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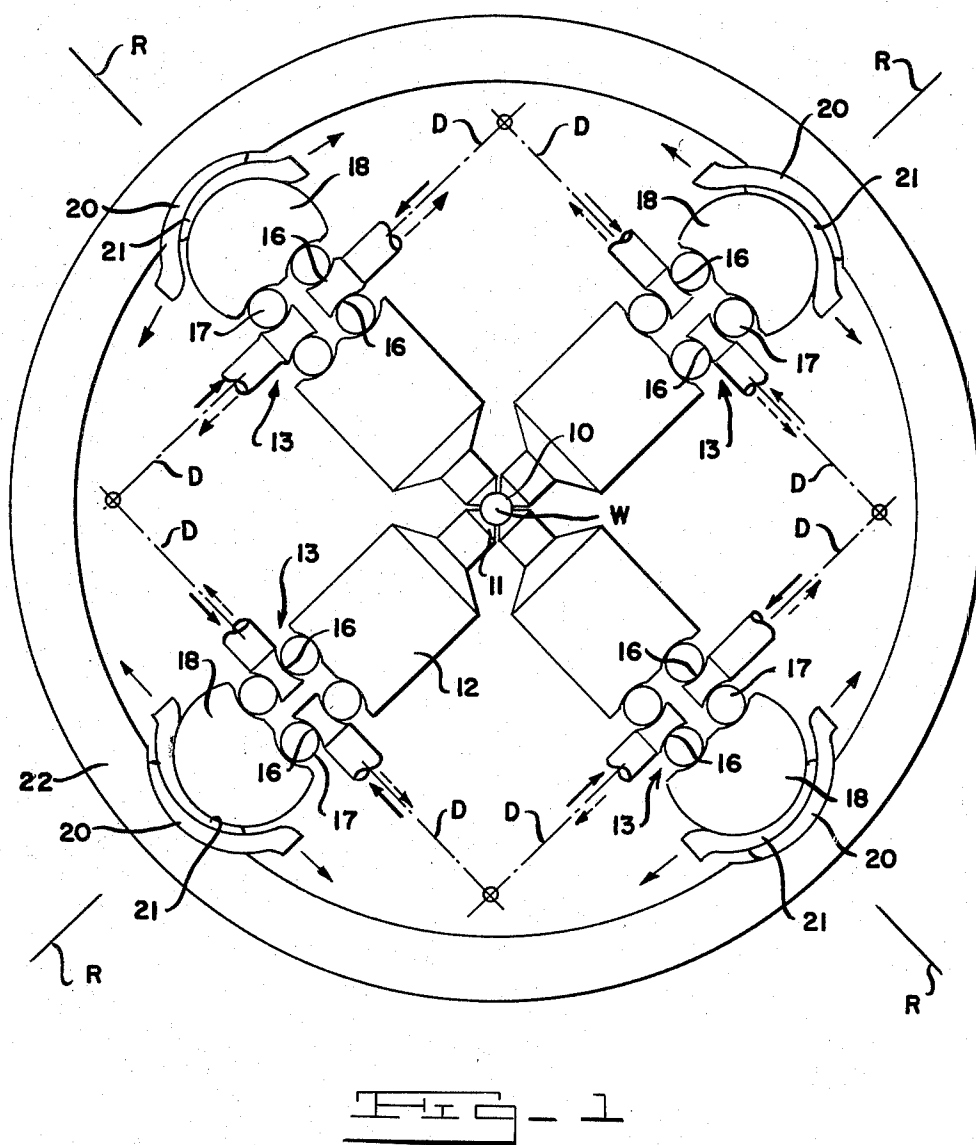
G. H. APPEL ET AL

