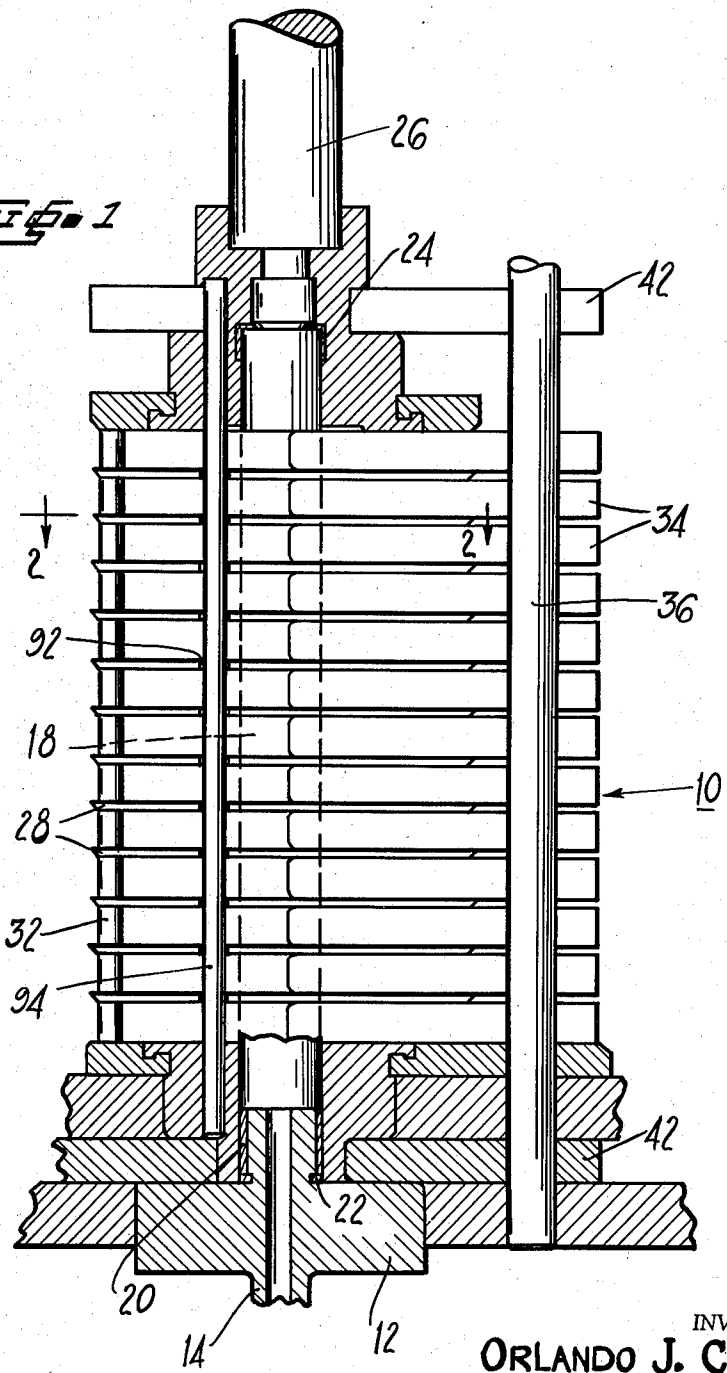
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DIE FOR BELLOWS OR CORRUGATING MACHINE

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Fig. 1



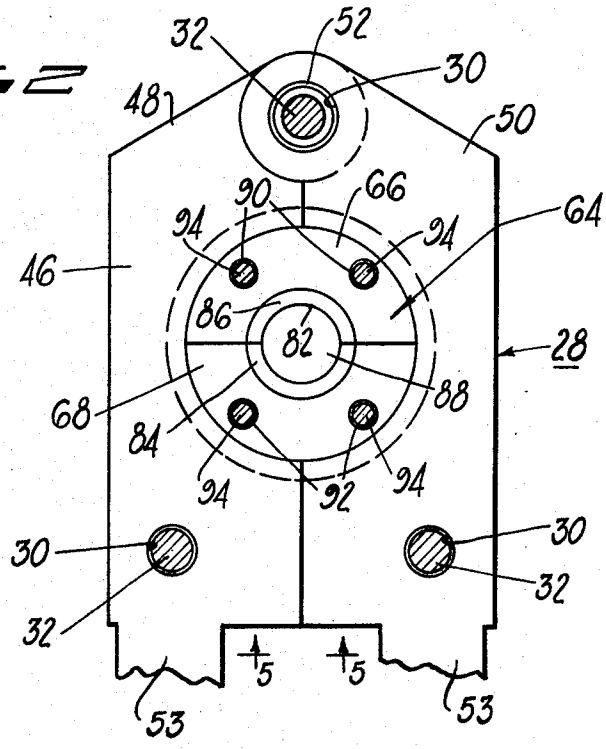
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Fig. 2



