Oct. 29, 1968 X. LIPP 3,407,640

DEVICE FOR CONNECTING EDGES OF SHEET METAL

Filed Oct. 7, 1965 5 Sheets-Sheet 1

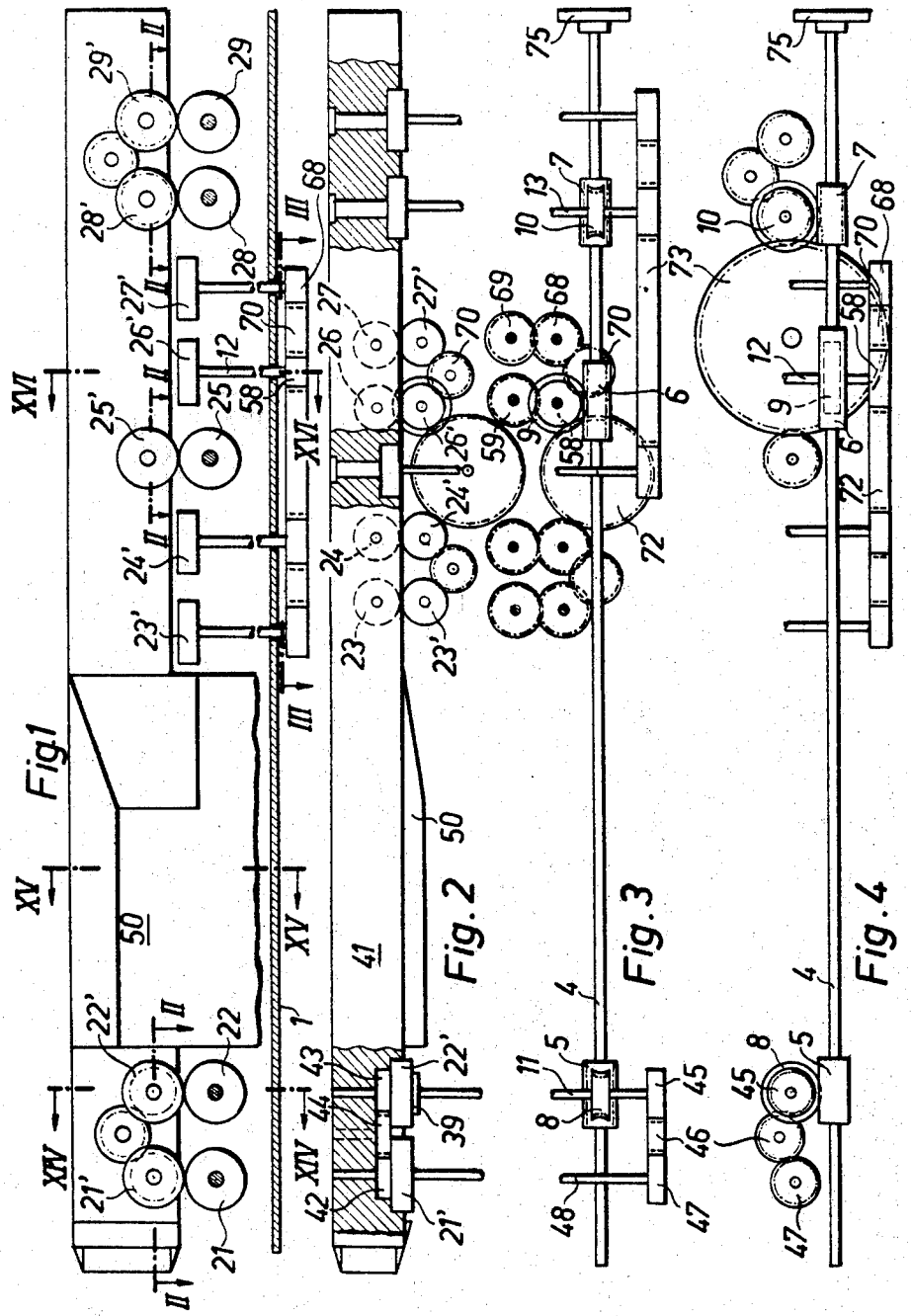

Fig.1

Fig.2

Fig.3

Fig.4

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DEVICE FOR CONNECTING EDGES OF SHEET METAL

