April 19, 1949. L. M. PUSTER 2,467,496

DIE PLATE

Filed June 28, 1946

Fig. 1.

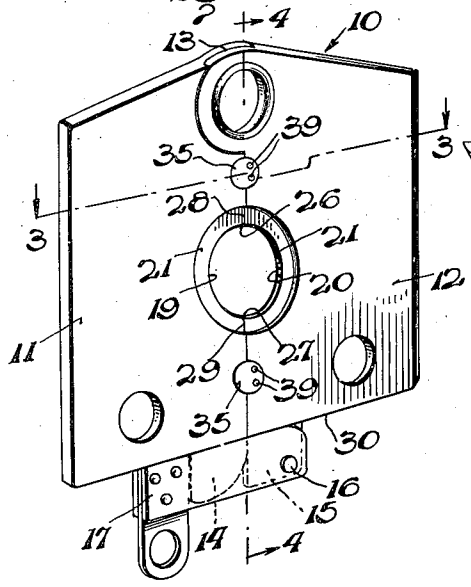
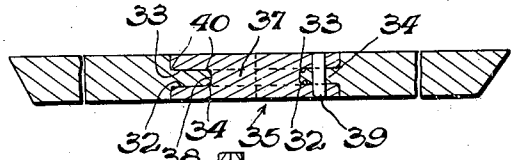



Fig. 3.



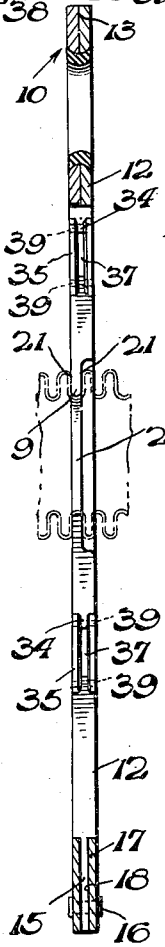




Fig. 4.

Fig. 2.

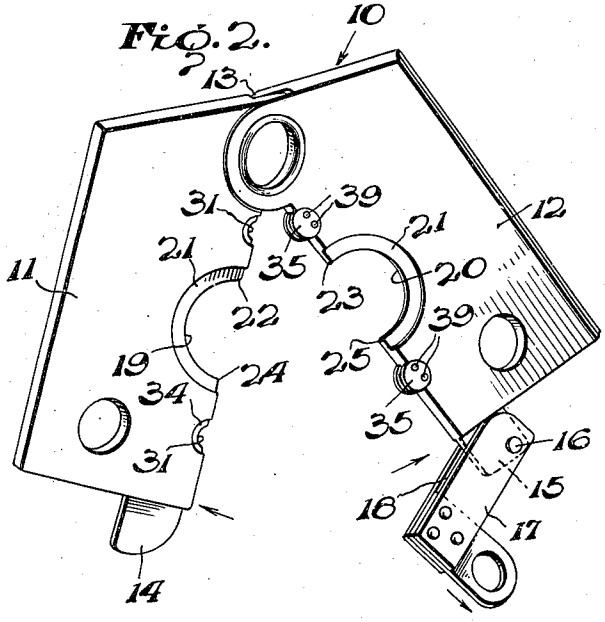
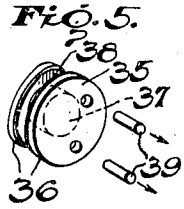



Fig. 5.




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## DIE PLATE

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6 Claims. (Cl. 153—73)

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This invention relates to die plates for corrugating machines and more particularly to improved means for aligning the relatively movable halves of such die plates.

Expansible and collapsible corrugated tubular walls or bellows are commonly made by surrounding the tube to be corrugated by spaced die plates mounted to move in the direction of the axis of the tube as the metal of the tube is caused to flow into corrugated form under the action of hydraulic pressure applied interiorly of the tube and end pressure applied in the direction of the axis of the tube. In order for the die plates to receive the tube to be corrugated and to provide for the withdrawal from the die plates of the corrugated tube, the die plates are commonly made in halves hinged together or otherwise suitably mounted so that the two halves of the die plates may be opened and closed with respect to each other, each half of the die plate having at its inner edge a semicircular recess provided with at least one suitably formed surface at the endge of the recess so that when the two halves of the die plate are closed together the two recesses together form a circular opening having at its periphery a formed surface which predetermines the shape and size of the corrugation formed by the bending of the metal around and into contact with the surfaces at the sides of the die ring.