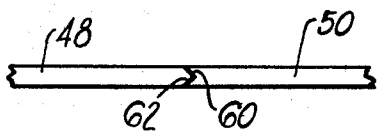


Fig. 5

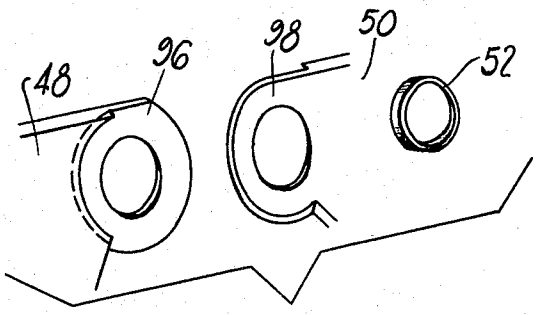


Fig. 4

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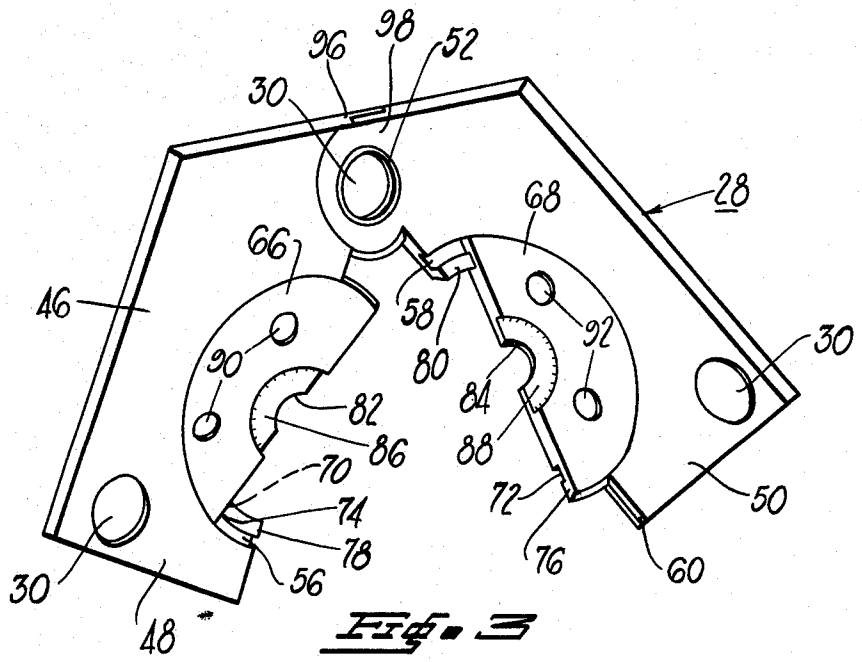


Fig. 3

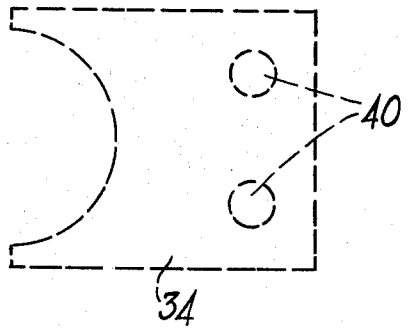


Fig. 6

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United States Patent Office 2,963,068 Patented Dec. 6, 1960

2,963,068

DIE FOR BELLOWS OR CORRUGATING MACHINE

Orlando J. Chiappe, Hamilton, Ohio, assignor to The Bendix Corporation, a corporation of Delaware

Filed Jan. 20, 1958, Ser. No. 709,950

3 Claims. (Cl. 153—73)

The present invention relates to a die for a bellows or corrugating machine and more particularly to an improved means for aligning and locking the relatively movable parts of such dies.

Expansible and collapsible corrugated tubular walls or bellows are commonly made by surrounding a tube to be corrugated by spaced die plates mounted to move in a 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 a direction of the axis of the tube. In order for the die plates to receive a tube to be corrugated and to provide for the withdrawal from the die plates of the corrugated tube, the die plates are commonly made and have hinged together or are 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 semi-circular recess provided with at least one suitably formed surface at the edge 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 form 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 .003 to .0012 of an inch in thickness, and when working with metal of such thinness it is of great importance that the surfaces of the semi-circular 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 surface into contact with which the metal is pressed by the hydrostatic pressure and therefor an imperfection in the metal of the resulting corrugation where the two halves of the die plate meet each other at said surfaces. It is also of great importance that the halves of the die plate be locked tightly together to resist separation during the application of pressure to the interior of the tube, since a separation of the die during the forming of the bellows would also result in an imperfection in the metal. Such an imperfection in the bellows would reduce the accuracy or capacity of the bellows to perform its intended function and would also seriously interfere with the life of the bellows under repeated stress.

