Sept. 10, 1946. G. O. CONNER 2,407,254

FORMING MACHINE

Filed Feb. 23, 1945 5 Sheets-Sheet 1

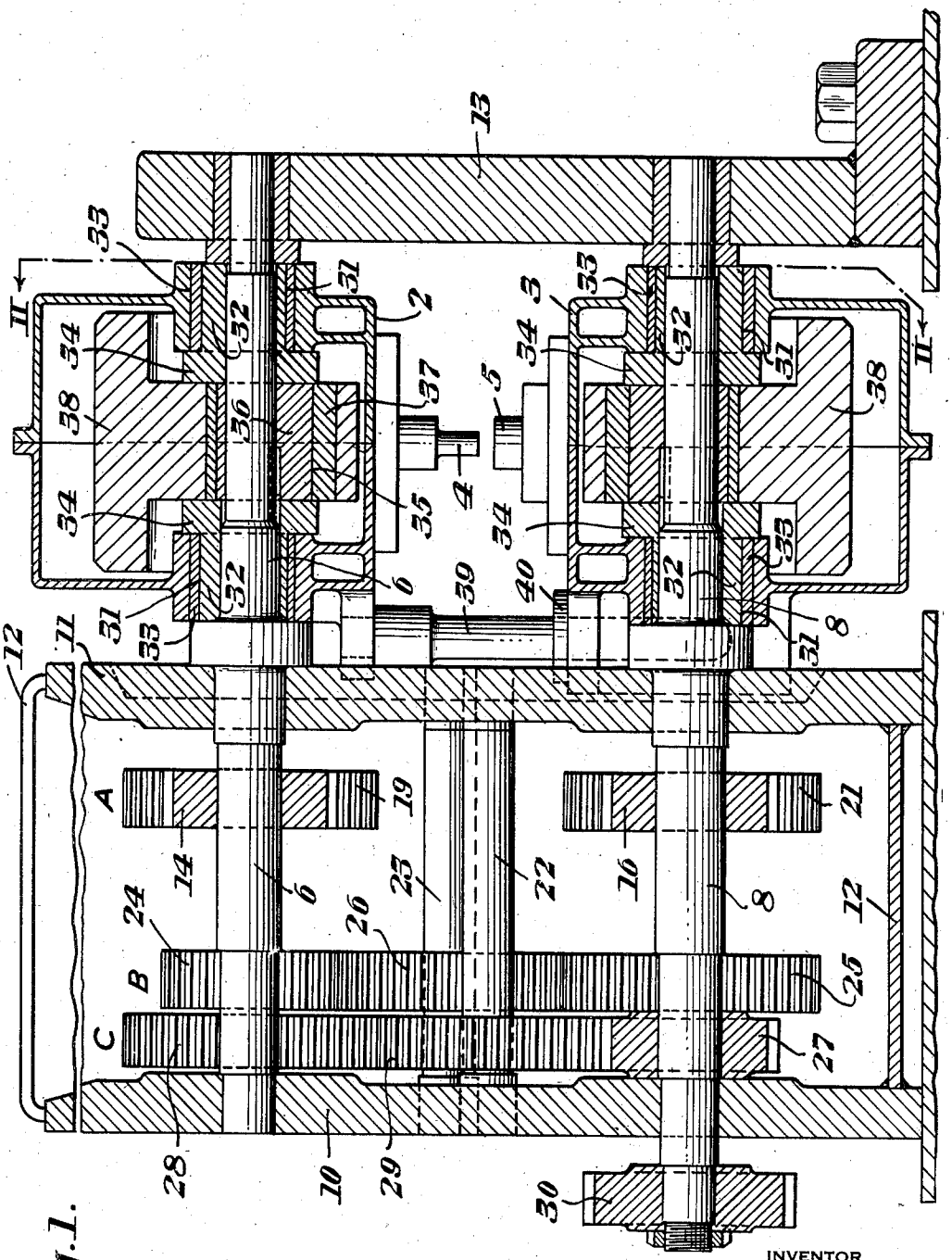


Fig. 1.