Filed Oct. 7, 1965 5 Sheets-Sheet 2

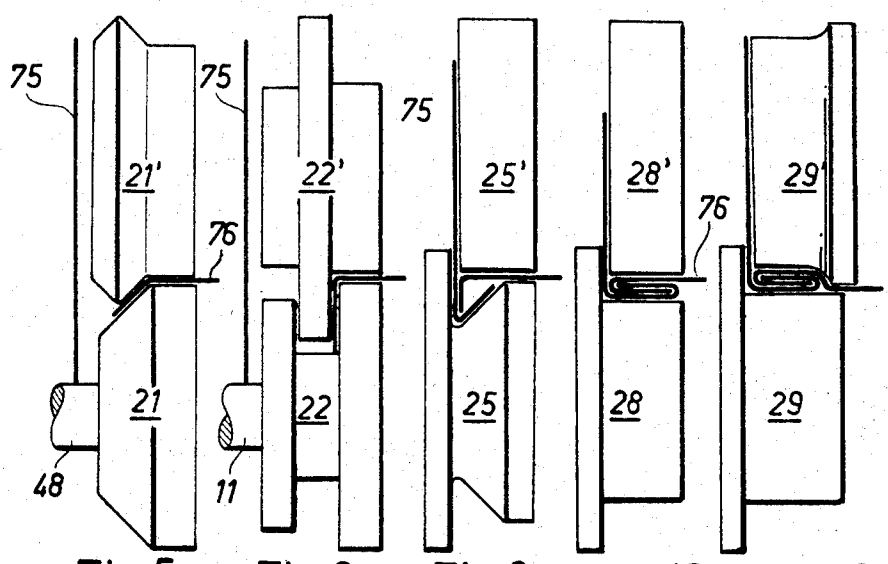

Fig.5 Fig.6 Fig.9 Fig.12 Fig.13

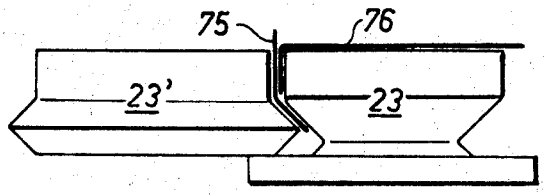

Fig.7

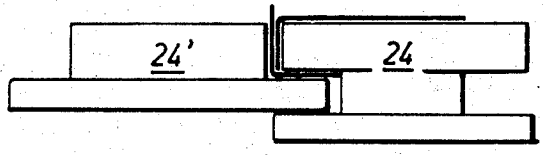

Fig.8

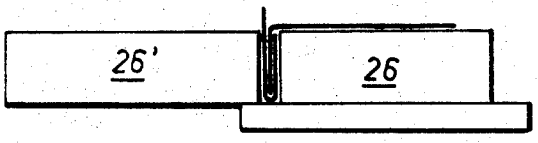

