Sept. 15, 1970 X. LIPP 3,528,167

METHOD FOR CONNECTING EDGES OF SHEET METAL

Original Filed Oct. 7, 1965 5 Sheets-Sheet 1

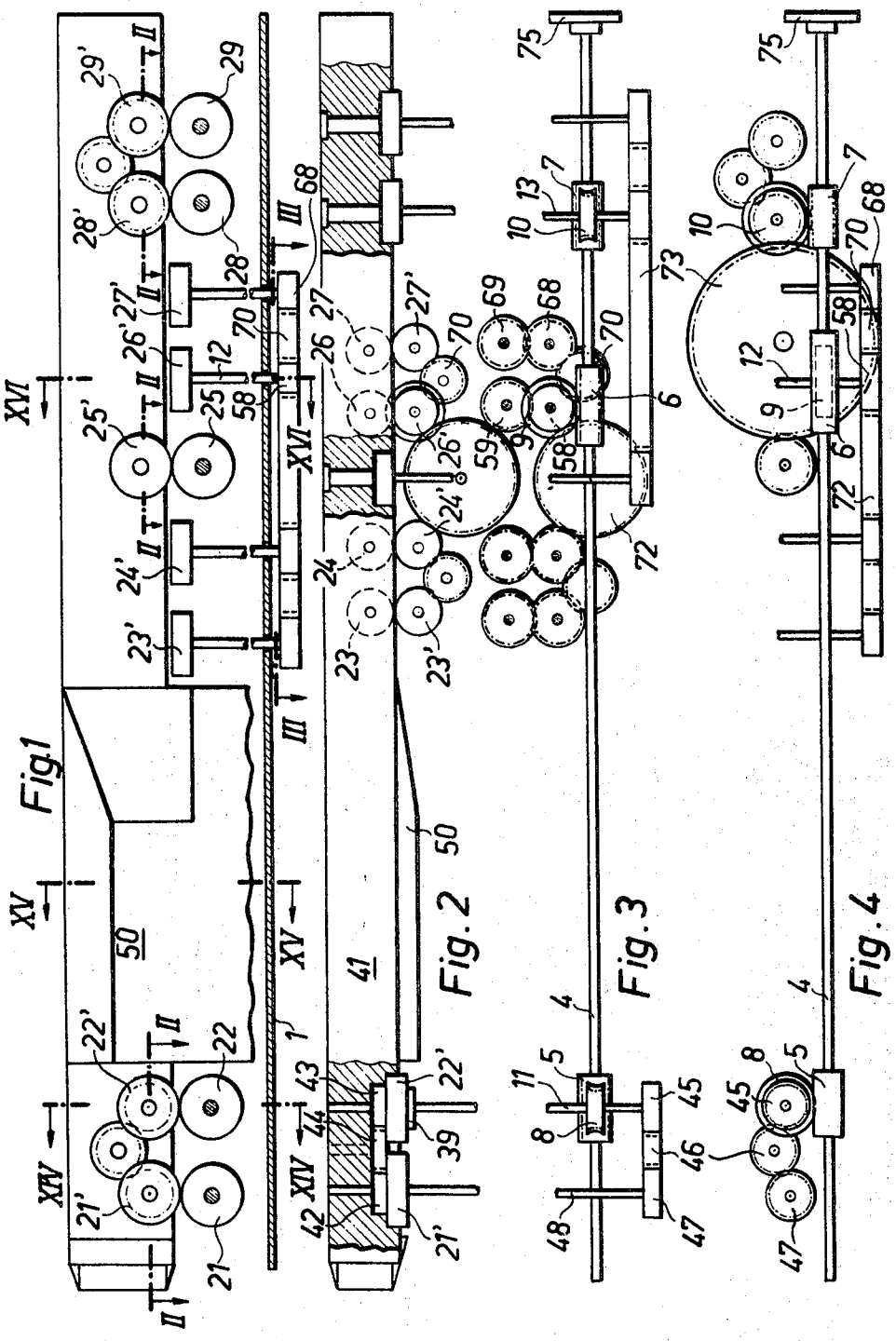


Fig. 1

Fig. 2

Fig. 3

Fig. 4

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METHOD FOR CONNECTING EDGES OF SHEET METAL

Original Filed Oct. 7, 1965 5 Sheets-Sheet 2