Bellows are made of a variety of metals from tubes whose wall thickness is on the order of five to ten thousandths of an inch in thickness, and when working with metal of such thinness it is of great importance that the surfaces at the semicircular recesses align perfectly when the halves of the die plate are closed together, as any lack of alignment of these surfaces either at the edge of the recess about which the sinus of the corrugation is to be formed or at the surfaces extending outwardly from said edge and into contact with which the metal of the tube is to be pressed to form the sides of the corrugation results in a discontinuity in the smoothness of the surfaces into contact with which the metal is pressed by the hydrostatic pressure and therefore an imperfection in the metal of the resulting corrugation where the two halves of the die plate meet each other at said surfaces. Such an imperfection in corrugated metal of such thinness may seriously interfere with the life of the bellows under repeated stress or the capacity of the bellows to perform its intended function.

It is an object of this invention to provide a die plate of the character described with improved means for assuring exact alignment of the halves of the die plate when they are brought together for the purpose of performing the corrugating operation.

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Another object of this invention is to provide a die plate of the character described with aligning means which may be readily replaced in the event that they become worn or otherwise injured in any respect.

Other objects will appear as the description of the invention proceeds.

The invention is capable of receiving a variety of mechanical expressions only one of which is illustrated on the accompanying drawing and it is therefore to be expressly understood that the drawing is for purposes of illustration only, and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to the drawing, wherein like reference characters are employed to designate corresponding parts of the several figures,

Fig. 1 is a perspective elevation of a die plate embodying the present invention and with the halves in closed position;

Fig. 2 is a corresponding view of the die plate with the halves in open position;

Fig. 3 is an enlarged fragmentary section on the line 3—3 of Fig. 1 to illustrate the novel aligning means;

Fig. 4 is an enlarged section of the die plate on line 4—4 of Fig. 1; and

Fig. 5 is a perspective view of one of the aligning elements removed from the die plate.

In the form shown, the die plate 10 is composed of two halves 11 and 12 and of the form wherein the two halves of the die plate are hingedly connected at 13 so that they may be closed as shown in Fig. 1 or opened as shown in Fig. 2. To lock the die plate halves in closed position one of the halves as 11 is provided with a lug 14 and the other half 12 has pivoted on a lug 15, as by the pin 16, a latch member 17 slotted at 18 to fit over the lug 14, as shown in Fig. 1, and thereby prevent opening of the die halves when pressure is applied during the corrugating operation. The inner edge of each die half is provided with a semicircular recess, 19 and 20 respectively, the semicircular edges of said recesses being smoothly curved in an axial direction to predetermine the size and shape of the bend at the sinus of the corrugation and having at at least one face of each die half a formed surface 21 extending radially outwardly from said edge to a distance somewhat in excess of the radial

dimension of the finished corrugation, as is clear from the relationship of a completed bellows 9 to the die plate shown in Fig. 4.

The tube to be corrugated can be introduced, when the die halves are in the open position shown in Fig. 2, into one of the aforesaid semicircular recesses, and thereupon the two halves of the die plate may be closed with respect to each other, to the relative position shown in Fig. 1, in which position the tube to be corrugated is engaged throughout its periphery by the edges of the recesses 19 and 20. In the course of the corrugating operation the metal of the tube is bent around the peripheral edges of said recesses into contact with the surfaces 21, as shown in Fig. 4, and in order that there shall be no discontinuity in the axially curved circular surface at the edge of the recesses 19 and 20 the extremities 22 and 23 and the extremities 24 and 25 of the semicircular edges of said recesses must align exactly, at the locations 26 and 27 in Fig. 1, when the two halves of the die plate are brought together. Similarly to avoid any discontinuity in the surfaces 21 when the die plates are brought together, there must also be exact alignment between the halves of the surfaces 21 at each side of the edge of the recess when the halves of such surfaces are brought together to form the joints at 28 and 29 in Fig. 1.

In conformity with the present invention the required alignment of the die plate surfaces is effected by the aligning means now to be described. Approximately midway between the die recess as heretofore described and the edge of the die plate at the hinge 13, on the one side, and the opposite edge 30 of the die plate, on the other side, each half of the die plate is provided with a semicircular recess 31 and the wall at either side of the recess so formed is cut away semicircularly as shown at 32 and 33 in Fig. 3 so as to provide an intermediate semicircular rib 34 midway of the thickness of the die plate halves and on the order of one third of the thickness of the die plate. The two recesses 31 of each pair therefore provide a pair of aligned semicircular ribs 34, and on one rib of each pair is suitably mounted an aligning device in the form of a spool 35 having circumferential end flanges 36 and an intermediate body 37 that together form a circumferential groove 38 which in depth is preferably on the order of one fourth of the outside diameter of the spool and in width is such as to provide a sliding fit for the other semicircular rib 34 of the pair. In the direction of its axis the spool is preferably so dimensioned that its end faces are flush with the side faces of the die plate halves, and the spool is held rigidly in position on its semicircular rib 34 in any suitable way, as by a pair of pins 39 passing through aligned apertures in the end flanges of the spool and in the rib on which it is mounted. At least the outer corners of the groove 38 are preferably chamfered as indicated at 40 to facilitate the guiding of the opposed rib 34 into the groove 38 when the die halves are moved from the open position of Fig. 2 to the closed position of Fig. 1.