Fig.10

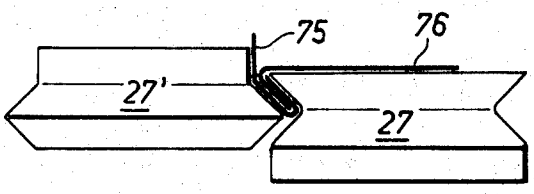

Fig.11

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DEVICE FOR CONNECTING EDGES OF SHEET METAL

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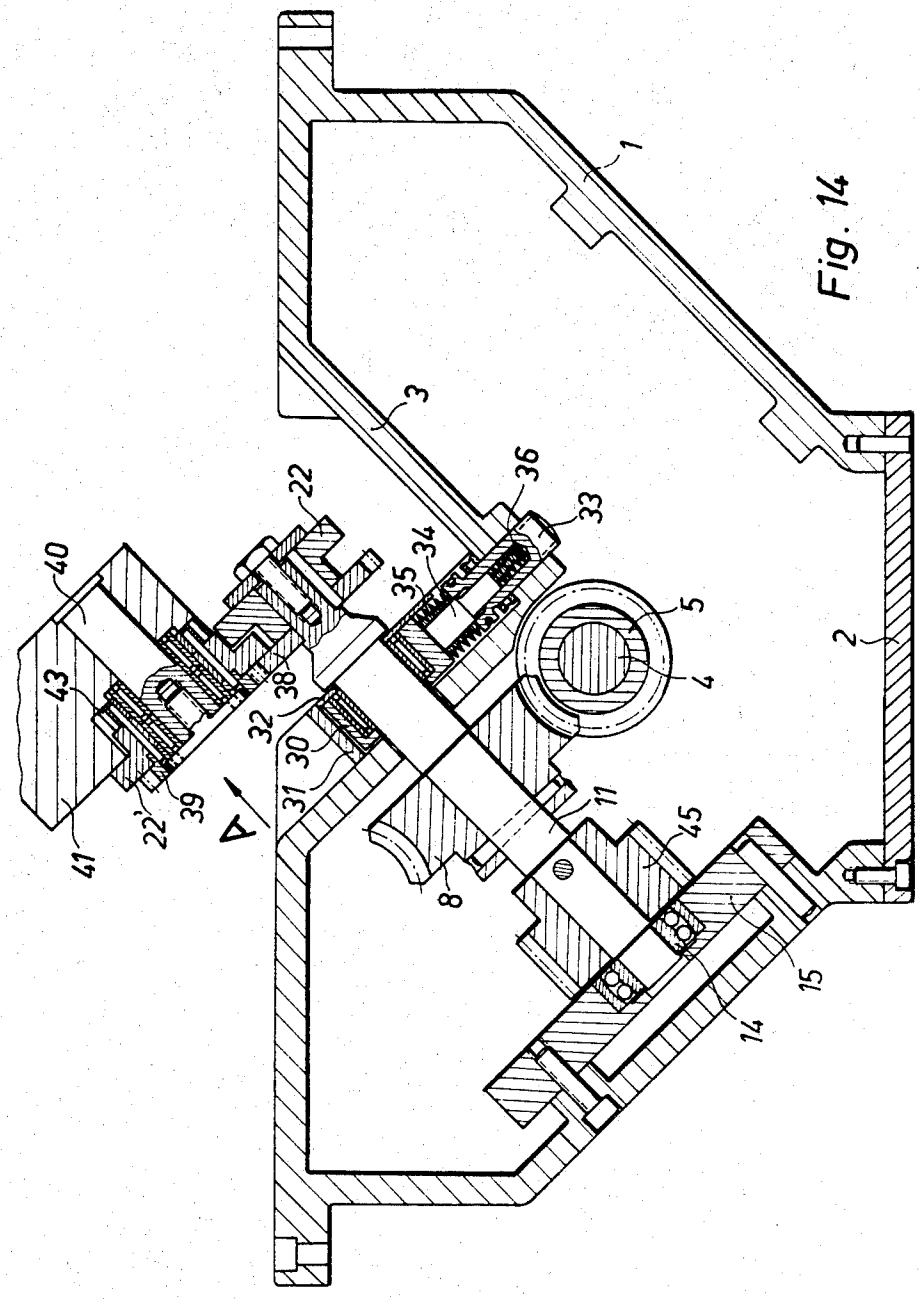

Fig. 14

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DEVICE FOR CONNECTING EDGES OF SHEET METAL

Filed Oct. 7, 1965 5 Sheets-Sheet 4

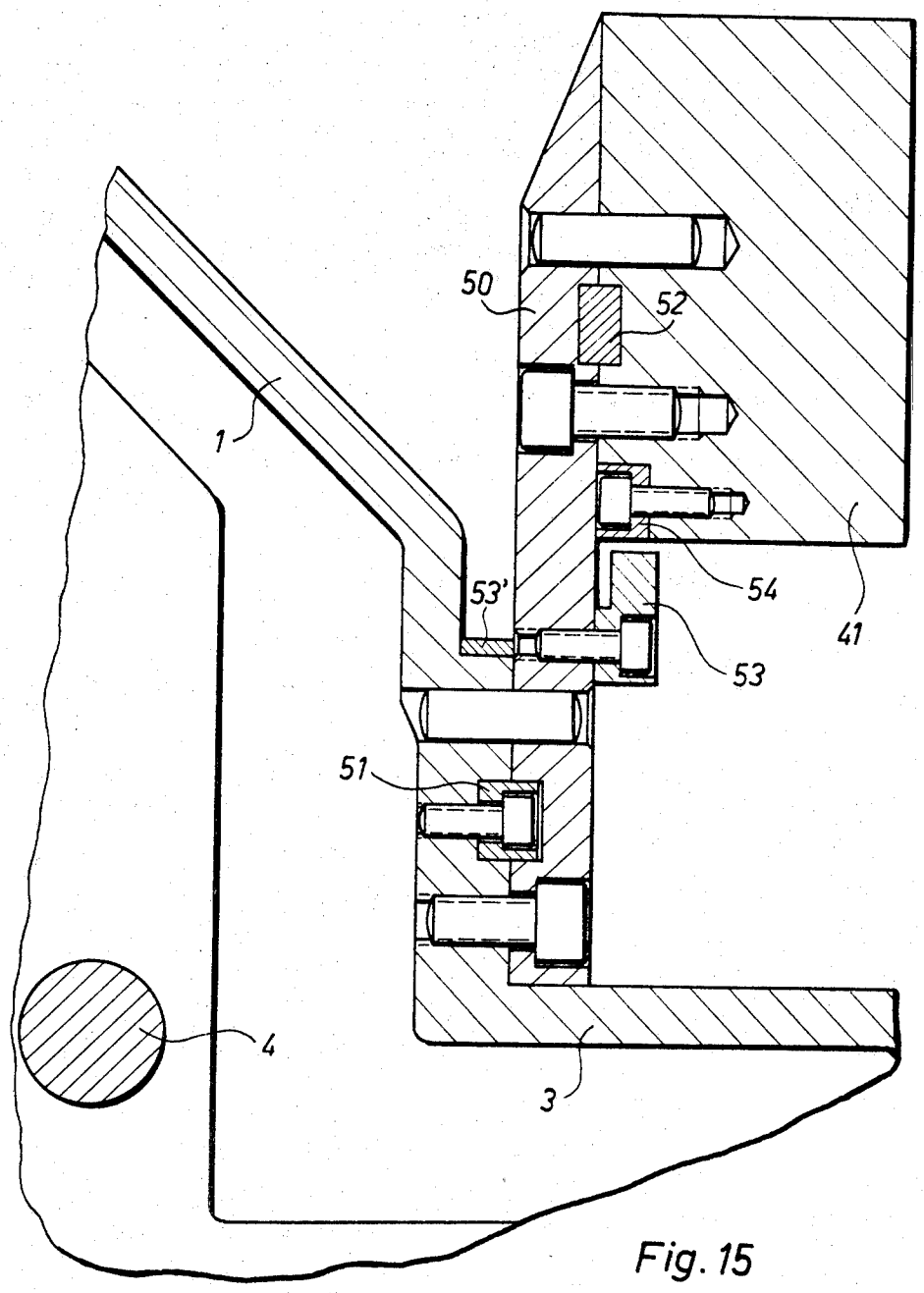

Fig. 15

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DEVICE FOR CONNECTING EDGES OF SHEET METAL

Filed Oct. 7, 1965 5 Sheets-Sheet 5

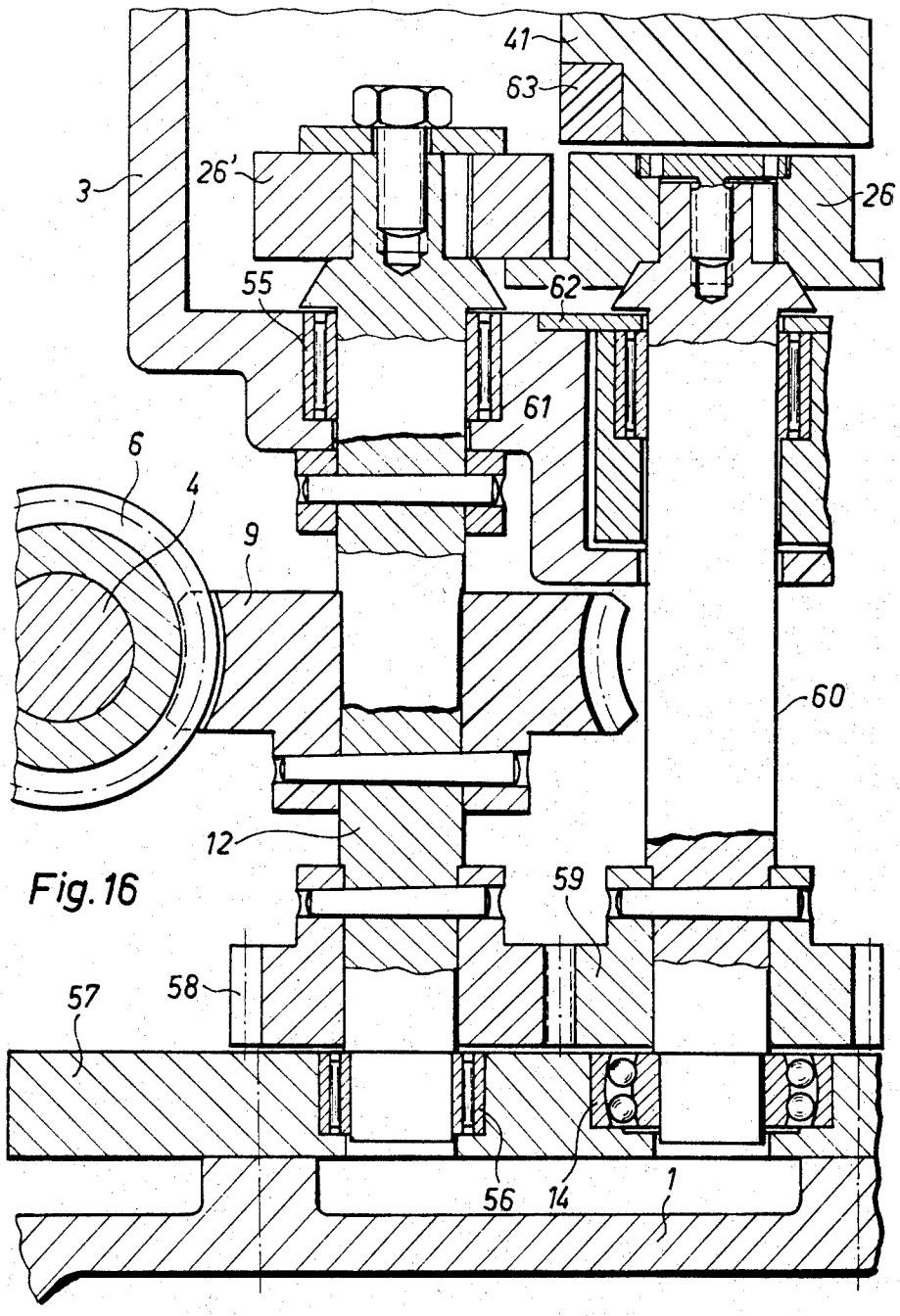

Fig. 16

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DEVICE FOR CONNECTING EDGES OF SHEET METAL

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11 Claims. (Cl. 72—181)

ABSTRACT OF THE DISCLOSURE

A device for foldably connecting edges of mutually perpendicular sheet metal portions to each other. A plurality or presser roller pairs are distributed along a predetermined straight path along which the mutual perpendicular portion sheet metal portions moved from one presser roller pair to the next, and the plurality of presser roller pairs form a means for initially acting on the sheet metal portions while they are spaced from each other to initiate the folding at one of the edges of one sheet metal portion and for then subsequently continuing the folding operations at the edges of the sheet metal portions while they engage each other. An elongated guide body extends along the path of movement of the sheet metal portions and serves as a mounting for at least some of the presser rollers, this guide body having a pair of opposed elongated free end portions, one of which carries presser rollers which act on the sheet metal portions while they are spaced from each other and the other of which carries presser rollers which act on the sheet metal portions while they engage each other. A retaining plate, fixedly carried by and extending from a housing of the device, carries the elongated guide body between the opposed elongated free end portions thereof.

This invention relates to a device for connecting two edges of a thin plate or the respective edges of two plates, such as plates made of sheet metal, and to a device which has a plurality of presser rollers arranged in series with respect to each other.

Devices are known for making pipes from bent sheet metal, by folding the edges thereof. The pipe is mounted around a cylindrical body and the fold is pressed against the cylindrical body by means of a presser roller. In this method, it is necessary to adjust the cylindrical body to correspond in shape and size to the desired pipe dimensions. Therefore, a different shape and size of pipe, requires a correspondingly different body shape and size.

It is an object of the present invention to connect two edges of a single sheet, or edges of two single sheets, and in particular flat sheets, by means of folding without the use of an inner body corresponding to the form of the desired pipes. With this object in view, the invention provides for one of the edges to be bent rectangularly in two steps. The bent edge is arranged in close proximity to the other edge of the sheet, which other edge is then folded around the bent edge in several steps. Thereafter, both bent edges are folded in a direction of a sheet portion adjacent those edges.

Thereby, it is possible, independent of the form of the sheet, to connect two edges by means of folding whereby not only cylindrical pipes, but rectangular, or square pipes can be made from at least two sheets, or two sheets can be connected at an angle.