INVENTOR
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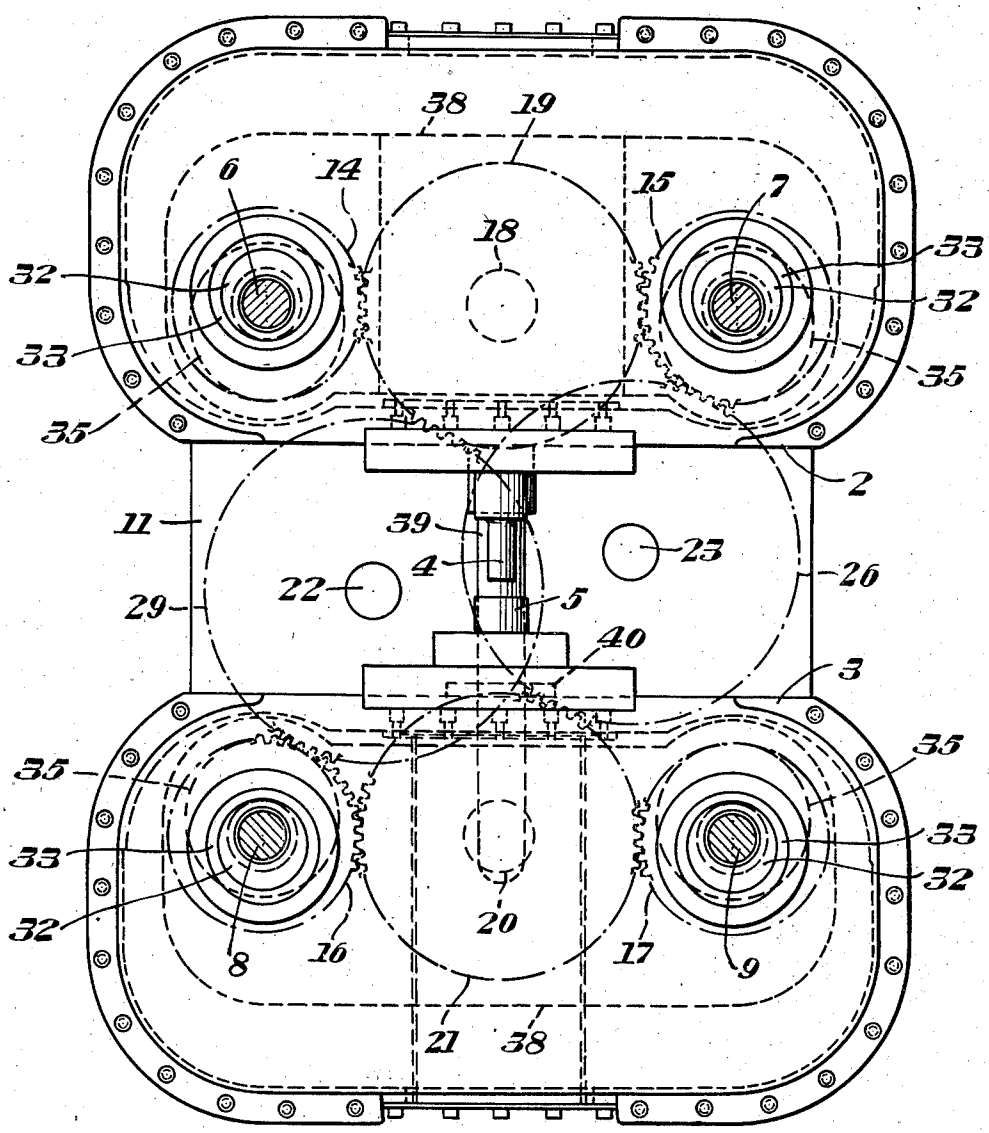
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FORMING MACHINE

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Fig. 2.



INVENTOR

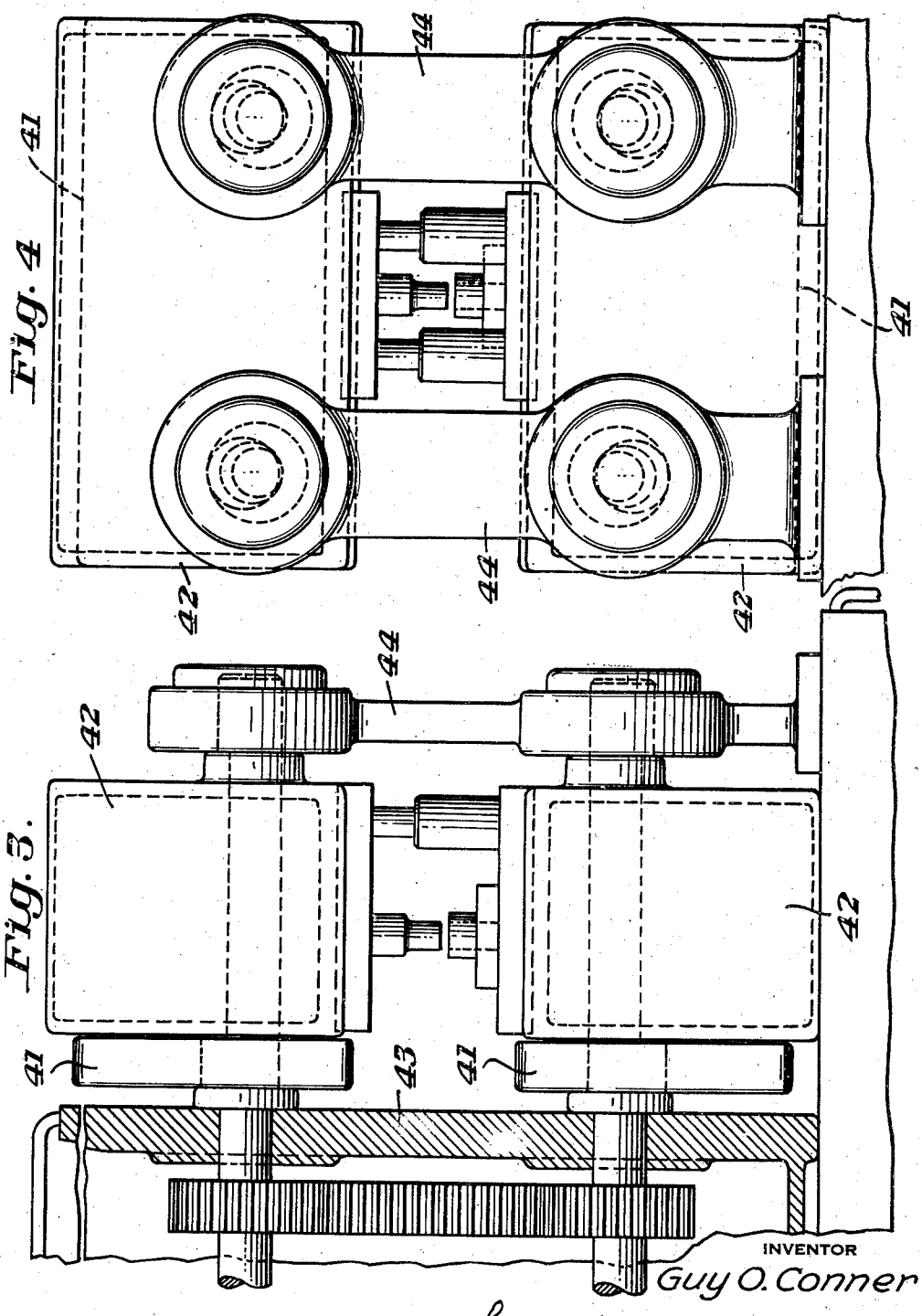
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FORMING MACHINE