2,863,342

STROKE ADJUSTMENT MEANS FOR FORMING MACHINES

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4 Sheets-Sheet 1



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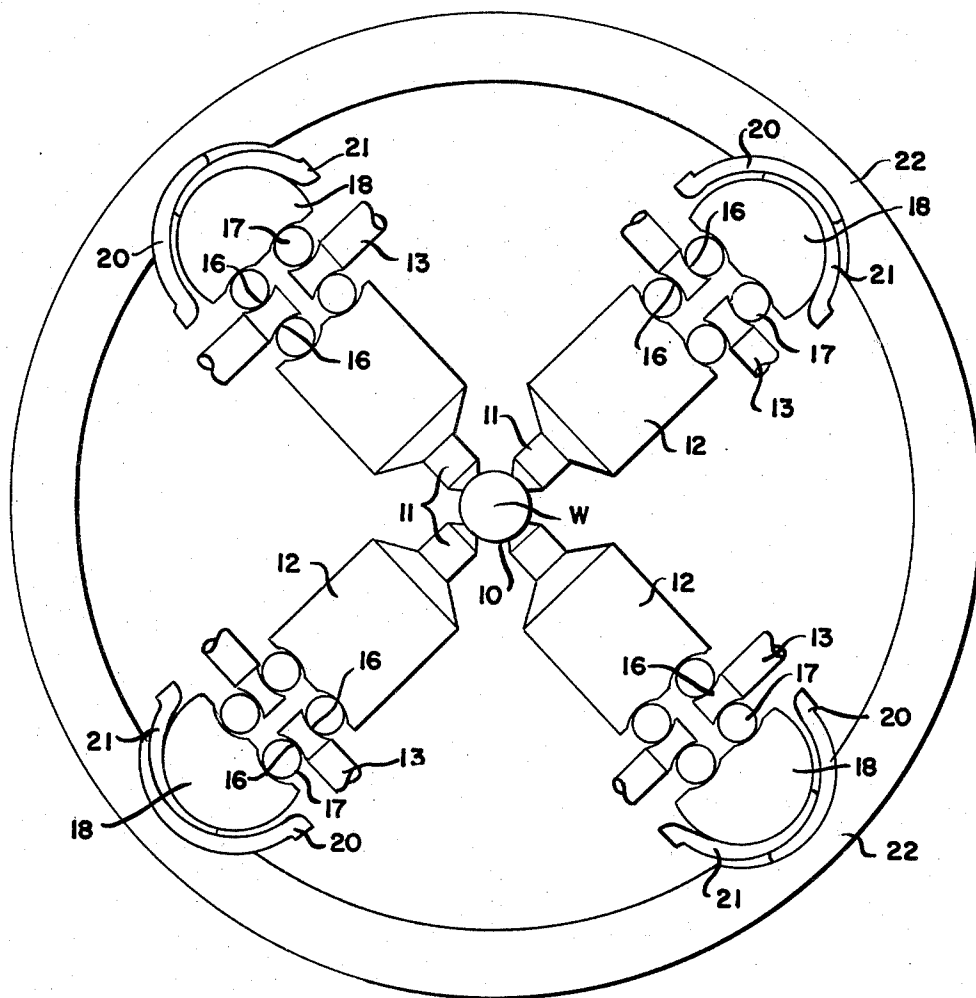
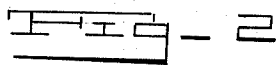
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STROKE ADJUSTMENT MEANS FOR FORMING MACHINES