When the halves of the die plate are open to receive a tube to be corrugated the parts are in the relative position shown in Fig. 2, with the two spools held firmly in position by the pins 39. Each spool therefore presents a semicircular groove 38 in opposition to a semi-circular rib 34 one the opposite half of the die plate. When the die plate halves are closed as shown in Fig. 1, each rib 34 enters its opposed groove 38, sliding tightly therein, and owing to the location of the guiding spools with respect to the die recesses 19 and 20, at diametrically opposite sides of the latter in an approximately balanced relationship, and owing to the depth of the grooves afforded by the spools as well as the semi-circumferential extent of the cooperation of said grooves with the opposed flanges 34, the die halves when closed are made to move at each closure to an exact predetermined relationship, so that if the forming surfaces are initially in proper alignment they will resume such relationship every time the die halves are closed.



It will therefore be seen that simple but certain means have been provided for assuring the desired alignment of the die surfaces on the die halves. If a spool becomes worn or injured it may be readily replaced by removing the pins 39 and substituting a new spool.

While the embodiment of the invention illustrated on the drawing has been described with considerable particularity it is to be expressly understood that the invention is not limited thereto as it may receive other expressions as will be apparent to those skilled in the art, and changes may be made in matters of size, arrangement, details of construction, etc., without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the invention.

What is claimed is:

1. In a die plate for corrugating machines of the type comprising halves adapted to be opened and closed and provided with die surfaces which when said halves are closed are to be aligned to present smooth forming surfaces, aligning means for the die plate halves including at least one spool-shaped element carried by one of the halves at a position spaced from both said forming surfaces and the edge of the plate and comprising spaced circumferential flanges, and a flange on the other die plate half adapted to be slidingly received in the space between said first named flanges when the die plate halves are closed.

2. In a die plate for corrugating machines of the type comprising halves adapted to be opened and closed and provided with die surfaces which when said halves are closed are to be aligned to present smooth forming surfaces, aligning means for the die plate halves including a pair of spool-shaped elements carried thereby at opposite sides of the forming surfaces and at positions spaced from both said forming surfaces and the edges of the plate, each of said elements comprising spaced circumferential flanges, and flanges on the opposite die plate half aligned with the spaces between the flanges on the spool shaped elements and adapted to fit into said spaces when the die plate halves are closed.

3. In a die plate for corrugating machines of the type comprising halves adapted to be opened and closed and provided with die surfaces which when said halves are closed are to be aligned to present smooth forming surfaces, aligning means for the die plate halves including at least one pair of semicircular flanges respectively formed on the die plate halves and disposed for alignment when the halves are closed, and a spool-shaped element having end flanges mounted on the flange of one die plate half and adapted when the die plate halves are closed to receive slidingly between its end flanges the semicircular flange on the opposite die plate half.

4. In a die plate for corrugating machines of the type comprising halves adapted to be opened

and closed and provided with die surfaces which when said halves are closed are to be aligned to present smooth forming surfaces, aligning means for the die plate halves including two pair of semicircular flanges respectively formed on the die plate halves at opposite sides of the forming surfaces thereof and disposed for alignment when the halves are closed, and a spool shaped element having end flanges mounted on one semicircular flange of each pair and adapted to receive slidingly in the space between said flanges the other semicircular flange of the pair when the die plate halves are closed.

5. In a die plate for corrugating machines of the type comprising halves adapted to be opened and closed and provided with die surfaces which when said halves are closed are to be aligned to present smooth forming surfaces, aligning means for the die plate halves including at least one spool-shaped element carried by one of the halves and comprising spaced circumferential flanges which receive between them a portion of the half on which it is mounted and a flange on the other die plate half adapted to be slidingly received in the space between said first named flanges when the die plate halves are closed, and means for detachably securing said spool-shaped element in position on its die plate half.



6. In a die plate for corrugating machines of the type comprising halves adapted to be opened and closed and provided with die surfaces which when said halves are closed are to be aligned to present smooth forming surfaces, aligning means for the die plate halves including at least one pair of semicircular flanges respectively formed on the die plate halves and disposed for alignment when the halves are closed, and a spool-shaped element having end flanges mounted on the flange of one die plate half and adapted when the die plate halves are closed to receive slidingly between its end flanges the semicircular flange on the opposite die plate half, and means for detachably securing said spool-shaped element to the semicircular flange on which it is mounted.

LOUIS M. PUSTER.


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