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FORMING MACHINE

Filed Feb. 23, 1945 5 Sheets-Sheet 4

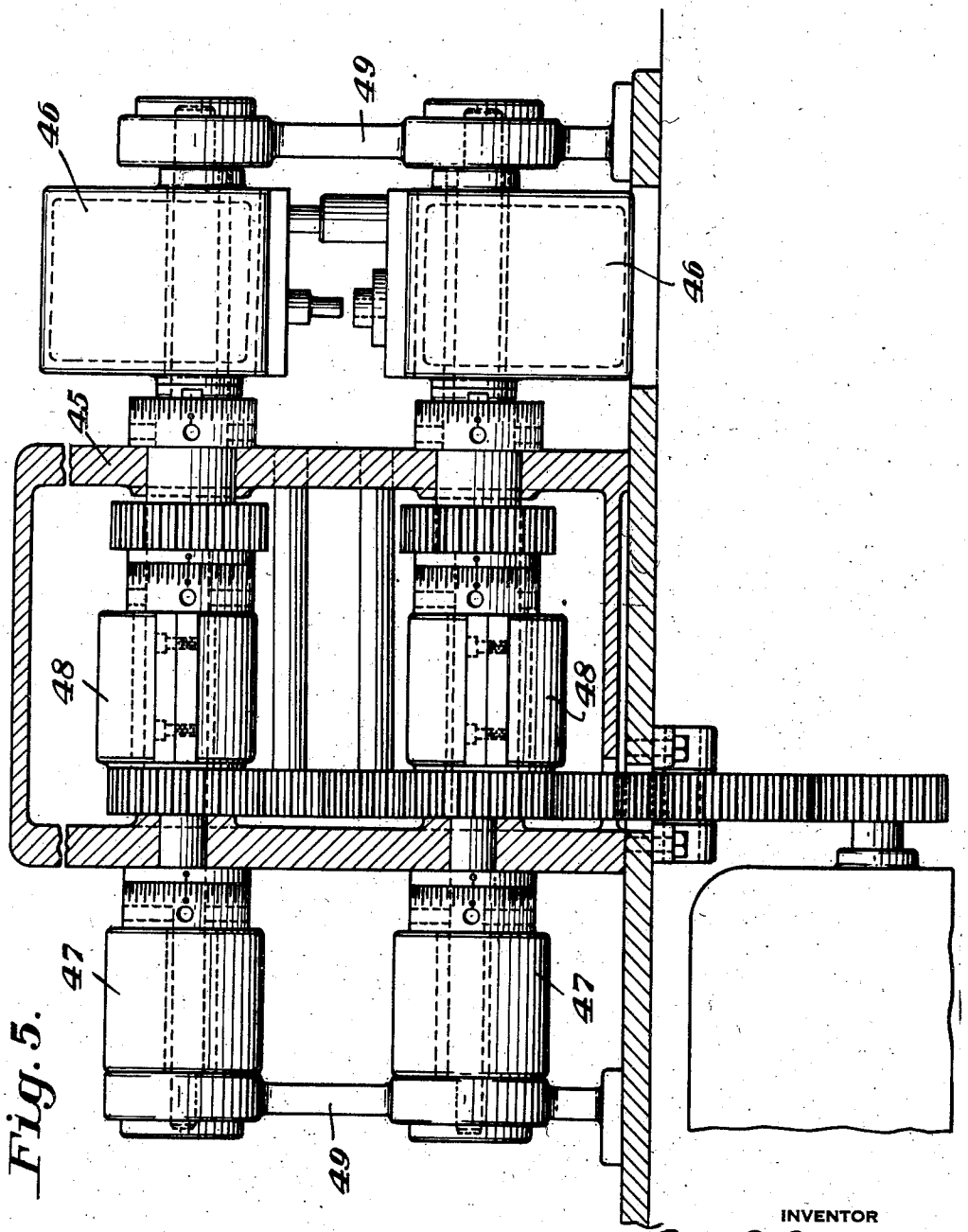


Fig. 5.