Also should the die plates bind on the guide rods during the bellows forming operation the corrugations will not be perpendicular to the axis of the tube. This condition known as "stack off" results in inaccuracies in bellows performance. Binding of the die plates on the guide rods may be caused by a slight separation of the plate when subjected to pressure.

It is an object of my invention to provide in a bellows or corrugating machine an improved die means for assuring exact alignment and secure locking of the halves of the die when they are brought together for the purpose of performing the corrugating operation.

It is another object of my invention to provide a die for a corrugating machine having a forming insert which may be readily replaced.

It is a further object of my invention to provide in a corrugating machine means for simultaneously locking a plurality of die members in closed position.

Other objects and advantages of my invention will become readily apparent from a reading of the following detailed description taken in connection with the appended drawings, in which:

Figure 1 is an elevation of a corrugating machine with some of the parts removed showing the die members of my invention in their operative position;

Figure 2 is a view taken along line 2—2 of Figure 1;

Figure 3 is a perspective view of a die member in the open position;

Figure 4 is a fragmentary exploded perspective view of the die member hinge shown in Figures 2 and 3.

Figure 5 is a fragmentary view of Figure 2 taken in the direction of arrows 5—5; and

Figure 6 is a top view of a spacer member shown in Figure 1.

Referring now to the drawings and more particularly to Figure 1 the corrugating machine **10** is provided with a base member **12** having a fluid nozzle **14** therein. The tube **18** to be corrugated is slipped over nozzle **14** and the annular extending portion **20** of base member **12** and is clamped into position by split ring **22**. The end of tube **18** opposite of nozzle **14** is closed by a cap **24** which is in engagement with a ram piston **26**. Fluid under pressure is supplied from a source (not shown) through a passage **27** in nozzle **14** to the interior of tube **18** to apply a pressure on the interior walls thereof. The ram piston **26** acting against cap **24** applies an axial force to tube **18**. Tube **18** is surrounded by a plurality of die members **28** which will be described more particularly hereinafter. The die members **28**, as best shown in Figure 2, are provided with openings **30** to receive guide rods **32**. The die members **28** are freely reciprocable on rods **32** and are held initially in spaced relation by spacer members **34** which are mounted on rods **36**. Spacers **34** are suitably formed with holes **40**, as best shown in Figure 6, to receive mounting rods **36**. In Figure 1 the spacers **34** are shown on only one side of the tube **18**. In actual practice a similar set of spacers would be provided on the other side of the tube but in the case of Figure 1 the additional spacers have been omitted to more clearly show other portions of the machine. End members **42** are reciprocably disposed on the spacer rod **36** and are respectively in operative engagement with base **12** and ram **26**.

When internal pressure is applied to the tube **28** and the ram **26** is energized to apply an axial force to the tube, the tube is caused to bulge between the die members **28**. After the tube has bulged sufficiently to hold the die members in position the interior pressure and ram pressure are relieved and the spacer members **34** are withdrawn. Ram and internal pressures are again applied and the tube bulged to its final bellows form. In the bulging process the die members **28** are freely movable on rods **32**; and when the tube is bulged to its final form the die members have been moved downwardly on rods **32** until the die members are in engagement with each other.

The die member **28** comprises a carrier plate **46** which is divided into first and second parts **48** and **50** respectively which are pivotally mounted on bushing **52** so as

to permit the parts to be opened and closed. One of the carrier plates is provided with a pair of handles 53 which may be grasped by the operator to open and close the carrier plate. The rods 32 which pass through the holes 30 in the carrier plate align the carrier plates and provide for the simultaneous response of all of the carrier plates when the handles 53 are actuated.