The device in accordance with the invention includes exclusively pairs of presser rollers for deforming the edges. The presser rollers are essentially arranged in the same plane, and are disposed vertically with respect to each other. The presser rollers are also arranged in the

housing of the device, or are mounted on a guide body, extending axially with respect to the presser rollers. The guide body is arranged adjacent the housing of the device at a location where the edges of the sheet to be connected are still apart from each other. By exclusively using presser rollers, the friction created between the roller and the sheets is substantially smaller than by using an additional body for deforming the sheet metal.

The roller arrangement results in an uncomplicated arrangement of the device which is easily accessible during a breakdown.

A guide body will be pulled toward the part to be guided adjacent the edges, so that additional guiding rollers are eliminated.

In a further embodiment of the invention, the guide body and the presser rollers are so arranged that both edges of the sheet to be connected are perpendicularly disposed with respect to each other during the operation process. Such an arrangement is of special advantage for making folds for rectangular or square pipes, wherein the folds are located at the edges thereof.

A favorable arrangement of the drive elements is attained when a yieldably mounted roller is secured on the shaft which is pivotably mounted at the furthest end away from the roller, and that at least a spring adjacent the yieldable roller, forces the roller against its associated stationary roller. Thereby, the space in the housing is advantageously used, particularly if the axis of the presser rollers are arranged at an angle of less than 45°.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of the specification. For a better understanding of the invention, its operating advantages and the specific objects attained by its use, reference should be had in the accompanying drawings and descriptive matter in which:

FIG. 1 is a schematic side view of the presser roller pairs in accordance with the invention, arranged successively in the work direction;

FIG. 2 is a plan view in schematic form of the presser roller pairs according to FIG. 1, shown partly in section, taken along lines II—II of FIG. 1;

FIG. 3 is a schematic plan view of the roller pair drive means shown partly in section, taken along lines III—III in FIG. 1;

FIG. 4 is a schematic side view of the drive for the roller pairs in accordance with FIG. 1;

FIGS. 5 to 13 show a pair of presser rollers together with an associated work piece;

FIGS. 14 to 16 are sectional views in different scales taken along lines XIV—XIV, XV—XV and XVI—XVI of FIG. 1.

With reference to the figures, and particularly to FIG. 14, it can be seen that the device comprises a triangular housing or base **1** which is closed at its lower portion by a cover plate **2**. Housing **1** includes a center portion **3** which has a wedge-shaped cross section, the walls of center portion **3** being arranged at an angle of 45 degrees. A drive shaft **4** extends longitudinally of housing **1** onto which worm wheels **5**, **6** and **7** are fixedly secured, and are in meshed engagement with corresponding worm wheels **8**, **9** and **10** which are mounted on corresponding operating shafts **11**, **12** and **13** laterally arranged with respect to drive shaft **4**.

Operating shaft **11** is rotatably and pivotably mounted in a roller bearing **14** which in turn is mounted on a bearing plate **15**. Bearing plate **15** is secured to housing **1**. Operating shaft **11** carries a movable presser roller **22** opposite its roller bearing **14**, which cooperates with a stationary counter presser roller **22'**. The movable presser rollers are designated by reference characters **20**, **21** to

29, and the corresponding stationary counter presser rollers by reference characters 21' to 29'. (FIGS. 1 and 2.)

Operating shaft 11 is mounted in a pin bearing 30 which lies adjacent to presser roller 22 and extends through center portion 3. The passageway in center portion 3, through which operating shaft 11 extends, is wider than operating shaft 11, so as to permit the free rotation of operating shaft 11. A cover plate 32 is secured to center portion 3 by a cover portion 31.

A retaining screw 33 is secured to center portion 3 and receives an axially movable centering piece 34, which serves to center a cup spring 35 disposed between retaining screws 33 and pin bearing 30. A further cup spring 36 is arranged between the bottom of retaining screw 33 and centering piece 34.

Operating shaft 11 drives counter presser roller 22' by means of a pair of toothed wheels 38 and 39 arranged adjacent presser roller pairs 22 and 22'. Counter presser roller 22' is rotatably mounted on a pin 40 by means of two pin bearings. Pin 40 is arranged within a guide body 41 which extends longitudinally of housing 1. The remaining counter presser roller pairs 21', 25', 28' and 29' are also mounted in guide body 41 similar to counter presser roller 22.