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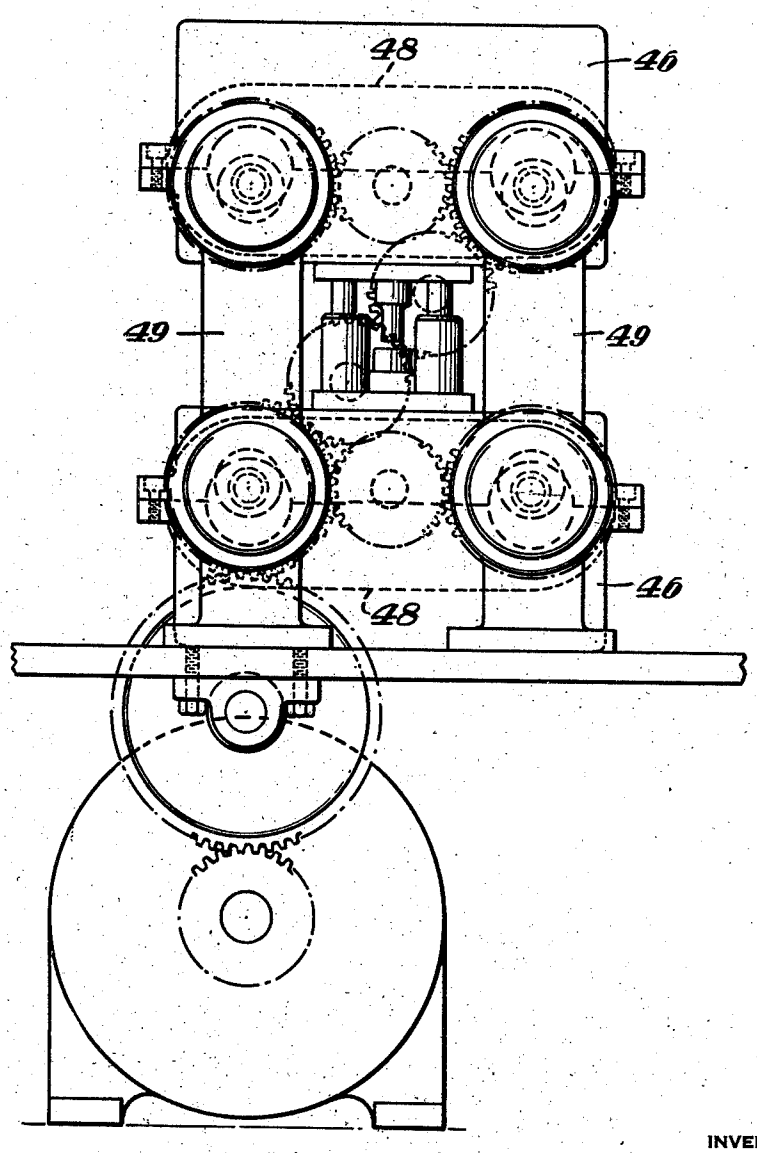
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Sept. 10, 1946. G. O. CONNER 2,407,254

FORMING MACHINE

Filed Feb. 23, 1945 5 Sheets-Sheet 5

Fig. 6.



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Patented Sept. 10, 1946

2,407,254

UNITED STATES PATENT OFFICE

2,407,254

FORMING MACHINE

Guy O. Conner, Cleveland Heights, Ohio

Application February 23, 1945, Serial No. 579,405

32 Claims. (Cl. 164—86)

1

This invention relates to forming machines and particularly to forming machines for high speed operation. It relates more particularly to machines through which work is passed and which act on the work with rapid successive operations. The term "forming machine" is used herein as a term of definition and not of limitation; my invention is applicable to practically all operations which may be performed on work passed through the machine—examples are stamping, die forming, plastic molding, ceramic molding, extrusion, printing, etc.

My invention is especially applicable to forming machines comprising opposed heads for operating on work positioned therebetween and which relatively move toward and away from each other and when closest together move laterally generally in the same direction. In my copending application Serial No. 497,792, filed August 7, 1943, there is illustrated a forming machine comprising opposed sets of parallel shafts having eccentric means thereon and opposed heads, one mounted on the shafts of each set and carried by eccentric means thereon so that upon rotation of the shafts the heads move toward and away from each other and when closest together move laterally generally in the same direction. My invention is applicable to such machines but is also applicable to other machines, as, for example, machines in which one head moves in a circular orbit and the cooperating head partakes simply of linear to and fro motion.

My invention has to do particularly with the counter-weighting of machines employing either one head or two heads movable toward and away from the work and when acting on the work movable laterally or in the direction of feed of the work. The heads of such machines may be ponderous. I operate them at speeds which, in comparison with the commercial speeds attained prior to my recent developments, are considered very high. The rapid operation of a ponderous working head in a circular orbit, acting on work during a portion of each cycle, tends to impart to the machine as a whole and to the supporting framework continually reversing stresses of considerable magnitude which, unless effectively counteracted, set up serious vibrations which not only tend to deteriorate the machine bearings and other parts, as well as the foundation upon which the machine is mounted, but also impose a limitation upon speed of operation. The proper counterweighting of such machines is therefore of the utmost importance.

In my said copending application I have disclosed the application of individual counterweights to the shafts upon which the heads are mounted. Such counterweights are desirably effective and have proved successful in use. I provide a different system of counterweighting machines of the type above referred to which is of considerable advantage from the standpoints of construction, assembly and operation over the application of individual counterweights to the various shafts. For example, I provide a forming machine comprising opposed heads for operating on work positioned therebetween and which relatively move toward and away from each other and when closest together move laterally generally in the same direction, a plurality of parallel shafts on which one of the heads is mounted, eccentric means on the shafts carrying the head to impart the desired movement to the head upon rotation of the shafts, a counterweight also mounted on the same shafts and eccentric means on the shafts carrying the counterweight. Thus a single counterweight may serve for all of the shafts which operate each head. Desirably the counterweight is mounted on the shafts in the same way as the head is mounted thereon so the forces imposed on the shafts by the counterweight are of the same character as those imposed by the head. The counterweight is preferably arranged on the shafts so that it is at all times approximately radially opposite the head so that the resultants of the forces exerted on the shafts by the head and counterweight are negligible. The counterweight is preferably adjustably carried by the shafts so that its angular position relatively to the head may be nicely controlled. It may be attached to the shafts at exactly 180° from the head or at an angle varying slightly one way or the other from 180°, depending upon the particular conditions of operation. The adjustment will be such that the machine vibrates little or none in operation. Machines counterweighted according to my present invention have operated on work at very high speeds without even being bolted to a foundation and have not even exhibited a tendency to creep.

The heads and counterweights are, as above stated, applied to their shafts through eccentric means on the shafts so that when the shafts rotate the heads and counterweights partake of orbital movement. The eccentric means may be any appropriate means accomplishing the function, such, for example, as cranks, although I prefer to employ eccentric sleeves on the shafts, and desirably each eccentric sleeve comprises an inner eccentric bushing and an outer eccentric collar mounted on the eccentric bushing so that by appropriate angular adjustment of the bushing and collar the throw or amplitude of movement of the head or counterweight, as the case may be, as well as the relative angular positions of the head and counterweight on the shafts may be controlled.

I prefer to arrange the working head means and the counterweight means in machines of the type under discussion so that the respective re-

sultant forces exerted thereby on the shafts act thereon at the same points axially thereof. This may be accomplished in various ways, as, for example, by the provision of counterweights on opposite sides of a head, or the head may straddle the counterweight or the counterweight may straddle the head. Alternatively, the working head and counterweight may be disposed immediately adjacent each other on the shafts. Various other arrangements of heads and counterweights may be employed, the best results being obtained by arranging the working head means and the counterweight means on the shafts so that the resultants of all the forces imposed on the shafts are as near zero as possible. The shafts are driven by power transmitting means and the working head means and counterweight means may be disposed in various relationships to the power transmitting means depending upon the conditions of operation, as will be explained.

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 cross-sectional view with a portion cut away of a forming machine, the view being taken on a plane perpendicular to the direction of feed;

Figure 2 is a vertical cross-sectional view taken on the line II—II of Figure 1;

Figure 3 is a fragmentary view similar to Figure 1, but to somewhat reduced scale, of a different structure, portions of the structure being shown in elevation;

Figure 4 is an elevational view of the structure shown in Figure 3 as viewed from the right-hand side of that figure;

Figure 5 is a view similar to Figures 1 and 3, but to further reduced scale, showing a further modified structure; and

Figure 6 is a view similar to Figure 2 of the structure shown in Figure 5.

Referring now more particularly to the drawings, there is shown in Figures 1 and 2 a forming machine having an upper working head 2 and a lower working head 3 each operable in a circular orbit, the working heads cooperating with each other to act upon work passed therebetween. The work is fed through the machine in the crosswise direction viewing Figure 2 or in the direction perpendicular to the paper viewing Figure 1. The feeding and guiding means for the work form no part of the present invention and hence are not shown. The work may be fed and guided by hand but I prefer to employ means for that purpose, the feeding and guiding means of my said copending application being recommended. I have shown on the upper head 2 a punch 4 adapted to cooperate with a die 5 on the lower head 3 for either stamping or die-forming work, which may, for example, be strip metal.

The heads 2 and 3 are mounted upon parallel shafts. The head 2 is mounted upon shafts 6 and 7 and the head 3 is mounted upon shafts 8 and 9. The shafts 6 and 7 are disposed at the same elevation and are the same distance apart as are the shafts 8 and 9, the axes of the shafts 6 and 8 lying in a common vertical plane parallel to the vertical plane containing the axes of the shafts 7 and 9.

The machine frame comprises uprights 10 and 11 in which the shafts 6, 7, 8 and 9 are journaled. The uprights are joined by members 12 and by face portions forming a casing in which is disposed the gearing, presently to be described, for driving the shafts 6, 7, 8 and 9. The shafts project from the casing, the two upper shafts 6 and 7 carrying at their projecting portions the upper head 2 and the two lower shafts 8 and 9 carrying at their projecting portions the lower head 3. The projecting shaft portions also carry the counterweights presently to be described. The outer ends of the shafts are journaled in outboard bearings carried by a pedestal 13.

In operation the two upper shafts 6 and 7 turn at the same speed in the same direction and the two lower shafts 8 and 9 turn at the same speed as that of the shafts 6 and 7 but in the opposite direction. For example, if the work is to move from right to left, viewing Figure 2, the upper shafts 6 and 7 rotate clockwise and the lower shafts 8 and 9 rotate counterclockwise. To drive the four shafts in the directions indicated and at the same speed gearing is provided in the casing above referred to. Four pinions 14, 15, 16 and 17 of equal diameter are keyed to the respective shafts 6, 7, 8 and 9, those pinions lying in the same plane indicated by the letter A in Figure 1. A shaft 18 parallel to the shafts 6 and 7 and disposed therebetween equidistant therefrom is journaled in the uprights 10 and 11 and has keyed thereto a gear 19 meshing with the two pinions 14 and 15. A shaft 20 parallel to the shafts 8 and 9 and disposed therebetween equidistant therefrom is journaled in the uprights 10 and 11 and has keyed thereto a gear 21 meshing with the two pinions 16 and 17. Two other shafts 22 and 23 parallel to the shafts which have been described are also journaled in the uprights 10 and 11.

In the plane indicated by the letter B in Figure 1 there is keyed to the shaft 7 a pinion 24 of the same diameter as the pinion 15, there is keyed to the shaft 20 a gear 25 of the same diameter as the gear 21 and the intermediate shaft 23 carries a gear 26 meshing with the gears 24 and 25. In the plane indicated by the letter C in Figure 1 there is keyed to the shaft 8 a pinion 27 of the same diameter as the pinion 16, there is keyed to the shaft 18 a gear 28 of the same diameter as the gear 19 and the intermediate shaft 22 carries a gear 29 meshing with the gears 27 and 28.

The gearing just described constitutes power transmitting means for rotating in unison the shafts 6, 7, 8 and 9 in the directions indicated. Power may be applied through any of the shafts, a driving pinion 30 being shown keyed to the shaft 8 for that purpose. Power for driving the pinion 30 may be derived from any suitable source such as an electric motor.

