging means relative to the bed into and out of position to engage the work and also is provided with a mechanism connected to the work engaging means and operative sequentially to swing one end of the work engaging means upward and then shift it in a direction to withdraw the work engaging means and the work engaged thereby out of the press to an unloading position. The apparatus also preferably includes additional work engaging means for moving the work from one forming station to another forming station between the press members.

Another object of this invention is to provide a mechanism in combination with a forging press for loading blanks to be forged into dies, releasing the blanks while the ram descends to form the blank in a first operation. Then as the ram of the press rises, the mechanism grips the partially formed blank, lifts it out of the die cavity, advances it to a second cavity, and subsequently lifts the completely formed blank from the die and discharges it.

A further object of the invention is to provide a work handling apparatus which is simple in construction, economical to manufacture, and simple and efficient in operation.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawings and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

FIG. 1 is a partial front view of a forging press having

an improved work handling mechanism supported thereon;

FIG. 2 is a cross sectional view taken on line 2—2 of FIG. 1; and

FIG. 3 is an end view of the mechanism.

Now with more specific reference to the drawings, a forging press is shown having a bolster 10 with fixed die parts 49', 50', and 51' supported thereon. The die parts 49' 50', and 51' may have a plurality of cavities 49, 50, and 51, respectively. A ram 10*a* has movable die parts 49*a*, 50*a*, and 51*a* attached thereto. The dies 50' and 51' are preferably of the progressive type so that a first forging operation is performed in the cavity 50, the blank thus partially formed is then transferred to the cavity 51, and the blank is thence provided with a finishing forging operation in the cavity 51.

The press is shown in combination with a loading and unloading mechanism indicated at 13 which has grips 14 supported on gripping arms 15 which are attached to the distal ends of working arms 21 and spaced vertically from each other and arranged in rows so that one row of the grips 14 grasps the article above and the other below the flash thereon. The grips 14 are so arranged that they engage the side of the forging itself above and below the flash. This is desirable because the forging has a constant dimension while the width of the flash will vary from one forging to another, both with temperature and with size of blank.

The working arms 21 are in turn swingably attached to a universal joint member 22 made up of a transverse member 52 which has a transverse bore therein which receives a pin 54 connecting the transverse member 52 to rocker levers 20 and vertical pins 53 which swingably connect the working arms 21 to the universal joint member 22. The rocker levers 20 are made up of two spaced lever members with a follower 47 therebetween. The levers 20 are journalled to a common hollow journal member which receives a pivot shaft 33 which is in turn connected to a pivot shaft journal bearing 40 attached to the frame.

The roller cam follower 47 is journalled by means of a pin 55 to the levers 20 and is operated by a cam 48 which is mounted on a cam shaft 43. The cam shaft 43 is journalled in a cam housing 16 at 42 and has a bevelled gear 19 keyed thereto. The bevelled gear 19 is driven by a mating bevel gear 18 which is supported on a drive shaft 24 which is carried in a sleeve 23. The drive shaft 24 is driven through a sprocket 17 from a sprocket and chain connected to the eccentric shaft which operates the ram of the press. Therefore, the shaft 43 and cams thereon are driven in synchonism with the ram of the press. The sleeve 23 is supported on the housing 16 and provides a journal for the shaft 24. Therefore, as the shaft 24 is rotated a complete revolution for each stroke of the ram of the press, the rocker levers 20 and the working arms 21 attached thereto move forward and then backward through one complete cycle. A cam 48 is shaped to cause the arms 21 to move forward and backward at the proper rate.

