

Sept 17, 1957

A. YURKA, JR

2,806,506

WIPE FORMING MECHANISM AND DIE COMBINATION

Filed Aug. 24, 1954

4 Sheets-Sheet 1

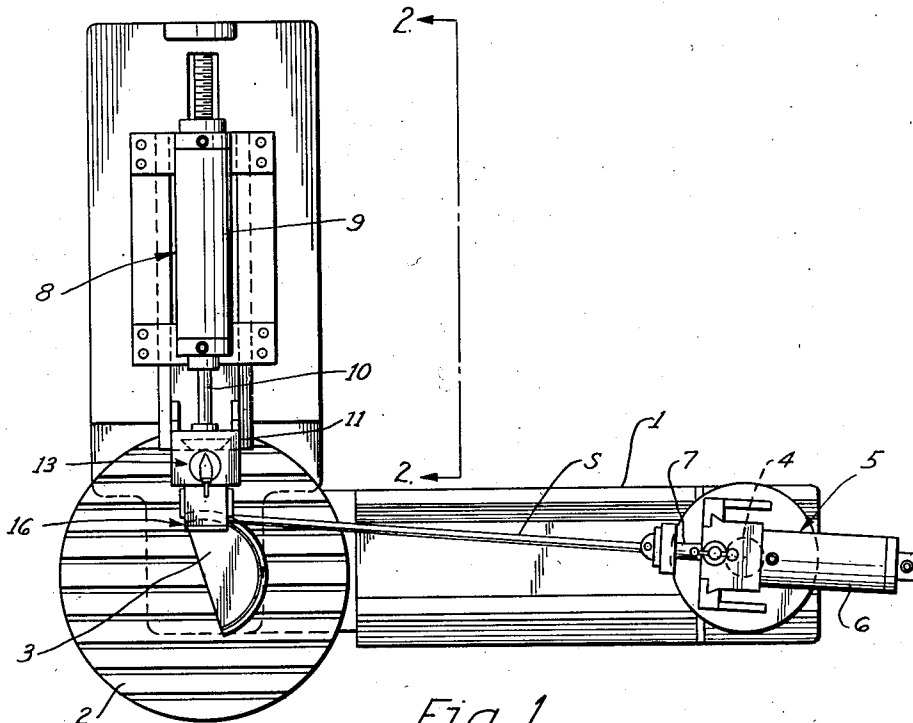


Fig. 1.

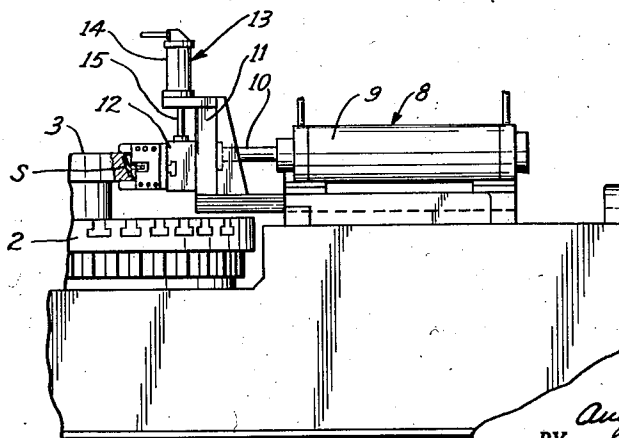


Fig. 2.