Each of the parts 48 and 50 of the carrier plate is formed with an under-cut semi-circular groove 56 and 58 respectively which are located to form a continuous annular groove when the parts 48 and 50 of the carrier are closed. As best seen in Figures 3 and 5 the edge of part 50 is provided with a substantially V-shaped groove 60 which is adapted to mesh with a complementary shaped portion 62 formed on the edge of part 48. The groove 60 and complementary shaped portion 62 provide for the exact alignment of parts 48 and 50 when the carrier plate 46 is in closed position. A die insert designated 64 is divided into two sections 66 and 68 respectively. Sections 66 and 68 are provided with beveled grooves 70 and 72 and beveled lands 74 and 76 respectively. Lands 74 and 76 are slidably disposed in the grooves 56 and 58 formed in the carrier. Beveled grooves 70 and 72 are arranged to receive lands 78 and 80 which are formed on the carrier 46. The land and groove constructions 70–80 permit the die insert sections to be exactly installed in a carrier and provides for their easy replacement in the event the inserts are worn or damaged. The land and groove constructions 70–80 also permit the die insert sections 66 and 68 to be rotated within the plane of the carrier 46. When the carrier parts 48 and 50 are in closed position the die insert sections are rotatable from a position wherein the abutting edges of the inert sections are parallel to the abutting edges of the carrier parts to a position wherein the abutting edges of the die insert sections are substantially at right angles to the abutting edges of the carrier plate parts. When the die inserts are rotated to the last mentioned position the carrier parts 48 and 50 are securely locked together.

The die insert sections 66 and 68 are provided with working edges 82 and 84 respectively which are adapted to engage the tube 18 and form the sinus of the corrugation. Depressions 86 and 88 are respectively formed in the surface of the insert sections outwardly from the working edges. The depressions 86 and 88 are shaped to form the corrugation in the tube 18.

Each of the die insert sections 66 and 68 is provided with a plurality of holes 90 and 92 respectively which are adapted to receive rods 94. The rods 94 are provided with suitable means, not shown, for their simultaneous rotation whereby the die insert sections may be simultaneously rotated from their unlocked position to their locked position.

As best seen in Figure 4 the carrier parts 48 and 50 are provided with apertured portions 96 and 98 which are adapted to overlap with their apertures in registration. A bushing 52 is pressed into the apertures to pivotally secure the parts together.

The construction above described provides means whereby the carrier plates may be simultaneously opened and closed and whereby they may be simultaneously locked. The die insert performs the additional function of locking member and is so constructed as to provide for the easy replacement of one of the damaged members.

While only one embodiment of my invention has been described it will be readily apparent to those skilled in the art that various modifications and arrangements may be made without departing from the teaching of the invention.

I claim:

1. A die for a corrugating machine comprising a carrier plate having first and second parts which are adapted to be opened and closed, abutting edges on said parts being aligned so that said parts lie in the same plane when said plate is closed, an annular groove formed in said plate and disposed equally in said first and second parts, said groove being disposed within the plane of said plate, first and second die inserts each formed with a die surface which when said inserts are in edge abutting relation define an opening, and a land formed on each insert and adapted to be received in said groove for mounting said inserts in edge abutting relation for rotation within the plane of said plate, said inserts being rotatable from a position wherein the abutting edges of the inserts are parallel with the abutting edges of said parts to a position wherein the abutting edges of the inserts are transverse the abutting edges of said parts.

2. In a corrugating machine, a plurality of carrier plates having separable parts which are adapted to be opened and closed, abutting edges on said parts being aligned so that the parts of each plate are coplanar when said plates are closed, an annular groove formed in each of said plates and disposed equally in said parts, said groove being disposed within the plane of said plate, a die insert for each of said plates and having sections separable in the same plane as said carrier plate parts, a land formed on each of said inserts and adapted to be respectively received in said annular grooves, a die surface formed on each of said sections which when said sections are in engagement define an opening means defining a plurality of holes in each of said sections, a rod for each of said holes adapted to extend through the holes in each insert, and means connecting said rods whereby rotation of said means simultaneously rotates said inserts from a position wherein the line of separation of said sections is parallel to the line of separation of said parts to a position wherein said line of separation of said sections is transverse the line of separation of said parts.

3. A die for a corrugating machine comprising a carrier plate having first and second parts which are adapted to be opened and closed, a substantially V-shaped groove formed on an edge of one of said parts, a complementary shaped portion formed on an edge of the other of said parts to mesh with said groove to align said parts in the same plane when plate is closed, an annular groove formed in said plate and disposed equally in said first and second parts, said groove being disposed within the plane of said plate, said annular groove being disposed within the plane of said plate, first and second die inserts each formed with a die surface which when said inserts are in edge abutting relation define an opening, and a land formed on each insert and adapted to be received in said annular groove for mounting said inserts in edge abutting relation for rotation within the plane of said plate, said inserts being rotatable from a position wherein the abutting edges of the inserts are parallel with the abutting edges of said parts to a position wherein the abutting edges of the inserts are transverse the abutting edges of said parts.

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UNITED STATES PATENT OFFICE
CERTIFICATION OF CORRECTION

Patent No. 2,963,068 December 6, 1960

Orlando J. Chiappe

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 41, for the indistinct word after "which" read -- will --; column 4, line 33, after "opening" insert a comma.

Signed and sealed this 30th day of May 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents