Feb. 12, 1946. G. O. CONNER 2,394,534

FORMING MACHINE AND FEEDING DEVICE THEREFOR

Filed Oct. 28, 1943 2 Sheets-Sheet 1

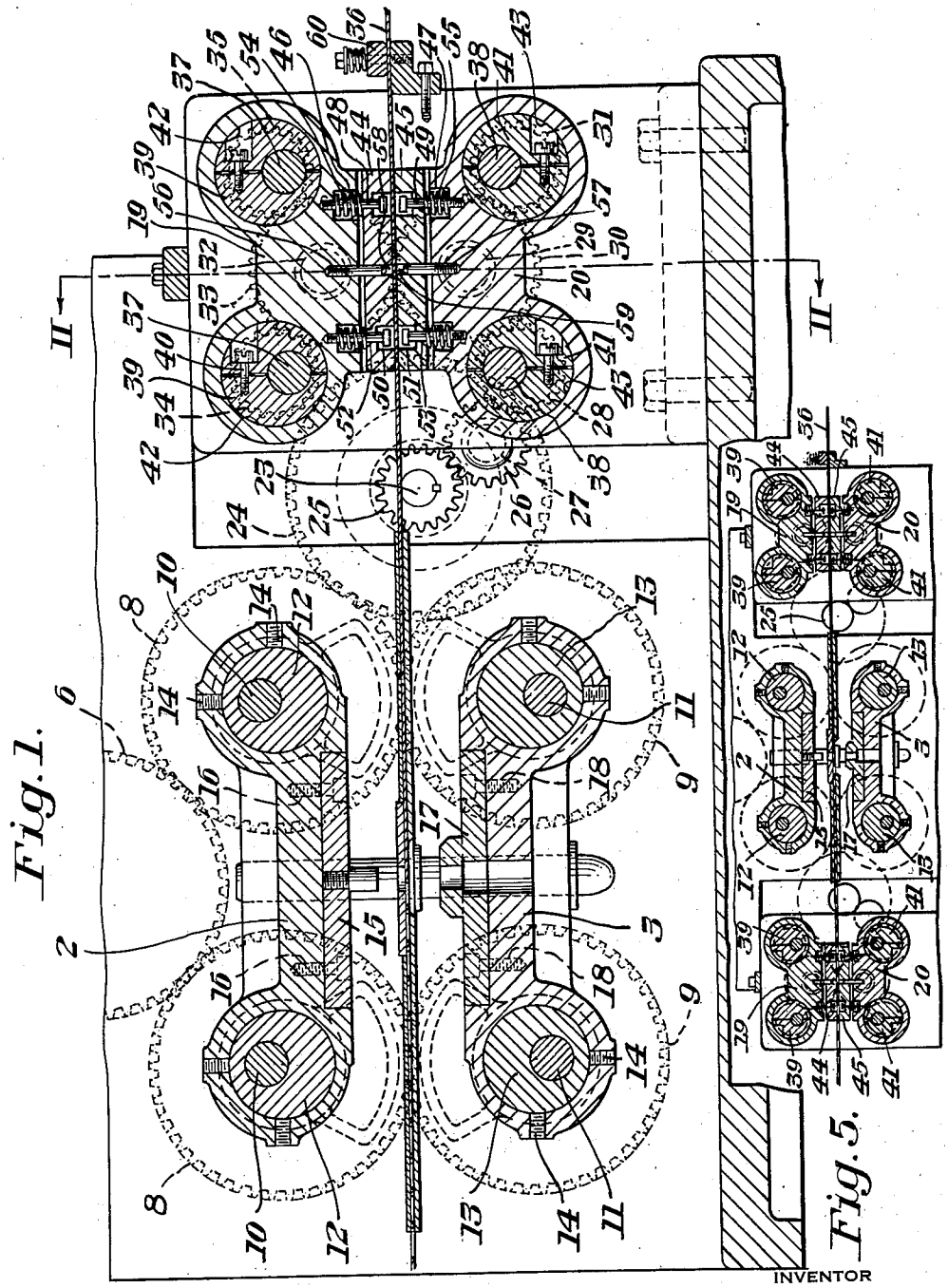


Fig. 1.

Fig. 5.

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Fig. 2.

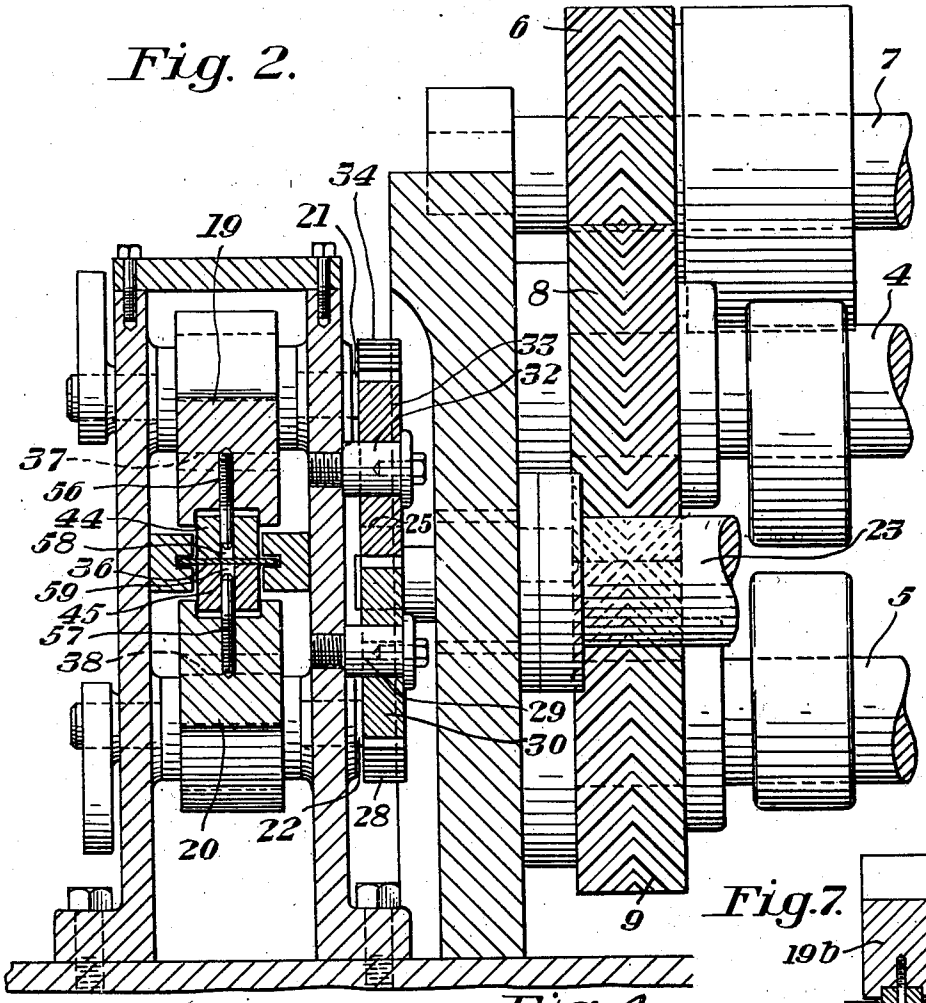


Fig. 7.

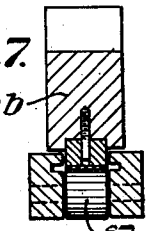


Fig. 3.

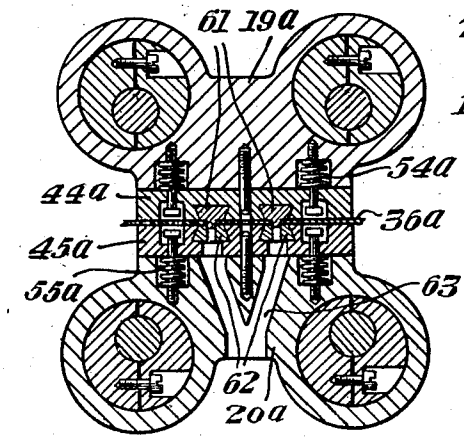


Fig. 4.

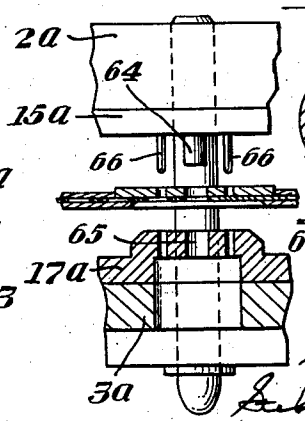
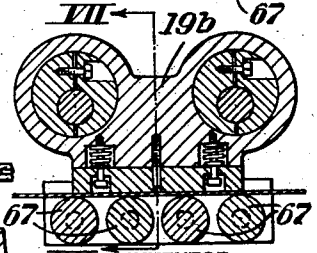


Fig. 6.



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UNITED STATES PATENT OFFICE

2,394,534

FORMING MACHINE AND FEEDING DEVICE THEREFOR

Guy O. Conner, Wheeling, W. Va.

Application October 28, 1943, Serial No. 507,936

24 Claims. (Cl. 164—89)

This invention relates to forming machines and feeding devices therefor. It relates particularly to forming machines of the type disclosed in my copending application Serial No. 497,792 and to feeding devices for feeding work through forming means or the like. The feeding devices are adapted for feeding work through forming machines of the type mentioned or other forming machines.

In my said application there is disclosed a forming machine for high speed operation employing heads movable toward and away from each other and when closest together moving also laterally generally in the same direction for acting upon work fed between the heads. Such a machine may be used in various arts, as, for example, stamping, die forming, plastic molding, ceramic molding, extrusion, printing, etc.

The present invention has to do particularly with the feeding of work passing through a forming machine. While the subject matter of the present application is illustrated as employed with a machine as disclosed in said application Serial No. 497,792, the invention is not so limited and, as above indicated, may be employed with other machines.

I provide a forming machine comprising opposed cooperating forming heads movable toward and away from each other and when closest together moving also laterally generally in the same direction and feeding means for feeding work between said heads, said feeding means comprising opposed cooperating feeding heads movable toward and away from each other and when closest together moving also laterally in the direction of lateral movement of the forming heads so as to feed the work in that direction. I also provide a feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like movable toward and away from each other and when closest together moving also laterally generally in the direction of feed and adapted to engage and advance the work. At least one of the feeding heads partakes of orbital movement while maintaining substantially fixed orientation. When I speak of a head as partaking of orbital movement while maintaining substantially fixed orientation I mean that the head maintains substantially fixed angular position in its orbit.

Preferably the forming heads and feeding means act alternately on work passing through the machine, the forming heads being relatively far apart while the feeding heads are relatively close together and the feeding heads being relatively far apart while the forming heads are relatively close together. Thus the feeding means feeds the work during the interval when the forming means is not acting on it. When the forming means is acting on the work it controls the feed of the work and during that time the feeding means becomes temporarily inoperative.

The feeding means may be disposed either at the entering side or at the discharge side of the forming means, or both. Whatever may be the case in this respect, the forming heads and feeding heads are preferably so constructed and arranged that at any instant the feeding heads move in a direction substantially opposed to the direction of movement of the forming heads whereby the stresses in the machine due to operation of said heads are at least partially balanced.

Preferably at least one of the feeding heads has thereon a work engaging member adapted resiliently to engage the work and to be urged thereagainst during that portion of the cycle of movement of the feeding device when the feeding heads are relatively close together. In certain of the structures shown in the drawings each of the feeding heads is provided with a work engaging member of the type mentioned, the work engaging members being loosely carried thereon, and yieldable means are interposed between the head and the work engaging members for urging the latter toward the work.

I also provide feeding means having members forming in the work surface interruptions to cooperate with a work positioner on the forming means or the like whereby to insure highly accurate control of the work during the forming operation.

In certain instances I may employ only one feeding head movable toward and away from the work and also when closest to the work moving laterally in the direction of feed to advance the work. Such a head may be employed in combination with suitable means backing up the work and permitting the work to advance along with the head. For example, idler rollers may be used to back up the work opposite the feeding head. While such a structure does not have the efficiency of feeding devices having opposed heads as above referred to and is not adapted for as high speed operation, it is found satisfactory for certain conditions of operation which may be encountered in practice.

Other details, objects and advantages of the invention will become apparent as the following

description of certain present preferred embodiments thereof proceeds.

In the accompanying drawings I have shown certain present preferred embodiments of the invention, in which

Figure 1 is a vertical longitudinal cross-sectional view through a forming machine;

Figure 2 is a vertical transverse cross-sectional view to enlarged scale through the machine shown in Figure 1 taken on the line II—II of that figure;

Figure 3 is a fragmentary vertical longitudinal cross-sectional view of a modified form of feeding device;

Figure 4 is a fragmentary vertical longitudinal cross-sectional view through forming means for use with the form of feeding device shown in Figure 3;

Figure 5 is a diagrammatic view of a forming machine with feeding devices on both the entering side and the discharge side of the forming means;

Figure 6 is a diagrammatic view of feeding means employing a single rotary feeding head with idler rollers backing up the work opposite the head; and

Figure 7 is a vertical transverse cross-sectional view taken on the line VII—VII of Figure 6.