The projecting portions of the shafts 6, 7, 8 and 9, carry eccentric sleeves upon which the heads 2 and 3 and the counterweights to be described are mounted. Each eccentric sleeve comprises an inner eccentric bushing and an outer eccentric collar so that by appropriate angular adjustment of the bushing and collar the throw or amplitude of the head or counterweight, as the case may be, as well as the relative angular positions of the head and counterweight on the shafts may be controlled. In the form shown in Figure 1 each head straddles the counterweight which is carried by the shafts which carry that head. Each shaft carries two eccentric sleeves upon which one of the heads is mounted and intermediate such two sleeves another ec-

centric sleeve on which one of the counterweights is mounted. Each of the four shafts carries two eccentric sleeves **31** each comprising an inner eccentric bushing **32** and an outer eccentric collar **33**. Each bushing is normally fast on its shaft but can be turned thereon for adjustment and each collar is normally disposed in fixed position on its bushing but can be turned thereon for adjustment. When the sleeve **31** as a whole is turned (without relative turning of the bushing **32** and collar **33**) the throw of the sleeve is not altered but the angular position of the head is altered. When either the bushing or the collar is turned relatively to the other the throw of the sleeve is altered.

Each bushing **32** has a radial flange **34** at its inner end, and between the flanges **34** on each of the four shafts **6**, **7**, **8** and **9** is disposed an eccentric sleeve **35** for mounting a counterweight. Each eccentric sleeve **35** comprises an inner eccentric bushing **36** and an outer eccentric collar **37**. Each bushing **36** is normally fast on its shaft but can be turned thereon for adjustment and each collar **37** is normally disposed in fixed position on its bushing but can be turned thereon for adjustment. When the sleeve **35** as a whole is turned (without relative turning of the bushing **36** and collar **37**) the throw of the sleeve is not altered but the angular position of the counterweight is altered. When either the bushing or the collar is turned relatively to the other the throw of the sleeve is altered.

As shown in Figure 1 each of the heads **2** and **3** is mounted on two of the sleeves **31** and a counterweight **38** is disposed generally within each head and is mounted on the corresponding sleeves **35**. As shown, each head is of hollow construction so that the corresponding counterweight lies substantially within the head but is free to partake of movement relatively to the head which it must do since it is mounted on the shafts at an angle of in the neighborhood of 180° from the corresponding head. In other words, the mounting of, for example, the upper head relatively to the upper counterweight is such that when the head is in its lowermost position and moving from right to left, viewing Figure 2, the counterweight is approximately in its uppermost position and moving from left to right. By this arrangement the counterweight effectively counteracts the stresses imposed on the shafts by the head since the stresses imposed on the shafts by the counterweight are at all times substantially opposite in direction to those imposed by the head. The mass of the counterweight is made approximately the same as the mass of the head and attached die so that the respective forces exerted on the shafts by the head and counterweight will not only be opposite in direction but approximately equal in magnitude. The mass of the counterweight may differ somewhat from the mass of the head depending on conditions of operation, but generally speaking the mass of the head and the mass of the counterweight are so related that the forces imposed thereby upon the shafts in operation of the machine will be of approximately equal magnitude.

The positioning of the counterweights within the heads as shown in Figures 1 and 2 results in the bringing to bear upon the shafts of the forces exerted by the head and counterweight at the same points axially of the shafts. In other words, the resultant of the forces imposed on a shaft by a head intersects the shaft axis at the same point as that at which the resultant of the

forces imposed on the same shaft by the counterweight intersects the shaft axis. Hence if the forces imposed on the shaft by the head and counterweight respectively are equal and opposite the resultant of all is zero. The practical effect of this is a remarkably smooth-running vibrationless machine which can be operated at speeds until recently believed unattainable. My counterweighting arrangement so effectively neutralizes the forces exerted on the shafts by the heads that I have been able actually to operate a machine upon work at high speed without even bolting the machine to the foundation. The machine remained in place and exhibited no substantial tendency to "creep." I was able to stand nickels on edge on the machine while in operation and there was not sufficient vibration to cause the nickels to fall over.

It is possible to employ individual counterweights on the respective shafts **6**, **7**, **8** and **9** in place of the counterweights **38**. Individual counterweights are disclosed in my said copending application. The eccentric sleeves **35** may themselves constitute counterweights and may if desired be enlarged for that purpose. If the eccentric collars **37** are left off the eccentric bushings **36** alone may serve as counterweights and they may be enlarged if desired. When the counterweights **38** are employed the eccentric members **36** and/or **37** may be considered as parts of the counterweights. I believe it to be new to employ heads and counterweights which exert their respective forces on the shafts at the same points axially of the shafts regardless of whether individual counterweights on the respective shafts or counterweights spanning the space between cooperating shafts are employed.

To insure proper orientation of the heads during operation of the machine I provide on the upper head a vertically downwardly extending guide pin **39** and on the lower head a sleeve **40** receiving the pin **39** in guiding engagement. The pin **39** and sleeve **40** insure that during operation of the machine the heads will be maintained in parallelism to effectively operate upon the work.

In Figures 3 and 4 there is shown a modified construction in which the counterweights **41** are disposed on the shafts beside or immediately adjacent the heads **42** instead of within the heads as in the structure of Figures 1 and 2. As shown in Figure 3, the counterweights **41** are disposed intermediate the uprights **43** forming a portion of the casing and the heads **42**. An outboard bearing **44** is applied to the ends of the shafts as in the structure of Figures 1 and 2. While there are various specific differences in design between the structure of Figures 1 and 2 and that of Figures 3 and 4, these are not of importance for present purposes since Figures 3 and 4 are intended simply to illustrate the positioning of the counterweights beside the heads instead of within the heads. The gearing for operating the shafts in the structure shown in Figures 3 and 4 may be the same as that of Figures 1 and 2 or it may be of different design. It will be appreciated that the shafts may be driven in the manner above explained by various different gear arrangements.

Figures 5 and 6 show a further modified construction in which the shafts project from both sides of the casing **45**, the heads **46** being carried on the ends of the shafts which project in one direction and counterweights **47** being carried on the ends of the shafts which project in the oppo-

site direction. Also additional counterweights 48 are positioned within the casing 45. Outboard bearings 49 are provided for both ends of the shafts. The arrangement of Figures 4 and 5 is of advantage under certain circumstances depending upon the conditions of operation. Whatever the conditions, it is desirable to position the heads and counterweights in relation to each other so that the resultant effects of all the heads and all the counterweights upon all the shafts is as near zero as possible.

The structure of and means for mounting the counterweights of Figures 3, 4, 5 and 6 may be the same as the structure of and means for mounting the counterweights of Figures 1 and 2.

The gear drive in Figures 5 and 6 is specifically different from that of Figures 1 and 2 but the specific gear drive forms no part of the present invention. The gear drive of Figures 1 and 2 or any other drive having the desired effect may be employed.

In Figure 5 the eccentric bushings and collars are shown as provided with indicia facilitating relative adjustment therebetween.

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 forming machine comprising opposed heads for operating on work positioned therebetween and which relatively move toward and away from each other and when closest together move laterally generally in the same direction, a plurality of parallel shafts on which one of the heads is mounted, eccentric means on said shafts carrying said head to impart the desired movement to said head upon rotation of said shafts, a counterweight also mounted on said shafts and eccentric means on said shafts carrying said counterweight.

2. A forming machine comprising opposed sets of parallel shafts, eccentric means on said shafts, opposed heads, one mounted on the shafts of each set and carried by certain of the eccentric means thereon so that upon rotation of said shafts said heads move toward and away from each other and when closest together move laterally generally in the same direction, and opposed counterweights, one mounted on the shafts of each set and carried by other of the eccentric means thereon.

3. A forming machine comprising opposed heads for operating on work positioned therebetween and which relatively move toward and away from each other and when closest together move laterally generally in the same direction, a plurality of parallel shafts on which one of the heads is mounted, eccentric means on said shafts carrying said head to impart the desired movement to said head upon rotation of said shafts, a counterweight also mounted on said shafts and eccentric means on said shafts carrying said counterweight, said eccentric means carrying said head and said eccentric means carrying said counterweight being relatively turnable on said shafts to alter the relative rotative positions of the head and counterweight.

4. A forming machine comprising opposed heads for operating on work positioned therebetween and which relatively move toward and away from each other and when closest together move laterally generally in the same direction, a plurality of parallel shafts on which one of the heads is mounted, eccentric means on said shafts carrying said head to impart the desired movement to said head upon rotation of said shafts, a counterweight also mounted on said shafts, eccentric means on said shafts carrying said counterweight and means for varying the throw of said eccentric means.

5. A forming machine comprising opposed heads for operating on work positioned therebetween and which relatively move toward and away from each other and when closest together move laterally generally in the same direction, a plurality of parallel shafts on which one of the heads is mounted, eccentric means on said shafts carrying said head to impart the desired movement to said head upon rotation of said shafts, a counterweight also mounted on said shafts, eccentric means on said shafts carrying said counterweight, said eccentric means carrying said head and said eccentric means carrying said counterweight being relatively turnable on said shafts to alter the relative rotative positions of the head and counterweight, and means for varying the throw of said eccentric means.

6. In a forming machine, a plurality of parallel shafts, two sets of eccentric bushings on said shafts, an eccentric collar on each bushing, a working head mounted on said shafts, said head being carried by one set of bushings and collars, and a counterweight mounted on said shafts, said counterweight being carried by the other set of bushings and collars, the bushings and collars being turnable relatively to the shafts and to each other to alter the relative rotative positions of the head and counterweight and vary the amplitudes of movement thereof about the axes of said shafts upon rotation of the shafts, and said bushings and collars being fastenable to the shafts and to each other in desired positions so as to rotate with the shafts.

7. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, two sets of eccentric means on said shafts, a working head mounted on said shafts and carried by one set of eccentric means and a counterweight mounted on said shafts and carried by the other set of eccentric means.

8. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, a plurality of sets of eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one set of eccentric means and counterweight means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one other set of eccentric means.

9. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, a plurality of sets of eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one set of eccentric means and counterweight means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one other set of eccentric means, said working head means and said counterweight means being arranged on the shafts so that their respective resultant forces act on the shafts at substantially the same points axially thereof.

10. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, a plurality of sets of eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one set of eccentric means and counterweight means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one other set of eccentric means, said working head means and said counterweight means being arranged on the shafts so that their respective resultant forces act on the shafts at substantially the same points axially thereof and are substantially opposite in direction.

11. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, a plurality of sets of eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one set of eccentric means and counterweight means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by at least one other set of eccentric means, said working head means and said counterweight means being of such mass and so arranged on the shafts that their respective resultant forces act on the shafts at substantially the same points axially thereof and are substantially equal in magnitude and opposite in direction.

12. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by certain of said eccentric means and counterweight means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by other of said eccentric means, the eccentric means carrying one of the working head means and counterweight means being disposed on the shafts on both sides of the eccentric means carrying the other thereof.

13. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by certain of said eccentric means and counterweight means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by other of said eccentric means, one of the working head means and counterweight means straddling the other thereof axially of the shafts.

14. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by certain of said eccentric means and counterweight means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by other of said eccentric means, one of the working head means and counterweight means straddling the other thereof axially of the shafts and said working head means and said counterweight means being arranged on the shafts so that their respective resultant forces act on the shafts at substantially the same points axially thereof.

15. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, eccentric means on said shafts, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts and carried by other of said eccentric means, the working head straddling the counterweight axially of the shafts.

16. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, eccentric means on said shafts, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts and carried by other of said eccentric means, the working head straddling the counterweight axially of the shafts and also covering and concealing the counterweight.

17. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, eccentric means on said shafts, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts and carried by other of said eccentric means, the working head and counterweight being disposed immediately adjacent each other on the shafts.

18. In a forming machine, a plurality of parallel shafts, driving means for rotating said shafts in unison, eccentric means on said shafts, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts between the driving means and the working head and carried by other of said eccentric means.

19. In a forming machine, a plurality of parallel shafts, driving means for rotating said shafts in unison, eccentric means on said shafts, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts between the driving means and the working head and disposed immediately adjacent the working head and carried by other of said eccentric means.

20. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, a casing about said power transmitting means, said shafts projecting through a wall of the casing and being journaled therein, outboard bearing means for the outer ends of said shafts, eccentric means on said shafts between said casing wall and said outboard bearing means, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts and carried by other of said eccentric means.

21. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, bearing means for said shafts adjacent the power transmitting means, said shafts projecting therefrom, bearing means for the projecting portions of said shafts, eccentric means on said shafts between said first mentioned bearing means and said second mentioned bearing means, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts and carried by other of said eccentric means.

22. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, bearing means for said shafts adjacent the power transmitting means, said shafts projecting therefrom, bearing means

for the projecting portions of said shafts, eccentric means on said shafts between said first mentioned bearing means and said second mentioned bearing means, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts and carried by other of said eccentric means, said working head and said counterweight being arranged on the shafts so that their respective resultant forces act on the shafts at substantially the same points axially thereof.

23. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, bearing means for said shafts adjacent the power transmitting means, said shafts projecting therefrom, bearing means for the projecting portions of said shafts, eccentric means on said shafts between said first mentioned bearing means and said second mentioned bearing means, a working head mounted on said shafts and carried by certain of said eccentric means and a counterweight mounted on said shafts and carried by other of said eccentric means, said working head and said counterweight being disposed immediately adjacent each other on the shafts.

24. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, bearing means for said shafts adjacent the power transmitting means, said shafts projecting therefrom in both directions, eccentric means on both projecting portions of said shafts, a working head mounted on said shafts on one side of said power transmitting means and carried by certain of said eccentric means and a counterweight mounted on said shafts on the opposite side of said power transmitting means and carried by other of said eccentric means.

25. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, bearing means for said shafts at opposite sides of said power transmitting means, said shafts projecting beyond both of said bearing means, eccentric means on at least one projecting portion of said shafts, a working head mounted on said eccentric means, other eccentric means on said shafts between said respective bearing means and a counterweight mounted on said other eccentric means.

26. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, bearing means for said shafts at opposite sides of said power transmitting means, said shafts projecting beyond both of said bearing means, three sets of eccentric means on said shafts, one set on each of the projecting portions of said shafts and one set between said respective bearing means, a working head mounted on at least one of said sets of eccentric means and a counterweight mounted on at least one of said sets of eccentric means, each of said three sets of eccentric means having mounted thereon a working head or a counterweight.

27. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, bearing means for said shafts at opposite sides of said power transmitting means, said shafts projecting beyond both of said bearing means, three sets of eccentric means on said shafts, one set on each of the projecting portions of said shafts and one set between said respective bearing means, a working head mounted on one of said sets of eccentric means and counterweights mounted respectively on each of the other sets of eccentric means.

28. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, inner bearing means for said shafts at opposite sides of said power transmitting mean, said shafts projecting beyond both of said inner bearing means, outer bearing means for the respective projecting ends of said shafts, three sets of eccentric means on said shafts, one set between the respective inner bearing means and one set between each of the outer bearing means and the nearer inner bearing means, a working head mounted on one of said sets of eccentric means and counterweights mounted respectively on each of the other two sets of eccentric means.

29. In a forming machine, a plurality of parallel shafts, power transmitting means for rotating said shafts in unison, inner bearing means for said shafts at opposite sides of said power transmitting means, said shafts projecting beyond both of said inner bearing means, outer bearing means for the respective projecting ends of said shafts, three sets of eccentric means on said shafts, one set between the respective inner bearing means and one set between each of the outer bearing means and the nearer inner bearing means, a working head mounted on the set of eccentric means between one of the outer bearing means and the nearer inner bearing means and counterweights mounted respectively on each of the other two sets of eccentric means.

30. In a forming machine, a plurality of parallel shafts, means for rotating said shafts in unison, eccentric means on said shafts, working head means comprising at least one member spanning the space between said shafts and mounted on said shafts collectively and carried by said eccentric means and counterweight means mounted on said shafts, said working head means and said counterweight means being arranged on the shafts so that their respective resultant forces act on the shafts at substantially the same points axially thereof.

31. A forming machine comprising opposed heads for operating on work positioned therebetween and which relatively move toward and away from each other and when closest together move laterally generally in the same direction, a plurality of parallel shafts on which one of the heads is mounted, eccentric means on said shafts carrying said head to impart the desired movement to said head upon rotation of said shafts and counterweight means also mounted on said shafts, said heads and said counterweight means being arranged on said shafts so that their respective resultant forces act on said shafts at substantially the same points axially thereof.

32. A forming machine comprising opposed sets of parallel shafts, eccentric means on said shafts, opposed heads, one mounted on the shafts of each set and carried by eccentric means thereon so that upon rotation of said shafts said heads move toward and away from each other and when closest together move laterally generally in the same direction, and counterweight means also mounted on said shafts, said heads and said counterweight means being arranged on said shafts so that their respective resultant forces act on said shafts at substantially the same points axially thereof.

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