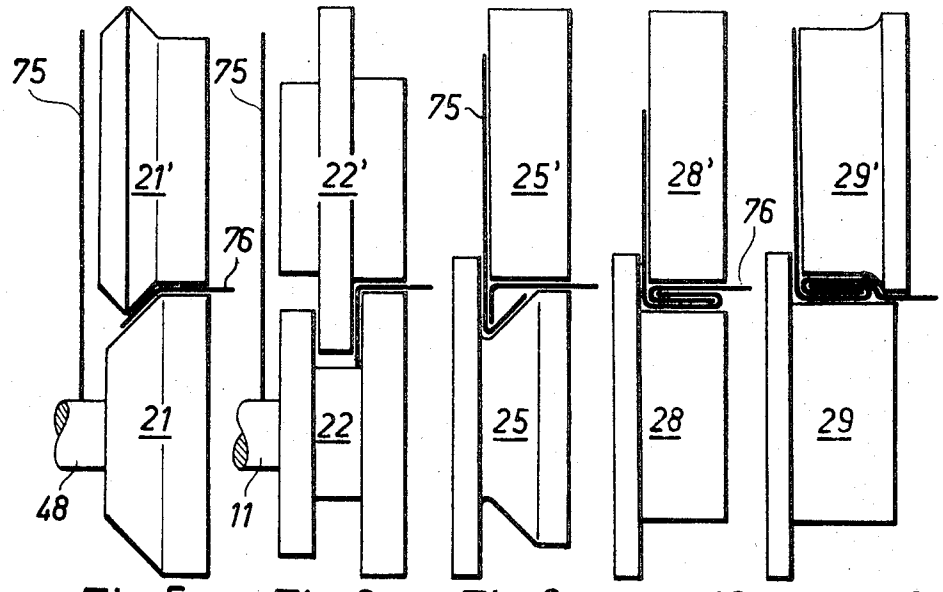


Fig.5 Fig.6 Fig.9 Fig.12 Fig.13

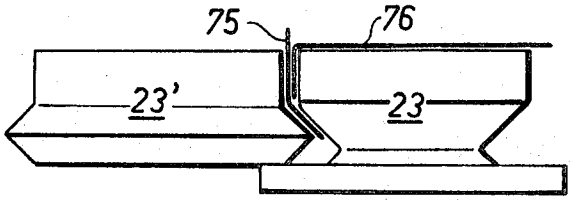


Fig.7

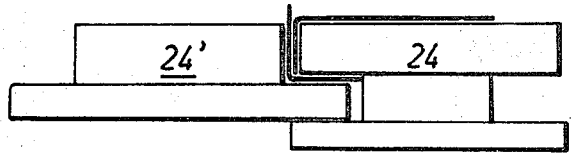


Fig.8

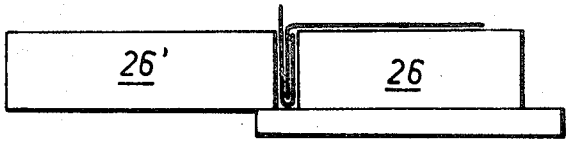


Fig.10

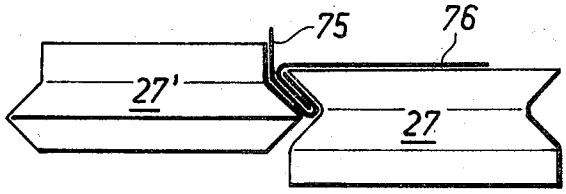


Fig.11

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Sept. 15, 1970 X. LIPP 3,528,167

METHOD FOR CONNECTING EDGES OF SHEET METAL

Original Filed Oct. 7, 1965 5 Sheets-Sheet 3

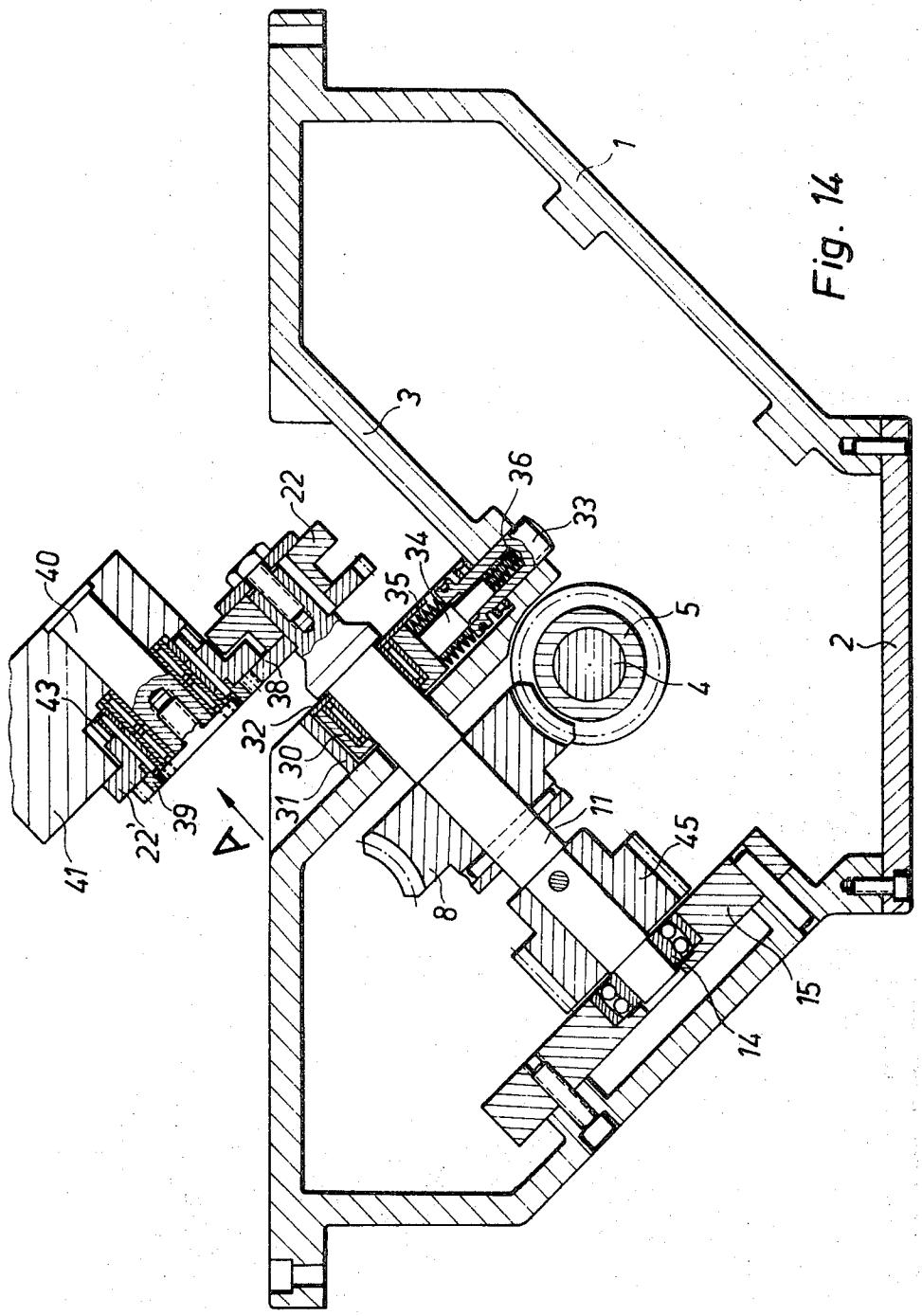


Fig. 14

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METHOD FOR CONNECTING EDGES OF SHEET METAL