Referring now more particularly to the drawings, there is shown a forming machine of the same general type as is disclosed in my said copending application. For the sake of clarity I have omitted details of the portion of the machine which is concerned with operation of the forming heads since the present invention is not concerned with such details. Referring to Figure 1, the upper forming head is shown at 2 and the lower forming head is shown at 3. Each of the heads is carried and operated by two shafts which are driven in unison, such shafts having thereon eccentric means which impart to the heads their operative movements. The upper head 2 is carried by two shafts 4 and the lower head 3 is carried by two shafts 5. In the machine shown in the drawings the axes of the shafts 4 lie in the same horizontal plane and the axes of the shafts 5 lie in another horizontal plane; also each of the shafts 4 is positioned directly above one of the shafts 5, as shown in Figure 1. Both shafts 4 are driven in the same direction, i. e., clockwise viewing Figure 1, at the same speed and both shafts 5 are driven in the same direction, i. e., counterclockwise viewing Figure 1, at the same speed as the shafts 4. This driving of the shafts 4 and 5 may be accomplished in various ways, a driving gear 6 being shown as being keyed to a driving shaft 7 and meshing with two gears 8, one keyed to each of the shafts 4, which gears 8 in turn respectively mesh with gears 9, one keyed to each shaft 5. All four of the gears 8 and 9 are of the same diameter.

Formed integrally with the forward end of each of the shafts 4 and 5, i. e., the end nearest the eye viewing Figure 1, is an eccentric pin. The eccentric pins on the shafts 4 are designated 10 and the eccentric pins on the shafts 5 are designated 11. Each eccentric pin projects forwardly from the end of the shaft which carries it so that the head 2 is carried on the pins 10 and may be easily removed therefrom and the head 3 is carried on the pins 11 and may be easily removed therefrom. The head 2 carries eccentric bushings 12 adapted to be slipped over the respective pins 10 and the head 3 carries eccentric bushings 13 adapted to be slipped over the respective pins 11. Each of the bushings may be rotated in its head to a desired angular position and maintained in that position by set screws 14. By suitable rotative positioning of the eccentric bushings the clearance between the heads 2 and 3 when they are closest together may be determined. The shafts 4 have their eccentric pins 10 similarly oriented relatively to the shaft axes and also the eccentric bushings 12 are similarly oriented so that upon rotation of the shafts 4 the head 2 will while maintaining its orientation be moved through a circular path. The same applies with respect to the lower head 3. Also the shafts 4 will ordinarily have their eccentric pins 10 turned 180° from the corresponding positions of the eccentric pins on the shafts 5 and the eccentric bushings on all four pins will be arranged so that in operation the upper and lower heads partake of opposed synchronous movement, approaching each other during the same interval, reaching their respective positions in which each is nearest the axes of the shafts of the other at the same time and the heads when closest together moving laterally in the same direction, i. e., toward the left viewing Figure 1.

In the structure shown in Figure 1 a die 15 is connected with the upper head 2 by screws 16 and the die 17 is connected with the lower head 3 by screws 18. When the heads come together the dies act on work positioned therebetween, but during the interval while the dies are acting on the work both the work and the dies are moving laterally. The particular conformation of the work engaging portions of the dies forms no part of the present invention and the dies may be designed to perform any desired work. In Figure 1 the heads 2 and 3 and the dies 15 and 17 are shown in their farthest apart position. As they move toward each other and toward the point of engagement with the work they move also first toward the right and then toward the left so that at the point of maximum penetration of the work they are in the same relative lateral position as shown in Figure 1.

The work feeding device shown at the right-hand side of Figure 1 and at both the right and left-hand sides of Figure 5 is basically similar in structure and motion to the forming means which have been described. The upper feeding head is shown at 19 and the lower feeding head at 20. Each of the heads is carried and operated by two shafts which are driven in unison, such shafts having thereon eccentric means which impart to the heads their operative movements. The upper feeding head 19 is carried by two shafts 21 and the lower feeding head 20 is carried by two shafts 22. In the feeding device shown in the drawings the axes of the shafts 21 lie in the same horizontal plane and the axes of the shafts 22 lie in another horizontal plane; also each of the shafts 21 is positioned directly above one of the shafts 22 as shown in Figure 1. Both shafts 21 are driven in the same direction, i. e., clockwise viewing Figure 1, at the same speed, and both shafts 22 are driven in the same direction, i. e., counterclockwise viewing Figure 1, at the same speed as the shafts 21. This driving of the shafts 21 and 22 may be accomplished in various ways. There is shown a shaft 23 to which is keyed a gear 24 meshing with the gear 8 and driven therefrom. Also keyed to the shaft 23 is a pinion 25. The pinion 25 meshes with a pinion 26 carried by a shaft 27. The pinion 26 meshes with a gear 28 keyed to the left-hand

shaft 22 viewing Figure 1. A shaft 29 carries a gear 30 which meshes with the gear 28. Keyed to the right-hand shaft 22 viewing Figure 1 is a gear 31, which also meshes with the gear 30. A shaft 32 carries a gear 33 which is of the same diameter as and meshes with the gear 30. Keyed to the left-hand shaft 21 viewing Figure 1 is a gear 34 which meshes with the gear 33. Keyed to the right-hand shaft 21 viewing Figure 1 is a gear 35 which also meshes with the gear 33. The gears 28, 31, 34 and 35 are all of the same diameter.

The gears for operating the forming means and those for operating the feeding device are proportioned so that the feeding device, which operates on the work as will presently be described, advances the work through the forming means at a speed approximately equal to the lateral speed (i. e., the speed in the horizontal direction toward the left viewing Figure 1) of the dies 15 and 17 when they are in their position of maximum penetration of the work, or, in other words, when the forming heads 2 and 3 are closest together. The time cycle of the forming means is the same as the time cycle of the feeding device. However, as shown in Figure 1, the feeding heads 19 and 20 are farthest apart or approximately farthest apart when the forming heads 2 and 3 are closest together and vice versa. Thus the feeding device operates on the work to feed it during periods which alternate with periods during which the forming means operates on the work to form it. The feeding device feeds the work to the forming means and when the forming means engages the work it is disengaged by the feeding device so that at the time when the work is being operated on it is fed and controlled entirely by the forming means, the feeding device being then temporarily ineffective. The feeding device disclosed is adapted particularly for feeding strip as distinguished from separate blanks through the forming means and the work as shown in the drawings consists of a metal strip 36, although it will be appreciated that the mechanism is equally capable of operating upon materials other than metal.

Reverting to the mechanism for operating the feeding heads, each of the shafts 21 is provided with a crank 37 and each of the shafts 22 is provided with a crank 38. Each of the cranks 37 carries an eccentric 39 shown as of the split type fastened to the crank by a screw 40. Similarly, an eccentric 41 is carried by each of the cranks 38. Each of the eccentrics is fastened tightly upon the crank which carries it. The upper feeding head 19 has two bores 42 which respectively receive the eccentrics 39 so that the eccentrics are rotatable therein, and the lower feeding head 20 has two bores 43 which respectively receive the eccentrics 41 so that the eccentrics are rotatable therein.

Each of the eccentrics 39 and 41 may be rotated on the crank on which it is mounted so as to assume a desired angular position and may be maintained in that position by the screw 40. By suitable rotative positioning of the eccentrics the clearance between the heads 19 and 20 when they are closest together may be determined. The shafts 21 have their cranks 37 similarly oriented relatively to the shaft axes and also the eccentrics 39 are similarly oriented so that upon rotation of the shafts the head 19 will, while maintaining its orientation, be moved through a circular path. The same applies with respect to the lower feeding head 20. Also the shafts 21 will ordinarily have their cranks 37 turned 180° from the corresponding positions of the cranks 38 on the shafts 22 and the eccentrics on all four cranks will be arranged so that in operation the upper and lower feeding heads partake of opposed synchronous movement, approaching each other during the same interval, reaching their respective positions in which each is nearest the axes of the shafts of the other at the same time and the heads when closest together moving laterally in the same direction, i. e., toward the left viewing Figure 1.

Each of the heads 19 and 20 carries work engaging members adapted to engage the work and feed the same through the machine. The work engaging members in the form of structure shown in the drawings are in the form of pads 44 and 45. The upper pad 44 is connected with the upper feeding head 19 and the lower pad 45 is connected with the lower feeding head 20. Recesses 46 are formed in the lower surface of the head 19 and recesses 47 are formed in the upper surface of the head 20. Bolts 48 enter the recesses 46 and are threaded into the head 19 at the bottoms of the recesses and bolts 49 enter the recesses 47 and are threaded into the head 20 at the bottoms of the recesses. The upper pad 44 is provided with recesses 50 and the lower pad 45 is provided with recesses 51. Bores 52 extend from the respective recesses 50 upwardly to the upper surface of the pad 44 and bores 53 extend from the recesses 51 downwardly to the lower surface of the pad 45. The heads of the bolts 48 lie in the recesses 50 and the bolts pass through the bores 52 and the heads of the bolts 49 lie in the recesses 51 and the bolts pass through the bores 53. The bores are somewhat larger in diameter than the bolts to permit relative movement between the pads and the bolts. A compression coil spring 54 surrounds each of the bolts 48 and enters the corresponding recess 46 and bears between the head 19 and the pad 44. A compression coil spring 55 surrounds each of the bolts 49 and enters the corresponding recess 47 and bears between the head 20 and the pad 45. Threaded into the head 19 is a guide pin 56 and threaded into the head 20 is a guide pin 57. These pins enter openings 58 and 59, respectively, in the pads 44 and 45 whereby the pads are guided for vertical movement. Movement of the pads away from the respective heads to which they are connected is limited by the heads of the bolts 48 and 49. The springs normally urge the pads away from their heads and toward the work 36. The work passes through a tensioner 60 before entering the feeding device.

The feeding device operates as follows. While the pads 44 and 45 are out of contact with the work the work is being operated on by the forming means and is simultaneously being fed or advanced by the forming means. As the forming means releases the work upon each cycle of operation the heads 19 and 20 are moving toward each other and toward the work. As the heads 19 and 20 approach the position in which they are closest together the pads 44 and 45, which are maintained away from their respective heads by the springs 54 and 55, engage the work and during continued rotation of the shafts 21 and 22 the springs are compressed, pressing the pads against the work, and at the same time the heads 19 and 20 carrying the pads move toward the left viewing Figure 1. The pads are guided for vertical move-

ment by the guide pins 58 and 59. As the heads 19 and 20 pass the position in which they are closest together and begin to move apart the springs 54 and 55 expand, maintaining the pads 44 and 45 in contact with the work until the heads of the bolts 48 and 49 engage the bottoms of the recesses 50 and 51, when the pads are withdrawn from contact with the work. At about this same time the forming means contacts the work and continues the feeding movement of the work during the forming operation. The length of time during which the pads 44 and 45 are in contact with the work upon each cycle may be determined by the extent to which the bolts 48 and 49 enter the respective feeding heads 19 and 20.

Figures 3 and 4 show modified constructions of the feeding and forming means. Figure 3 shows a feeding device which is the same as that shown in Figures 1 and 2 except that the pads 44*a* and 45*a* in Figure 3 have dies 61 and 62 which when the work is advanced by the feeding device form surface interruptions in the work, the surface interruptions in the form shown being openings or perforations through the work; they may, however, be in the nature of embossings or other surface interruptions. To insure the proper operation of the dies 61 and 62 the heads 19*a* and 20*a* engage the pads 44*a* and 45*a*, respectively, when the pads are in engagement with the work 36*a* as shown in Figure 3. Thus the dies 61 and 62 are operated positively by the heads which directly engage the pads carrying the dies and during the time when the heads are in engagement with the pads the springs 54*a* and 55*a* are fully compressed and temporarily inoperative. The metal removed by the dies 61 and 62 passes down through a passageway 63 and may drop into any suitable receptacle.

The purpose of forming the surface interruptions in the work by the dies 61 and 62 is so that when the work is acted on by the forming means the surface interruptions may serve to cooperate with work positioning means to insure highly accurate positioning of the work during the forming operation. The dies 61 and 62 may, as above indicated, be embossing dies and simply emboss the work instead of forming openings all the way through it and the embossings may likewise be used to receive the positioning means.

In Figure 4 is shown a portion of forming means for use with the work provided with the openings as shown in Figure 3. The upper head 2*a* of the forming means carries a die 15*a* and the lower head 3*a* carries a die 17*a*. The upper head also carries a punch 64 operating in a female die 65 in the lower head. The upper head further carries positioning pins 66 adapted to enter the openings in the work formed by the dies 61 and 62 of Figure 3. Thus when the forming means of Figure 4 operates on the work fed by the feeding device of Figure 3 the work is very accurately positioned by the forming means through the entrance of the pin 66 into the openings in the work during the forming operation.