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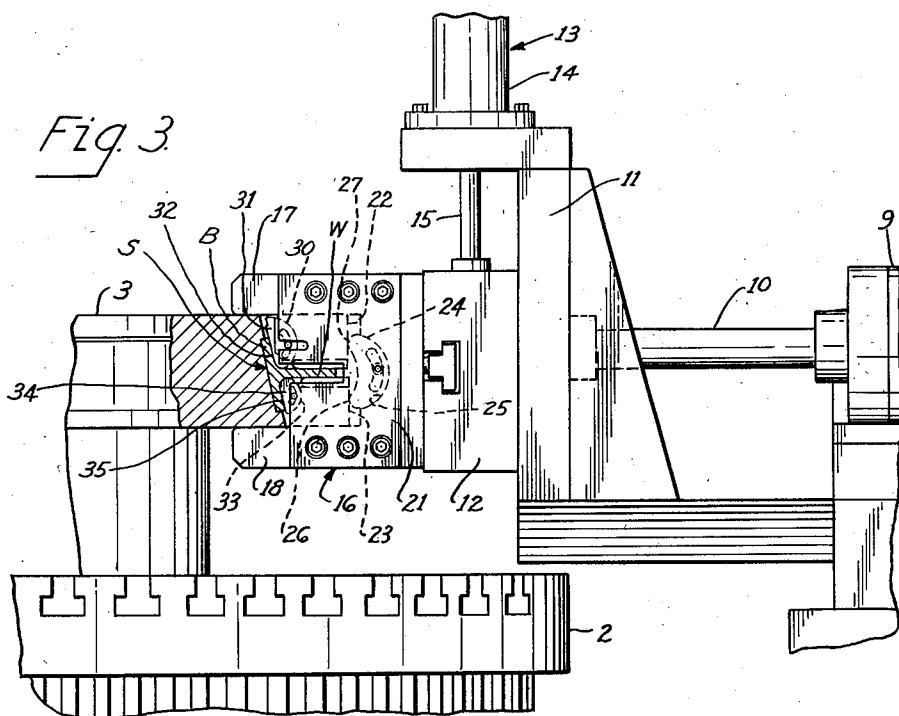
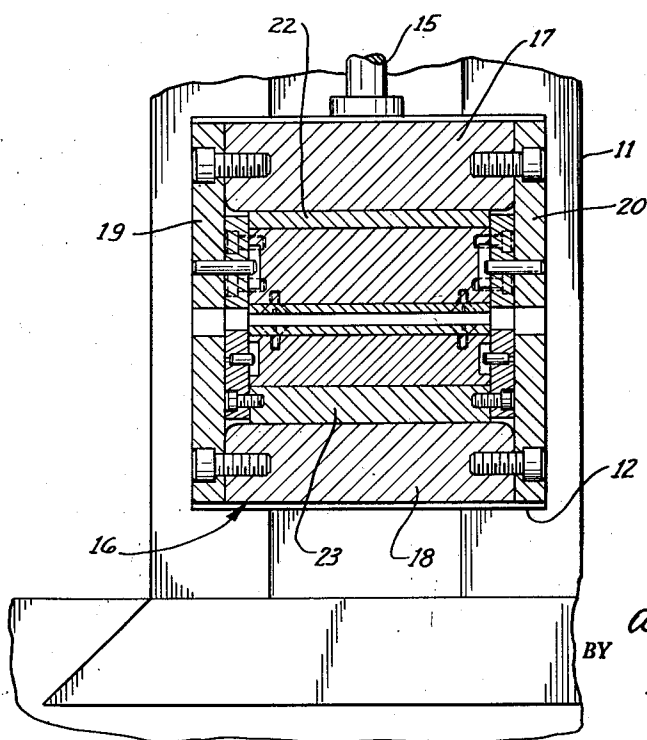
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WIPE FORMING MECHANISM AND DIE COMBINATION

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4 Sheets-Sheet 2



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Fig. 4.

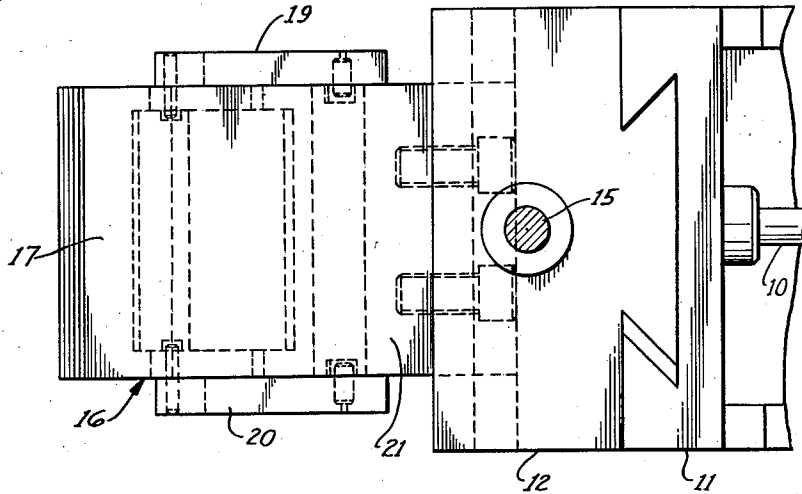
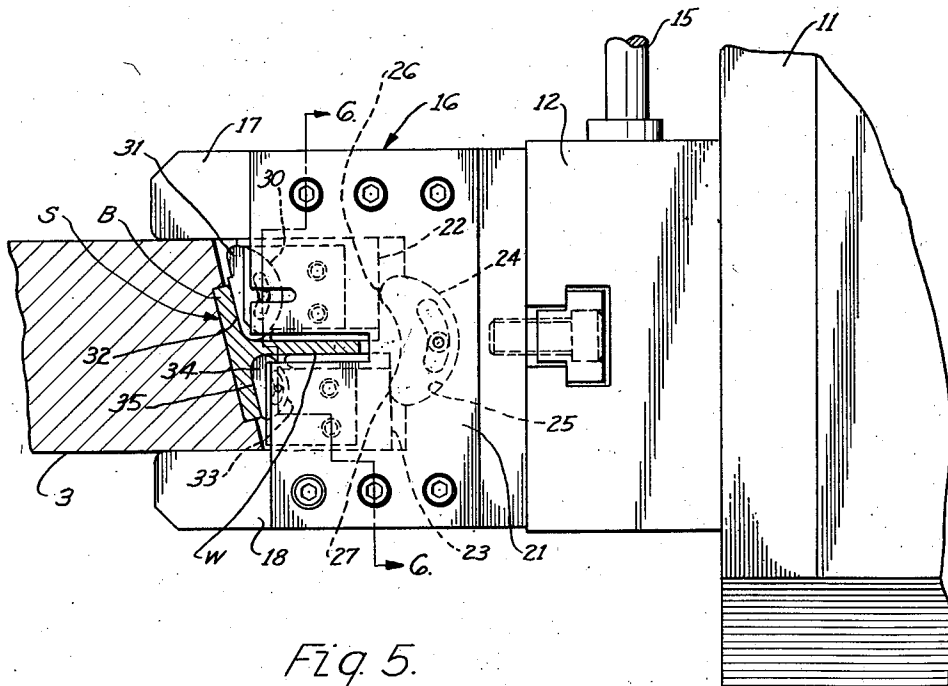


Fig 5.

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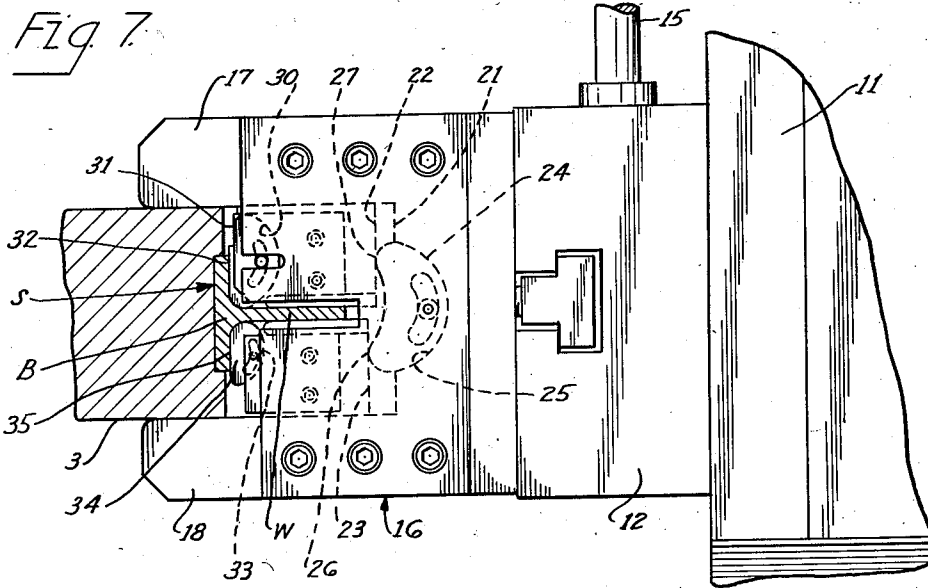
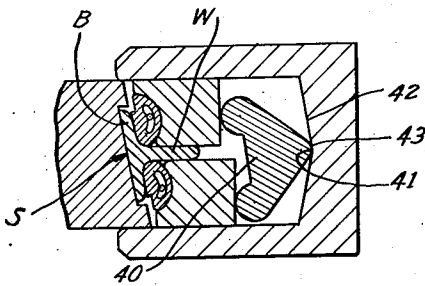


Fig 8.

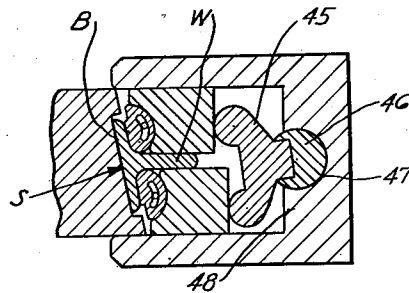


Fig 9.

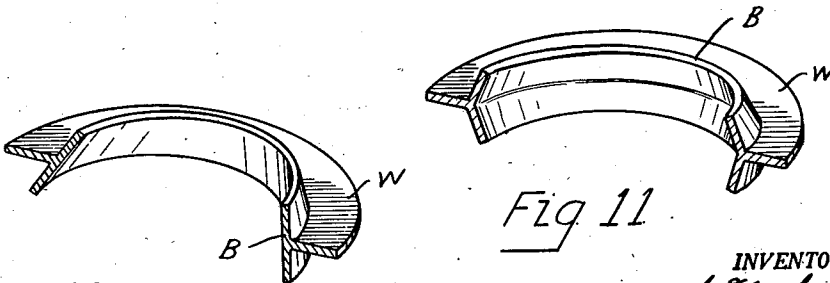


Fig 10

Fig 11

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2,806,506

WIPE FORMING MECHANISM AND DIE COMBINATION

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Application August 24, 1954, Serial No. 451,924

8 Claims. (Cl. 153—40)

This invention relates to a wipe forming mechanism and die combination and particularly to a wipe forming mechanism having an operating face with a plurality of stock engaging and forming portions which are movable relative to each other into various self-adjusted positions for accommodating themselves to different configurations and different angular relations of the surfaces of the stock to be engaged and formed by the mechanism.

Heretofore considerable difficulty has been encountered in the wipe forming, or the combined wipe and stretch forming, of elongated strip metal stock about a side face die by bending the main body of the stock flatwise laterally of the die about a generally upright axis and concurrently by bending one or more webs or flanges of the stock edgewise laterally of the die about said axis and endwise of the die relative to the main body so as to change the angular relation between a web or flange and the main body of the stock.

In order to effect such bending, it is necessary that the forming face portions of the wiping mechanism presented to the face portions of the stock be adjusted to the changed positions assumed by portions of the stock so as to remain in proper forming relation therewith. If the main body of the stock is to be bent flatwise and other than in a direction at right angles to the web or flange portions, considerable self adjustment of the different forming face portions of the shoe are necessary. Concurrently with the self-adjustment to such a change, it is necessary to maintain the original or preselected cross sectional shape of the web. All of these operations must take place while subjecting the stock through the medium of the shoe to relatively high wipe forming pressures.

The wipe forming mechanism with which the present invention is concerned not only is adapted for effecting these operations but also has certain advantages of simplicity of design and durability due to the manner of transmitting the forces thereto and therethrough to the stock.

Various other advantages and objects will become apparent from the following description wherein reference is made to the drawings, in which:

Figure 1 is a top plan view of a combined wipe forming and stretch forming machine with a wipe forming mechanism and die combination embodying the principles of the present invention installed thereon for operation thereby;

Figure 2 is a side elevation of the structure illustrated in Figure 1;

Figure 3 is an enlarged fragmentary side elevation of the wipe forming mechanism of the present invention and its shoe supporting and applying structure, part thereof being shown in section;

Figures 4 and 5 are an enlarged top plan view and a front elevation, respectively, of the structure illustrated in Figure 3;

Figure 6 is a vertical sectional view of the wipe forming mechanism and is taken on the line 6—6 of Figure 5;

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Figure 7 is a view similar to Figure 5 showing a different operating position of the various parts of the wipe forming mechanism;

Figures 8 and 9 are diagrammatic side elevations of modified forms of the wipe forming mechanism, respectively; and,

Figures 10 and 11 are fragmentary perspective views, respectively, of a length of stock showing the shape thereof after different forming operations.

Referring to the drawings which illustrate a preferred embodiment of the invention, the machine is preferably one such as disclosed in the copending application of Dolney and Hein, Serial No. 368,876, filed July 20, 1953.

This machine generally comprises a frame 1 on which is mounted a power driven turntable 2 which supports a side face forming die 3 about which the stock S is to be wipe formed or concurrently stretched and wipe formed.

Mounted on the frame 1 for swinging movement about an axis 4 parallel to the axis of rotation of the table 2 is a stretch forming piston and cylinder assemblage 5 which includes a cylinder 6 and a piston 7. The die 2 and the piston 7 are provided with means for engaging opposite ends of the stock so as to connect one end for rotation with the die 3 while the stock is held under stretch forming tension by a pull exerted on the opposite end by the piston 7.

Also mounted on the frame and angularly disposed about the axis of the table 2 from the assemblage 6 is a wipe forming piston and cylinder assemblage 8 which comprises a cylinder 9, piston 10 and a suitable guided carrier 11 connected to the piston and movable therewith axially of the cylinder 9. The parts hereinbefore described are more fully disclosed in the above entitled application.

For wipe forming, or combined wipe and stretch forming, the wipe forming mechanism of the present invention is mounted on the side of the carrier 11 facing the table 2 so as to be movable by the carrier laterally of the die toward and away from the side face of the die 3.

If it is desired that the wipe forming mechanism be mounted for movement to different positions vertically, it may be supported on a suitable slide block 12 which is mounted for vertical movement on the carrier 11. The block 12, in turn, may be movable by means of a suitable hydraulic or fluid pressure actuated piston and cylinder assemblage 13 having a cylinder 14 mounted on the carrier 11 and a piston 15 connected to the block 12. The assemblage 13 is preferably a double acting reversible fluid pressure operated assemblage and is connected through a suitable reversing valve to a source of fluid under pressure. It may be operated for lifting and lowering the block 12 during operation of the shoe, and for holding it in predetermined adjusted vertical positions by hydraulic locking of the assemblage 13. This particular feature is more fully disclosed in the above identified copending application.