The grips 14 are in the form of two horizontally spaced rows of vertical fingers spaced vertically from each other which are opened and closed by means of a suitable opening and closing mechanism made up of release rods 32 which are pivotally connected to the working arms 21 at 56 and to bellcranks 31 at 57. The bellcranks 31 themselves are pivotally connected to brackets 30 at 58. A right hand pillow block 30 is attached to a tapered surface 59 on a machine frame 12. Closing arms 29 are pivotally connected to the bellcranks 31 at 60 and to a crank 26 at 61. A crank 25 is keyed to a shaft 28 and the shaft 28 is journalled in brackets 27 which are

in turn fixed to the machine frame 12. The shaft 28 has arms 62 integrally attached thereto and extending rearwardly therefrom. The arms 62 have a follower roller 63 attached thereto which rides on a peripheral surface of a cam 64. A second follower 65 is pivotally connected to the arm 62 and rolls on the peripheral surface of a cam 66 to move the arms 29 in the opposite direction. Therefore, as the cam shaft 43 rotates a complete turn, the cam 64 will move the arms 29 in a first direction and the cam 66 will move the arms 29 in a second direction.

The grips 14 are raised up and down by means of a connecting rod 35. The connecting rod 35 is pivotally connected to the crank 25 at 44 and to a bellcrank 34 at 68. The bellcrank 34 is pivoted to the machine frame 12 at 39 through a bracket 38 and has a raising and lowering arm 36 pivotally connected thereto at 69 which is in turn pivoted to a bracket 37 at 70. The shaft 28 can be driven through suitable shaft and gear connections from the drive for the ram and synchronized with the ram drive.

The crank 26 is pivotally supported on the shaft 28 and swings thereon. The shaft 28 has follower members 71 and 74 connected thereto through an arm integrally attached thereto. The follower members 71 and 74 ride on the surface of cams 73 and 72, respectively, and are fixed to rotate with the shaft 43. Therefore, when the shaft 43 rotates a complete revolution, it raises the grips 14 through the arm 36 and lowers them down again through one complete cycle.

In operation, blanks will be fed into the machine at the cavity 49. The blanks may be fed in manually or through a suitable chute arrangement which will place one blank at the cavity 49 each time a blank is formed in the first cavity of the die by the ram of the press. When the press is started, the cams on the shaft 43 will move the grips 14 backwards by swinging the levers 20 backwards until the grips 14 are disposed one at each side of the blank. Then the closing arms 29 will be operated through the cam to close the grips 14 on the blank. The raising and lowering arm 36 will lift the blank to a height above the top of the dies. The rocker levers 20 will then swing the grips 14 forward to place the blank over the cavity 50. The closing arms 29 will then swing the bellcranks 31 to open the grips 14 out of the way of the ram and the ram will descend.

While the ram is descending, the grips 14 will move back, bringing the grips 14 to the position at the side of the blank in the position 49. The grips 14 will then close on the blank as the ram raises. Then grips 14' will close on the partially forged blank in the cavity 50 and, at the same time, the grips 14 will close on the next blank. Then as the ram continues to rise, the levers 20 will swing the grips 14 and 14' forward to bring the blank over the cavity 50 and the forged blank over the cavity 51. The operation will repeat and each time the blank from the cavity 50 will be advanced to the cavity 51, the forged blank from the cavity 51 will be lifted out and lowered to a repository. In each instance, the work being formed will be lifted, advanced, lowered, and released.

It will be apparent that with the feeding mechanism disclosed herein, a rugged, positive device has been provided.

The foregoing specification sets forth the invention in its preferred practical forms but it is understood that the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In combination, a forging machine having progressive die members thereon and a mechanism for loading hot work into said die members for transferring and removing said work therefrom, said die members each having a fixed part and a movable part, said forging machine having a ram carrying said movable die part and a bed supporting said fixed die part, said mechanism comprising cam means disposed on said machine and driven in synchronism with said ram, grippers, one said gripper being disposed at each side of said die members, a working arm attached to each said gripper, said working arms being swingably attached to said machine, closing arms pivotally attached to said working arms, and a raising arm attached to one said working arm, said cam means actuating said closing arms, said raising arm, and said working arms to close said working arms on blanks to be loaded into said die members, lowering said blanks to each progressive cavity in said die members and discharging said blanks when formed from said machine.