A toothed gear 42 is operatively connected with counter presser roller 21', and a toothed gear 43 with counter presser roller 22'. Both toothed gears 42 and 43 are in meshing engagement with an intermediate toothed gear 44 which is mounted in guide body 41, similar to counter presser roller 22'.

A toothed gear 45 is fixedly mounted on an operating shaft 11 which drives a further operating shaft 48 by means of an intermediate toothed gear 46, and a toothed gear 47. Operating shaft 48 is connected with presser roller 21.

FIG. 15 shows the mounting of the guide body 41 on housing 1, by means of wedges 51 and 52 and retaining plate 50. A guide rod 53 is provided on retaining plate 50 between center portion 3 and guide body 41. A counter guide rod 54 is provided above guide rod 53. A guideway is provided by means of guide rod 53' between center portion 3 and retaining plate 50. Retaining plate 50 is tapered on its upper end, and at the end which is adjacent presser roller 23.

FIG. 16 shows a drive for presser roller pairs 26 and 26' comprising worm gears 6 and 9, and drive shaft 4. Worm gear 9 is fixedly supported on operating shaft 12 which extends through center portion 3 of housing 1. The top and bottom ends of operating shaft 12 are rotatably and stationary mounted within two pin bearings 55 and 56 respectively. Bearing 55 is arranged in center portion 3 of housing 1, and bearing 56 is arranged in the support plate 57 which is secured to housing 1. Presser roller 26' is coupled to operating shaft 12 by means of the spring and groove connection. A toothed gear 58 is fixedly mounted on operating shaft 12 adjacent bearing 56, and is in meshing engagement with the toothed gear 59 which is fixedly mounted on operating shaft 60. Operating shaft 60 is arranged parallel with respect to operating shaft 12. Operating shaft 60 is pivotably mounted by means of roller bearing 14 similar to operating shaft 11.

A movable pin bearing 61 is provided adjacent presser roller 26 which is mounted in the recess of center portion 3 and covered by a plate 62. Pin bearing 61 is yieldably mounted in the same manner as pin bearing 30 as shown in pin bearing 14, whereby parts 33 to 36 may have different dimensions and may also have a different shape. These parts are mounted on a retaining plate, not shown, of housing 1. A counter guide rod 63 is mounted on guide body 41.

The operating shafts of presser roller pairs 27 and 27' are provided with meshing toothed gears 68 and 69, and operate in the same manner as toothed gears 58 and 59 of operating shaft 12 and 60. Toothed gears 58 and 68

are connected by means of an intermediate toothed gear 70.

Presser roller pairs 23 and 23', 24 and 24' are driven in the same manner as presser roller pairs 26 and 26', 27 and 27', by means of an intermediate toothed gear 72 which is in meshing engagement with toothed gear 58.

The drive of presser roller pairs 28 and 28', 29 and 29' corresponds to the presser roller pairs 21 and 21', 22 and 22', whereby the drive is transmitted to presser roller pairs 25 and 25' by means of an intermediate wheel 73. Drive shaft 4 is connected by means of a clutch 75 to a drive motor, not shown.

The shape of presser rollers 21 to 29, and 21' to 29', is shown in FIGS. 5 to 13. The frame (not shown), which extends above the housing of the device for guiding the edges of two adjoining sheets to be connected with each other, is provided. The vertically adjustable rod may be provided at the frame.

As shown in FIG. 5, two sheets 75 and 76, the edges of which are to be connected with each other, are mounted on the guide frame at right angles with respect to each other, so that they are arranged adjacent presser roller pairs 21 and 21', whereby sheet 75 is disposed vertically with respect to operating shaft 48 of presser roller 21 and sheet 76 is deformed within presser roller pairs 21 and 21'. The next deforming stage of sheet 76 between presser roller 22 and 22' is shown in FIG. 6, whereby sheet 75 is disposed vertically with respect to shaft 11.

The front ends of the sheets may be connected with each other by means of a pin (not shown) which is mounted around guide body 41. The bent off edge of sheet 76 is guided by guide rod 53, FIG. 15, after leaving presser roller pairs 22 and 22', while sheet 75 is guided between retaining plate 50 and center portion 3 of housing 1. This guide is so arranged that at the end of retaining plate 50 both sheets 75 and 76 are adjacent to each other as shown in FIG. 7. In the next operating steps the edge of sheet 75 is folded around the edge of sheet 76 by means of presser roller pairs 23 and 23', 24 and 24', 25 and 25' as well as 26 and 26'. Thereafter, both edges of sheets 75 and 76 are bent in the direction of sheet 76, FIGS. 11 and 12, and the attained fold is arranged in a common plane with sheet 76 (FIG. 13).