Referring to the wipe forming mechanism which embodies the present invention, for purposes of illustration it is described as applied to the formation of a piece of stock S of T-shaped cross section having a main body or head portion B and tail or web portion W. The piece of stock is to be bent so that its head B is curved flatwise about an upright axis so that the web or tail portion W will be disposed on the convex side of the body B after bending of the body B and will be bent edgewise about the axis of curvature. At the same time the web portion W which, in the original stock, could be at right angles to the body portion B, is to be bent endwise of the die 3 at other than a right angle to the body B, as illustrated in Figure 3. When wipe forming the stock to this shape, each of the principal features of the

shoe is brought into cooperative relation with the others for producing the necessary bending effects.

Referring specifically to the wipe forming mechanism, it comprises a housing or carrier 16 having upper and lower jaws 17 and 18, respectively, lateral walls 19 and 20, respectively, and a rear wall 21. The housing or carrier 16 is open at the front face. The walls thus define an open end cavity within which are mounted movable shoes.

The shoes comprise an upper shoe 22 and a lower shoe 23. The shoes 22 and 23 are mounted in the housing 16 for guided movement lineally toward and away from the rear wall 21 independently of each other. The adjacent faces of the shoes 22 and 23 having portions, respectively, which are spaced apart vertically of the carrier 16 the proper distance to accommodate therebetween the tail or web portion W of the piece of stock S. The shoes are constrained from separation vertically of the housing or carrier 16 by engagement with the cooperating inner faces of the jaws 17 and 18, respectively.

In forming a piece such as illustrated in Figure 3, it is apparent that as the head or body B changes its angular relation to the web W from right angular to non-right angular as illustrated, there must be a corresponding movement laterally of the die 2 of the shoes 22 and 23 in order to maintain their operating faces in contact with the outer face of the adjacent face of the body B. At the same time, the forming unit pressure must be applied equally to the two shoes 22 and 23.

For this purpose, an oscillatable force transmitting and prorating means is interposed between the rear wall 21 of the housing 16 and the shoes 22 and 23 for transmitting to the shoes through the medium of the housing 16 and the transmitting and prorating means, the power applied by the piston and cylinder assemblage 8.

In the form illustrated, the oscillatable force transmitting and prorating is one for equalizing the respective forces applied to the shoes. It comprises an elongated rigid shoe 24 having a thrust surface 25 which preferably is arcuate and of uniform radius about an axis extending preferably horizontally or at least at an abrupt angle to the vertical. The rear wall 21 of the housing or carrier 16 has a complementarily formed surface in engagement with the surface 25 through which the thrust is transmitted from the housing 16 to the element 24. The element 24 is preferably coextensive in a direction generally endwise of the forming face of the die 3 with the corresponding dimensions of the shoes 22 and 23. At the ends of its forward face the element 24 is provided with thrust surfaces 26 and 27, respectively, which engage rear surfaces of the shoes 22 and 23, respectively, for transmitting thrust thereto.

With this arrangement, it is apparent that as the carrier is moved toward the die, one or the other of the shoes 22 and 23 will be the first to engage the body B of the stock S and upon such engagement its movement will be arrested. Thereupon, upon continued movement of the carrier toward the die, the force transmitting and balancing means will be caused to oscillate so as to move the other one of the shoes 22 and 23 into engagement with the body B. When both shoes are in engagement with the body B, continued application of the force by the assemblage 8 is transmitted to both of the elements.

While in many instances, the force transmitting and prorating means transmits the force equally to both of the shoes 22 and 23 it may be prorated differently between them and then "balanced" in accordance with this preselection. For example, if the portions 26 and 27 of the means 24 are at different distances vertically of the shoe from the axis of oscillation then the force transmitted to the shoes 22 and 23 will be different depending upon the length of the respective lever arms. Accordingly, a distribution of the total force applied to the shoes 22 and 23 can be obtained such that the unit force applied to the stock may be equalized even though the

areas of the stock engaged by each element is different.