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4 Sheets-Sheet 2



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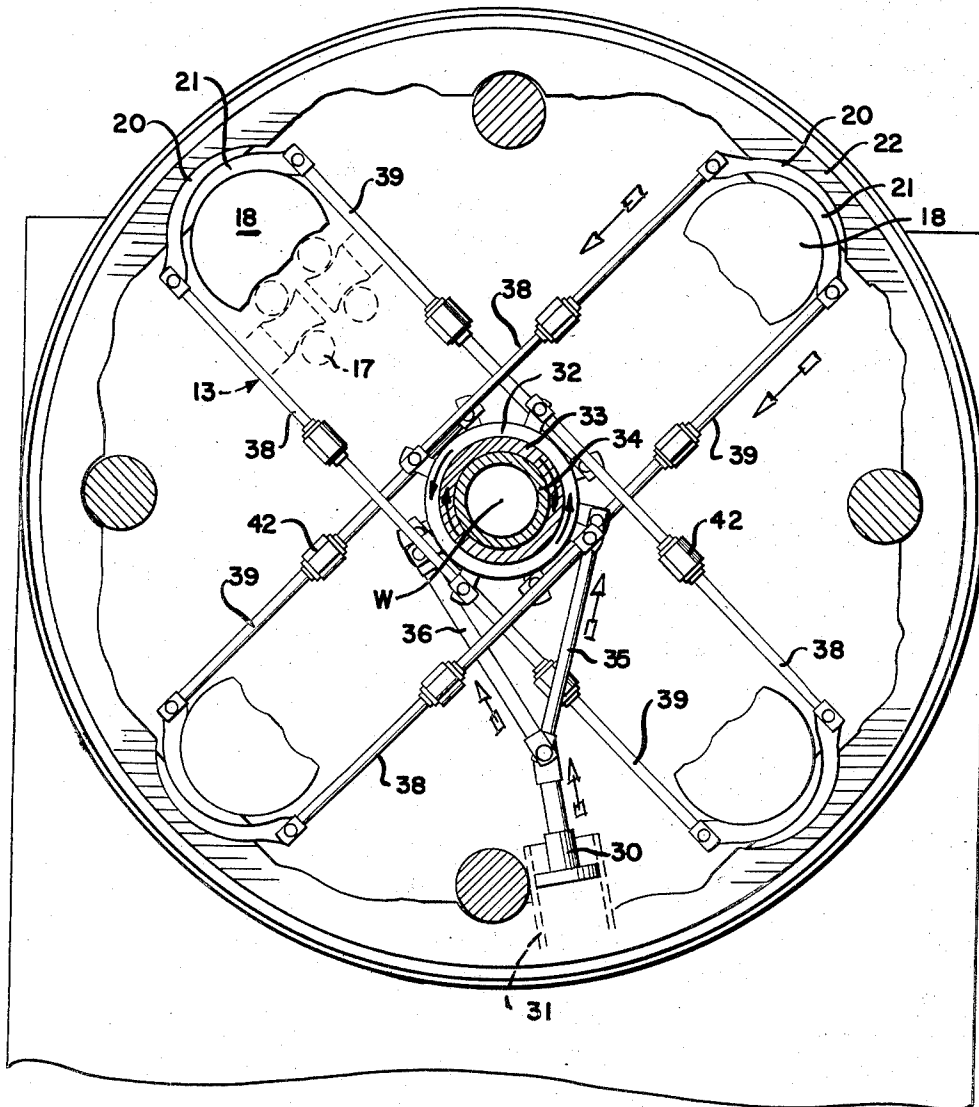
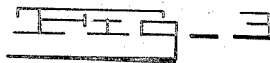
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STROKE ADJUSTMENT MEANS FOR FORMING MACHINES

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4 Sheets-Sheet 3



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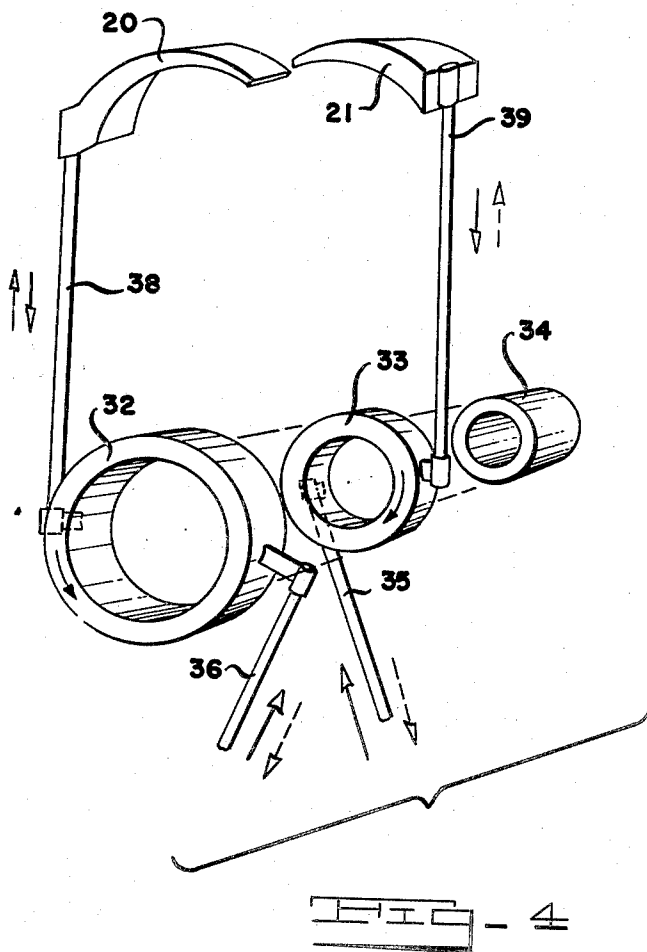
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STROKE ADJUSTMENT MEANS FOR FORMING MACHINES

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4 Sheets-Sheet 4



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2,863,342

STROKE ADJUSTMENT MEANS FOR FORMING MACHINES

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4 Claims. (Cl. 78—20)

It happens that a prior application, Serial No. 450,500 of August 17, 1954, discloses a forming machine wherein a workpiece is arranged so that it may if desired, move longitudinally in a path that is the workpiece axis so as to be formed by dies which move radially towards such axis. The machine comprises a plurality of forming sets arranged around the workpiece axis on radial axes transverse to the workpiece axis, with the radial axes defining paths of forming movements of the dies. Each forming set includes not only the die but also a set of drivers. Each driver has driver cams on its opposed faces which cooperate with rollers, the die, and a backing element so positioned that when the drivers are reciprocated in paths transversely to the radial axes the driver cams bias the rollers along the radial axes against the backing elements and against the dies and move the latter for forming. Such movement of the forming set is a forming stroke. Each forming stroke is extremely small, in the area of 3 to 5 thousandths of an inch; is under great pressure, such as in the area of several hundred thousand pounds per square inch which varies considerably depending upon the particular workpiece formed; and the forming strokes are extremely rapid, such as in the area of 700–3,000 thousand strokes per minute.

This application relates to such forming machines and more particularly relates to an improvement in the provision of an adjustment means for the positions of the forming strokes of the dies. This application discloses an adjustment means which enables adjustments of the positions of the strokes of the forming sets during the forming operation. It is understood that the means varies the position, as a whole, of the stroke, rather than varying the lengths of the strokes, the strokes being of constant length.

A further improvement is to so arrange the adjustment means that each forming set may be separately adjusted both in regard to its stroke position and in any required slight adjustment of its angular relationship to another forming set.

The adjustment is provided by the use of wedges for the backing element and the adjustment means is so arranged that it may be operated by power means and may operate simultaneously on all of the forming sets.

It is therefore a specific object of the present invention to provide a novel adjustment means for the backing elements of such forming machine for adjusting stroke positions of the forming sets.

The foregoing and other objects of the present invention will best be understood upon reference to the appended drawings which disclose the preferred embodiment of the adjustment means.

In these drawings,

Fig. 1 is a diagrammatic end view of a machine showing the adjustment means positioned for a relatively small radial distance between the dies and the workpiece axis;

Fig. 2 is a similar view but showing the adjustment means positioned for a relatively large distance;

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Fig. 3 is a view showing construction details of the adjustment means; and

Fig. 4 is an exploded view better illustrating some of the details of construction.

The drawings show a forming machine wherein a workpiece 10 is positioned on an axis W so that it may, if desired, move in a path that is the workpiece axis W so as to be formed by dies 11 under the pressure of die movers 12. The machine further comprises a plurality of forming sets arranged around the workpiece axis on radial axes R transverse to the workpiece axis W. The radial axes R define paths of forming movements of the dies 11. Each forming set includes a set of drivers referenced generally 13, each having driver cams 16 on its opposed faces for cooperation with roller 17, a backing element 18, a mover 12 and a die 11, whereby reciprocation of the drivers in paths D transversely of radial axes R causes the driver cams 16 to bias the rollers 17 along the radial axes R against the backing elements 18 and against the movers 12 to cause these to bias the dies 11 and move them for forming towards axis W.

The foregoing is the general description of the machine to which the specific improvement of this application relates and such specific improvement will now be described. It is a stroke position adjustment means for the forming sets and comprises sets of opposing wedges 20 and 21 between and against the backing elements 18 and fixed structure 22 of the machine. These wedges may be separated or telescoped for varying the distances between the backing elements 18 and the fixed structure 22 and thus varying the position of the strokes of the forming sets in a manner that will best be understood upon comparison of Figs. 1 and 2.

The stroke adjustment means further includes a power means for moving all of the wedge sets 20–21 simultaneously and in identical distances for simultaneously effecting identical adjustments of stroke position of all of the forming sets.

The power means includes a power movable piston 30 within a fluid pressure cylinder 31 and connected by a linkage to all of the wedges. The linkage includes rings 32 and 33 nested within each other and arranged around a bushing 34 and arranged coaxial with the workpiece axis W. The rings 32–33 are connected on one side by power links 35–36 to the piston 30 and on the other side by wedge links 38–39 to wedges 20–21. There are eight wedge links 38–39 for the eight wedges 20–21 and for the four wedge sets and there are two power links 35–36 for the two rings.

Operation

The operation is as follows: Whenever it is desired to adjust the positions of the strokes of the forming sets, the piston 30 is moved.

Fig. 3 shows the parts in a position corresponding to a small radial distance M between axis W and the dies.

To increase that distance M, the wedges of each set are moved from each other to move the backing element and the entire forming set away from the workpiece axis W and this is effected by moving the piston 30 radially towards the axis W which moves the power links 35 and 36, the rings 32 and 33, and the wedge links 38–39 in such a way as to move the wedge elements 20 and 21 away from each other and thus move the backing elements towards the fixed structure 22 of the machine and thus change the position of the stroke of the forming set by moving the entire forming set and its entire stroke away from the axis W. On the other hand, to decrease the distance M, the piston is moved radially outwardly away from the axis W which in turn moves the power link 35–36, the rings 32–33, the wedge link 38–39 in such a way as to move the wedges

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20 and 21 of a wedge set towards each other and thus shift the backing element 18 away from fixed structure 22 and thus position the forming set and its stroke more closely to the axis W.

Suitable means are also provided in the form of adjusting nuts 42 on the various wedge links for adjusting them in their relationship to one another and thus insuring identical response to movements of the single power means, the piston 30, and also for providing means for obtaining any slight adjustment of angular relationship between the axes of the forming sets.

It will be observed that the construction herein disclosed is such as to shift all of the backing elements simultaneously and identically in response to movements of the piston 30 and thus shift all of the forming sets simultaneously and in identical manner and thus shift the forming strokes simultaneously and in identical manner.

The adjustment of stroke position may be effected while a specific increment of the workpiece is within the dies, so that stroke position adjustment may be used to gradually effect a reduction in diameter of the workpiece during the operation of forming upon that specific increment of the workpiece. The finished diameter of the workpiece is a function of the end position of the final die stroke. Step by step reduction of workpiece diameter is a function of step by step adjustment, inwardly towards axis W, of stroke position. The forming process, then, includes radial strokes of the dies for forming plus radial step by step adjustment of stroke position of the dies effected by step by step movement of the adjustment means, wedges 20—21, and the power means.

Now having described the preferred embodiment herein disclosed reference should be had to the claims which follow.

We claim:

1. In a forming machine, a plurality of dies arranged radially and symmetrically about a longitudinal axis and having facing surfaces which define a die throat, each die having a die moving means comprising two opposed and oppositely reciprocating driver rods, the rods being interconnected at their ends so that they and their dies all move simultaneously, the machine having fixed structure, and a backing means at each die radially arranged between the fixed structure and the driver rods, the improvement which comprises a means for adjusting the positions of the strokes of all the dies, said adjusting

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means including a means for simultaneously moving the backing means for all the dies radially towards or away from the dies, the means for moving the backing means comprising, for each die, a pair of opposed and oppositely moving overlapping curved wedges which may be separated or telescoped, means for moving corresponding wedges of all pairs separately of one another, and also separately and independently of the other wedges of all the pairs, whereby any or all of the wedges may be moved circularly as desired for adjusting them transversely of the radial axes, and means for simultaneously moving both wedges of all pairs identically for adjusting all pairs along the radial axes simultaneously and identically.

2. A construction according to claim 1 including power means for actuating the last named means.

3. A construction according to claim 1 including power means for actuating the last named means, with a positive and direct connection with no lost motion between the power means and said last named means.

4. A construction according to claim 1 including power means for actuating the last named means, with a positive and direct connection with no lost motion between the power means and said last named means, the connection including links arranged transversely of said longitudinal axis, two links for each die and for each pair of wedges, and means for moving the links lengthwise.

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