By appropriate arrangement of these rollers and the guide frame, the edges of a sheet bent into a pipe shape may be folded in a similar manner, whereby roller pairs 21 and 21', 22 and 22' for bending one edge of the sheet should be provided with further rollers, for bending the other edges of the sheet. The bending operation of these additional rollers corresponds to that of roller pairs 21 and 21', 22 and 22'. However, the location of the bend as seen from the edge of the sheet which is subject to the additional rollers, is twice as far from the edge of the sheet than that of the edge which is subject to roller pairs 21 and 21', 22 and 22'. Roller pairs 21 and 21', 22 and 22', and the additional rollers form a guide for the respective edges of the sheet, in such a way, that both edges are guided simultaneously to roller pair 23 and 23'.

What is claimed is:

1. A device for foldably connecting edges of a pair of mutually perpendicular sheet metal portions, comprising: a plurality of presser roller pairs for operably receiving mutually perpendicular sheet metal portions therebetween and forming a means for initially folding one of said sheet metal portions at said edge thereof while said mutually perpendicular sheet metal portions are spaced from each other and subsequently continuing the folding of the edges of the sheet metal portions together while said mutually perpendicular sheet metal portions engage each other, said means including one group of said presser roller pairs for acting on said sheet metal portions while they are spaced from each other and another group of presser roller pairs for acting on said sheet metal portions when they engage each other, an

elongated guide body for mounting at least some of said plurality of presser roller pairs thereon, said guide body extending along the path of movement of said sheet metal portions while they are acted upon by said plurality of roller pairs, said guide body having a pair of opposed elongated free end portions one of which carries presser rollers of said one group the other of which carries presser rollers of said other group, a housing, and a retaining plate fixed to and extending from said housing and fixed to said guide body between said elongated end portions thereof for mounting the latter at the location spaced from the said housing with said free end portions of said guide body extending in opposed directions beyond said retaining plate so that on one side of said retaining plate where said one end portion of said guide body is located said sheet metal portions are spaced from each other while on the other side of said retaining plate where said other end portion of said guide body is located said sheet metal portions engage each other.

2. The device according to claim 1, wherein said retaining plate tapers toward said other elongated free end portion of said guide body so that said sheet metal portions will gradually approach each other as they advance toward said other elongated free end portion of guide body.

3. The device according to claim 2, wherein a first drive shaft extends longitudinally along said device to drive said plurality of presser roller pairs.

4. The device according to claim 3, wherein an individual drive is provided for driving roller pairs disposed in a common plane.

5. The device according to claim 4, wherein the axis of said presser roller pairs are arranged at an angle less than 45° with respect to a vertical plane.

6. The device according to claim 1, wherein said housing has a center portion of wedge-shaped cross section, at least one axis of roller pairs disposed in one plane being guided through one side of said center portion, and

at least an axis of roller pairs disposed in another plane being guided through the other side of said center portion.

7. The device according to claim 1, wherein a guide bar is arranged at said retaining plate adjacent said guide body, and a guide way arranged opposite said guide bar for maintaining one of the sheet metal portions perpendicular to the other sheet metal portion, with the latter sheet metal portion being engaged by said guide bar.

8. The device according to claim 7, wherein individual drive means are provided for each of a first and a second pair of rollers, a third and a fourth pair of rollers, a sixth and a seventh pair of rollers, and a fifth, eighth and ninth pair of said plurality of rollers.

9. The device according to claim 8, wherein one roller of each of said plurality of roller pairs is mounted stationarily while the respective cooperating roller is mounted to yield in the direction of the associated stationary roller, and further comprising at least one spring means for pressing each of said yieldably mounted rollers against said respective stationarily mounted roller.

10. The device according to claim 9, wherein a shaft is provided for mounting each of said yieldably arranged rollers, said shaft being pivotably mounted at the end thereof remotest from the respective yieldable roller, said spring means operating at the end of said shaft adjacent said yieldably mounted roller.

11. The device according to claim 10, wherein centering means is arranged axially movable with respect to said shaft for centering said spring means, second spring means pressing said centering piece against a bearing of the respective one of said yieldably mounted roller.

References Cited

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