In Figures 6 and 7 there is shown a feeding device employing only a single rotary feeding head 19*b* which may be identical in structure and operation with the head 19. Opposed to the head 19*b* is a series of idler rollers 67 which underlie the work and which cooperate with the head 19*b* in positioning and advancing the work. The feeding impetus comes entirely from the head 19*b*, the idler rollers 67 serving to support the work and to press it against the feeding head as the head moves into feeding position relatively to the work. As the work is advanced by the head 19*b* the rollers 67 turn under the influence of the work so as to reduce the friction on the work. The structure of Figures 6 and 7 is less efficient than other structures herein disclosed and is not adapted for as high speed operation but is found satisfactory for certain conditions of operation encountered in practice.

Details of the mechanism not essential to the features of the invention of the present application are not described at length herein but are disclosed in my said copending application Serial No. 497,792.

While I have shown and described certain present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like and eccentric means on which at least one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work.

2. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like and eccentric means on which each of the feeding heads is mounted and for operating the same whereby each feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work.

3. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like and eccentric means on which at least one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, at least one of the feeding heads having work engaging means adapted resiliently to engage the work and to be urged thereagainst during advancement thereof.

4. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like and eccentric means on which at least one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, each of the feeding heads having work engaging means adapted resiliently to engage the

work and to be urged thereagainst during advancement thereof.

5. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like and eccentric means on which one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, the opposed feeding head comprising anti-friction means engaging the work opposite the first mentioned feeding head.

6. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like and eccentric means on which one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, the opposed feeding head comprising anti-friction means engaging the work opposite the first mentioned feeding head, the first mentioned feeding head having work engaging means adapted resiliently to engage the work and to be urged thereagainst during advancement thereof.

7. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like and means for operating each of said feeding heads whereby it moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work in such manner as not to substantially deform the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work.

8. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like, eccentric means on which at least one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, at least one of the feeding heads loosely carrying work engaging means, and spring means between said head and said work engaging means for urging said work engaging means toward the work.

9. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like, eccentric means on which at least one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, at least one of the feeding heads having movably mounted thereon work engaging means adapted to engage the work during that portion of the cycle of movement of the feeding device when the feeding heads are relatively close together, and guide means for guiding the work engaging means in movements toward and from said head.

10. A forming machine comprising, in tandem, forming means and a feeding device for feeding work through the forming means, the feeding device comprising opposed cooperating feeding heads, and eccentric means on which at least one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work.

11. A forming machine comprising, in tandem, a forming device comprising opposed cooperating forming heads, means for operating at least one of said forming heads whereby it moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation, a feeding device for feeding work through the forming device, the feeding device comprising opposed cooperating feeding heads, and eccentric means on which at least one of the feeding heads is mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, said forming heads being relatively far apart while said feeding heads are relatively close together and said feeding heads being relatively far apart while said forming heads are relatively close together.

12. A forming machine comprising, in tandem, a forming device comprising opposed cooperating forming heads, means for operating each of said forming heads whereby it moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation, a feeding device for feeding work through the forming device, the feeding device comprising opposed cooperating feeding heads, and means for operating each of said feeding heads whereby it moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, said forming heads being relatively far apart while said feeding heads are relatively close together and said feeding heads being relatively far apart while said forming heads are relatively close together.

13. A forming machine comprising, in tandem, a forming device comprising opposed cooperating forming heads, means for operating at least one of said forming heads whereby it moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation, a feeding device for feeding work through the forming device, the feeding device comprising opposed cooperating feeding heads, and eccentric means on which at least one of the feeding heads is

mounted and for operating the same whereby that feeding head moves generally in an orbit adjacent the path of the work while maintaining substantially fixed orientation and when closest to the work engages the work, presses it against the opposed feeding head and moves generally in the direction of feed, whereby to advance the work, said forming heads being relatively far apart while said feeding heads are relatively close together and said feeding heads being relatively far apart while said forming heads are relatively close together, at least one of the feeding heads having work engaging means adapted resiliently to engage the work and to be urged thereagainst during advancement thereof.

14. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like movable toward and away from each other and moving also laterally generally in the direction of feed and adapted to engage and advance the work, said feeding heads having means forming in the work surface interruptions to cooperate with work positioning means on the forming means or the like.

15. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads separate from the forming means or the like movable toward and away from each other and when closest together moving also laterally generally in the direction of feed and adapted to engage and advance the work, said feeding heads having means forming in the work openings to receive work positioning means on the forming means or the like, at least one of said feeding heads having thereon work engaging means adapted resiliently to engage the work and to be urged thereagainst during that portion of the cycle of movement of the feeding device when the feeding heads are relatively close together, said feeding head pressing directly against said work engaging means when the heads are closest together to insure operation of said opening forming means.

16. A forming machine comprising opposed cooperating forming heads movable toward and away from each other and when closest together moving also laterally generally in the same direction, at least one of said forming heads having guiding means adapted to enter previously formed openings in the work, and feeding means comprising opposed cooperating feeding heads movable toward and away from each other and when closest together moving also laterally generally in the direction of feed, said feeding means having means forming in the work said openings to receive said guiding means.

17. A forming machine comprising opposed cooperating forming heads at least one of which is movable toward and away from the other between which work is adapted to be fed, at least one of said forming heads having guiding means adapted to cooperatively engage surface interruptions in the work, and feeding means feeding work between said forming heads, said feeding means having means forming in the work said openings to receive said guiding means.

18. A forming machine comprising opposed cooperating forming heads between which work is adapted to be fed, at least one of said forming heads having guiding means adapted to enter previously formed openings in the work, and feeding means feeding work between said forming heads, said feeding means comprising cooperating feeding heads adapted to engage and advance the work, at least one of said feeding heads having thereon work engaging means adapted yieldingly to engage the work, said feeding means having means forming in the work said openings to receive said guiding means, said feeding head pressing directly against said work engaging means when the heads are closest together to insure operation of said opening forming means.

19. A forming machine comprising opposed cooperating forming heads movable toward and away from each other and when closest together moving also laterally generally in the same direction and feeding means for feeding work between said heads, said feeding means comprising opposed cooperating feeding heads movable toward and away from each other and when closest together moving also laterally generally in the direction of feed, the forming heads and feeding heads being so constructed and arranged that at any instant the feeding heads move in a direction substantially opposed to the direction of movement of the forming heads whereby the stresses in the machine due to operation of said heads are at least partially balanced.

20. A forming machine comprising forming means having opposed cooperating forming heads movable toward and away from each other and when closest together moving also laterally generally in the same direction and feeding means at both the entering side and the discharge side of the forming means for feeding work between said heads, said feeding means comprising opposed cooperating feeding heads movable toward and away from each other and when closest together moving also laterally generally in the direction of feed, the forming heads and feeding heads being so constructed and arranged that at any instant the feeding heads move in a direction substantialy opposed to the direction of movement of the forming heads whereby the stresses in the machine due to operation of said heads are at least partially balanced.

21. A forming machine comprising opposed cooperating forming heads between which work is adapted to be fed, at least one of said forming heads having guiding means adapted to enter previously formed openings in the work, feeding means feeding work between said forming heads, said feeding means comprising cooperating work-engaging means adapted to engage and advance the work, at least one of said work-engaging means being mounted so as to yieldingly engage the work, said feeding means having means forming in the work said openings to receive said guiding means, and means pressing directly against said one of said work-engaging means when the heads are closest together to insure operation of said opening forming means.

22. A feeding device for feeding work through forming means or the like comprising opposed work engaging means adapted to engage the work at opposite faces thereof, said means at one face only of the work being guided so as to maintain substantially fixed orientation, orbitally movable toward and away from the work and when closest to the work engaging the work and pressing it against said means at the opposite face of the work and advancing the work in the direction of feed, said means at the opposite face of the work positioning the work while it is advanced by said movable means.

23. A feeding device for feeding work through forming means or the like comprising opposed work engaging means adapted to engage the work at opposite faces thereof, said means at one face

of the work being movable toward and away from the work and when closest to the work engaging the work and pressing it against said means at the opposite face of the work and also moving laterally generally in the direction of feed whereby to advance the work, said means at the opposite face of the work comprising roller means which positions the work while it is advanced by said movable means.

24. A feeding device for feeding work through forming means or the like comprising opposed cooperating feeding heads movable toward and away from each other and moving also laterally generally in the direction of feed and adapted to engage and advance the work, said feeding heads having means forming in the work surface interruptions to cooperate with work positioning means on the forming means or the like.

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