2. In combination, a forging machine having a bed, a die, and a ram, and a feeding and unloading mechanism, said mechanism comprising two working arms disposed generally horizontally, one at each side of said die, said working arms being swingably attached at one end to a rocker lever and having grippers on the distal end for gripping articles, said rocker lever being swingably attached to said machine, cam means actuating said rocker lever, raising arms, said raising arms being pivotally attached to said working arms at one end and to a bell crank at the other, said bell crank being attached to said machine, means connecting said bell crank to said cam means to raise and lower said raising arms, and closing arms, one end of each said closing arm being connected to said working arms, the other end of each said closing arm being connected to said cam means and said cam means being connected to said machine, said working arms, raising arms, and closing arms being actuated by said cam means in synchronism with the movement of said ram to lift, load, and discharge workpieces into and from said die.

3. The combination recited in claim 2 wherein said die is a progressive die having at least two cavities, said working arms being moved by said cam means through said raising arms and said closing arms to lift an article over the first cavity and lower it onto said cavity and move outwardly to release said article before said ram engages said articles and after said ram engages said article in said first cavity and raises, said closing arms energized by said cam means then lifting said article from said first cavity and lowering it into said second cavity, said raising arms then energized by said cam means moving outwardly while said ram moves down, performing another operation on said article, said arms then closing and lifting said article and discharging it.

4. The combination recited in claim 3 wherein said grippers are attached to said closing arms, said grippers comprising members attached to said working arms in pairs, one gripper above the other, with a space therebetween to receive the flash on an article being forged by said machine.

5. The combination recited in claim 2 wherein said ram is driven by a motor and said cam means are driven through a drive connected to said motor.

6. The combination recited in claim 2 wherein said cam means include a first cam driving said rocker lever in a first direction to move said working arms in a first direction and a second cam driving said rocker lever in a second direction swinging said working arms in a second direction.

7. The combination recited in claim 2 wherein said bell crank is attached to said cam means by means of a connecting rod attached at one end to said bell crank and at the other end to a follower member for said cam means.

8. A forging press and a loading and unloading mechanism therefor, said forging press comprising a bed, spaced support members extending upwardly from said bed, a

reciprocating ram supported on said support members, a fixed die on said bed and a movable die on said ram adapted to forge articles between said fixed die and said movable die, said fixed die having at least a first and a second spaced cavity therein disposed longitudinally on said bed, article moving means comprising laterally spaced, longitudinally extending working arms disposed generally in a horizontal plane, a cam housing disposed at the side of said mechanism, a cam shaft having spaced cams thereon journalled in said housing and extending laterally thereof, vertically extending rocker arms swingably attached to said housing at their lower ends and attached to said working arms at their upper ends, followers on said rocker arms, one said cam rocking said rocker arms forward to move said working arms forward relative to said fixed die and another said cam rocking said rocker arms rearward relative to said fixed die, a closing shaft journalled in said housing and extending laterally thereof, followers on said closing shaft, said followers on said closing shaft engaging said cams to rotate said closing shaft first in one direction and then in another, a crank attached to said closing shaft at each end thereof, a bell crank attached to said mechanism at each side thereof and swingable in a horizontal plane, connecting rods attaching said cranks on said closing shaft to said bell cranks and an arm of each said bell crank being attached to a closing arm, said closing arms being connected to said working arms for moving said closing arms toward and away from said fixed die, a lifting crank attached to said housing and extending upwardly thereof, said cams swinging said lifting crank toward and away from said press, a bell crank swingably connected to said press and swingable in a vertical plane, a connecting rod connecting said bell crank on said press to said lifting crank, a raising and lowering arm connecting said bell crank to an intermediate point on said working arms to swing them up and down, a drive for said ram, and drive means connecting said cam shaft to the drive of said ram whereby said cam shaft is driven to lift, advance, and lower said articles into one said die cavity, from one said die cavity to another, and from said die cavities to a discharge position.

9. The press and mechanism recited in claim 8 wherein each said working arm, lifting crank, and closing arm are positively moved in each of two directions by said cams engaging rigid follower elements on said arms, moving said arms.

10. The press and mechanism recited in claim 9 wherein said working arms engage said articles by means of gripping members spaced longitudinally and vertically thereon and adapted to engage said articles both above and below flashes formed on said articles.

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