It is apparent that when the shoes 22 and 23 move toward the side face of the die and force the head B to conform to the die face that the angular relation of the forward forming faces of the shoes 22 and 23 must move and shift relative to the elements. For this purpose, movable face members are mounted on the shoes 22 and 23, respectively, at the said forward ends of the shoes, each for oscillation relative to its associated one of the shoes about an axis preferably is horizontal, or at least is angularly disposed to the vertical.

Referring first to the shoe 22, it is provided on its forward face with a force transmitting surface 30 which is preferably coextensive in a direction lengthwise of the forming face of the die with the shoe 22 and which is curved about an axis extending generally horizontally or at least at an abrupt angle to the vertical. The movable face member of the shoe 22 comprises a rigid body 31 having on its rear face a surface complementary to the surface 30 and having a forward forming face 32 conforming to the surface of the stock against which it is to be applied. Correspondingly, the shoe 23 has an arcuate face 33 and is provided with a face member 34 having an arcuate surface complementary to the face 33 and having a forward forming face 35 configured to conform the shape of the face of the stock to be engaged.

In operation, a piece of stock S may be subjected to wipe forming or to combined wipe and stretch forming and for purposes of illustration, it is assumed that it is subjected to both operations concurrently.

One end of the stock S is fastened in fixed position to the die 3 for rotation therewith. The opposite end of the stock is connected to the piston 7 of the stretch forming assemblage 5 and stretch forming tension is applied to the stock. While held under tension, the wipe forming shoe is applied to the stock as best illustrated in Figure 3 under a wipe forming pressure supplied by the piston and cylinder assemblage 8. Assuming that the shoe 22 first moved to operating position against the body of the stock S by movement of the housing 16 laterally of the die toward the forming face, the forward surface 32 of the member 31 adjusts itself to the corresponding face of the body portion B of the stock. As the housing 16 continues to advance toward the die, the member 24 oscillates and engages the rear end of the shoe 23 and causes the shoe 23 to move forward relative to the shoe 22 until the forward face 35 of the member 34 likewise engages the body B of the stock. Thereupon the preselected prorating of pressure between the shoes 22 and 23 is maintained by the member 24. Meanwhile the flange is confined slidably between the adjacent faces of the shoes 22 and 23, respectively.

Upon continued application of the pressure of the assemblage 8, the shoes advance toward the side face of the die and bend the body or head portion B out of right angular relation to the web or tail portion W and hold the body portion B firmly in contact with the side face of the die under wiping pressure while the web W is confined between the shoes 22 and 23 and prevented thereby from becoming disfigured. Thereupon, the table is rotated while the stretch forming pressure and the wipe forming pressure are maintained, thus causing the right angular relation of the body or head portion B to the web W to change to the final non-right angular relation desired while at the same time, bending the body B into contact with the side face of the die 3, maintaining the flatness of the web, and bending the web edgewise.

Any changes in the relative positions of the faces in the body B engaged by the surfaces 32 and 35 are automatically compensated for by the movement of the shoes 22 and 23 and the automatic accommodations of the members 31 and 34 with respect thereto.

Referring next to Figures 8 and 9, a modification of the oscillatable force transmitting and prorating means is illustrated. In this form, the transmitting and prorating means comprises a member 40. The member 40

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has a much more limited contact surface 41 and the rear wall of the housing, indicated at 42, is provided with a face portion 43 which is complementary to the surface 41 and provides approximately a line contact therewith.

In Figure 9 is illustrated another modification in which the member 45 is provided with a cylindrical bearing portion 46 in oscillatable sliding engagement with a complementary cylindrical bearing surface 47 in the rear wall portion 48 of the shoe housing.

These modifications are in some respects less expensive to make and for many applications are equally effective. They do not provide the fully developed force transmitting capacity that is developed by the preferred embodiment.

Referring to Figures 10 and 11, two examples of the finally formed piece of stock are illustrated.

The piece illustrated in Figure 10 is one formed as above described with the body B bent flatwise with the web W bent edgewise and disposed outwardly at the opposite face of the body B from the axis about which the body B is bent, thus disposing the web on the convex side of the bent line of stock. The angular relation of the web to the body has been changed from right angular to non-right angular.

It is to be noted that the portions of the body B above and below the neck or web W are parallel with each other generally endwise of the die though intersecting the web W in other than right angular relation.

In Figure 11 the length of stock is oppositely bent, the web or tail portion W being disposed on the same side of the body B as the axis about which the body B is bent flatwise.

The portions of the body B above and below the web W are not only bent out of right angular relation to the web W but are angularly disposed relative to each other.

From the above description and the illustrations given, it is apparent that a wide variety of shapes can be made by wipe forming the stock with shoes embodying the principles hereinbefore disclosed.

The description of various parts as arranged one above the other, horizontally, vertically, and the like, as used in the claims, is for convenience in describing the relative positions of the parts and not as absolutes, inasmuch as the invention has been illustrated as used with a stretch forming machine in which the turntable for carrying the side face die is arranged with its axis extending vertically. Obviously the entire stretch forming machine illustrated in Fig. 1, together with the wipe forming mechanism can be turned to other positions so long as the relative positions of the parts are maintained.

Having thus described my invention, I claim:

1. A wipe forming mechanism comprising a carrier having an open end and a wall portion spaced from and facing toward said open end, said carrier being adapted to be moved forwardly with its open end foremost by a force applied to the carrier forwardly thereof, a pair of rigid force transmitting shoes mounted in the carrier, one above the other, between the top and bottom walls of the carrier for movement of each generally horizontally relative to the other in directions toward and away from said open end and having their forward ends facing outwardly from said open end of the carrier, oscillatable force transmitting and prorating means interposed between said wall and shoes for transmitting to the shoes

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in a direction toward said open end, forces applied to the carrier for moving it open end foremost, means supporting the oscillatable force transmitting and prorating means for oscillation relative to the carrier about a generally horizontal axis, and said oscillatable force transmitting and prorating means having two vertically spaced portions arranged at opposite sides of the horizontal axis and engaging the shoes, respectively, whereby when resisting force is applied to the forward ends of the shoes as the carrier is urged forwardly, the transmitted force is prorated to the shoes in all relative operating positions of the shoes.

2. A wipe forming mechanism according to claim 1 characterized in that aligned portions of the mutually facing surfaces of the shoes, beginning at said forward ends and extending at least part way toward their other ends, are spaced apart flatwise from each other.

3. A wipe forming mechanism according to claim 2 characterized in that movable forming members are mounted on the shoes, respectively, at said forward ends for oscillation relative to their associated shoes independently of each other in respective paths which are angularly disposed to the horizontal.

4. A wipe forming mechanism according to claim 3 characterized in that the adjacent edges of said shoes are disposed vertically substantially at the levels of said aligned portions, respectively, of the adjacent faces.

5. A wipe forming mechanism according to claim 1 characterized in that movable forming elements are mounted on the shoes, respectively, at said forward ends for oscillation relative to their associated shoes independently of each other in respective paths which are angularly disposed to the horizontal.

6. A wipe forming mechanism according to claim 5 characterized in that each shoe and its movable forming member have complementary arcuate bearing surfaces disposed with their axes at an angle to the vertical.

7. A wipe forming mechanism according to claim 6 characterized in that said complementary arcuate bearing surfaces of each shoe and its member are generally cylindrical and the one on the shoe is concave forwardly, and said complementary surfaces are coaxial and have their common axis disposed substantially horizontally.

8. A wipe forming mechanism according to claim 1 characterized in that said oscillatable force transmitting and prorating means includes a rigid member disposed at the rear of the shoes, the vertically spaced portions are forwardly extending and engage the rear ends of the shoes, respectively, said member has a rearwardly convex rear face portion curved about a generally horizontal axis, and said carrier has a forwardly concave curved forward face portion complementary to said rear face portion and in sliding contact therewith.

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