Original Filed Oct. 7, 1965 5 Sheets-Sheet 4

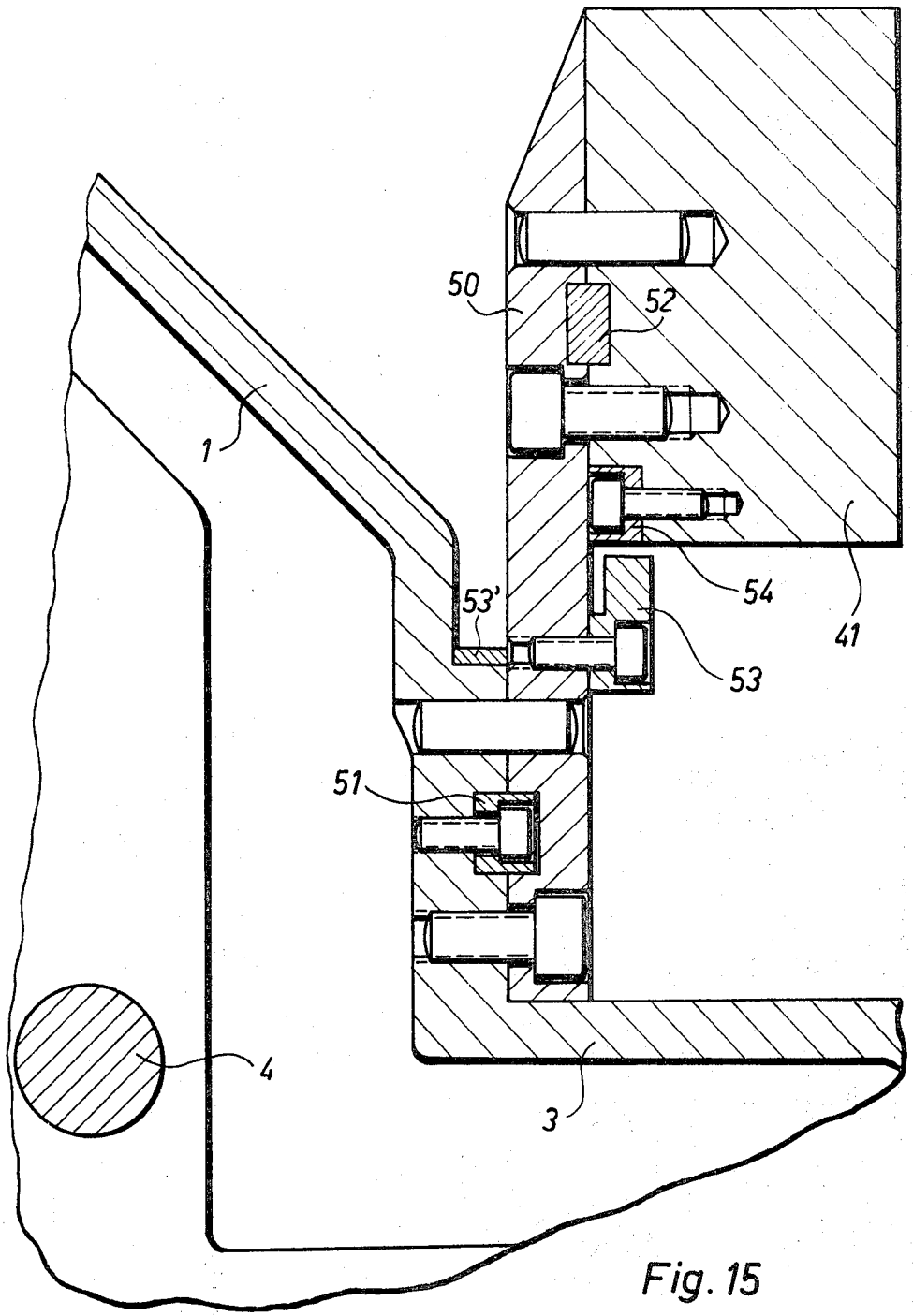


Fig. 15

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METHOD FOR CONNECTING EDGES OF SHEET METAL

Original Filed Oct. 7, 1965 5 Sheets-Sheet 5

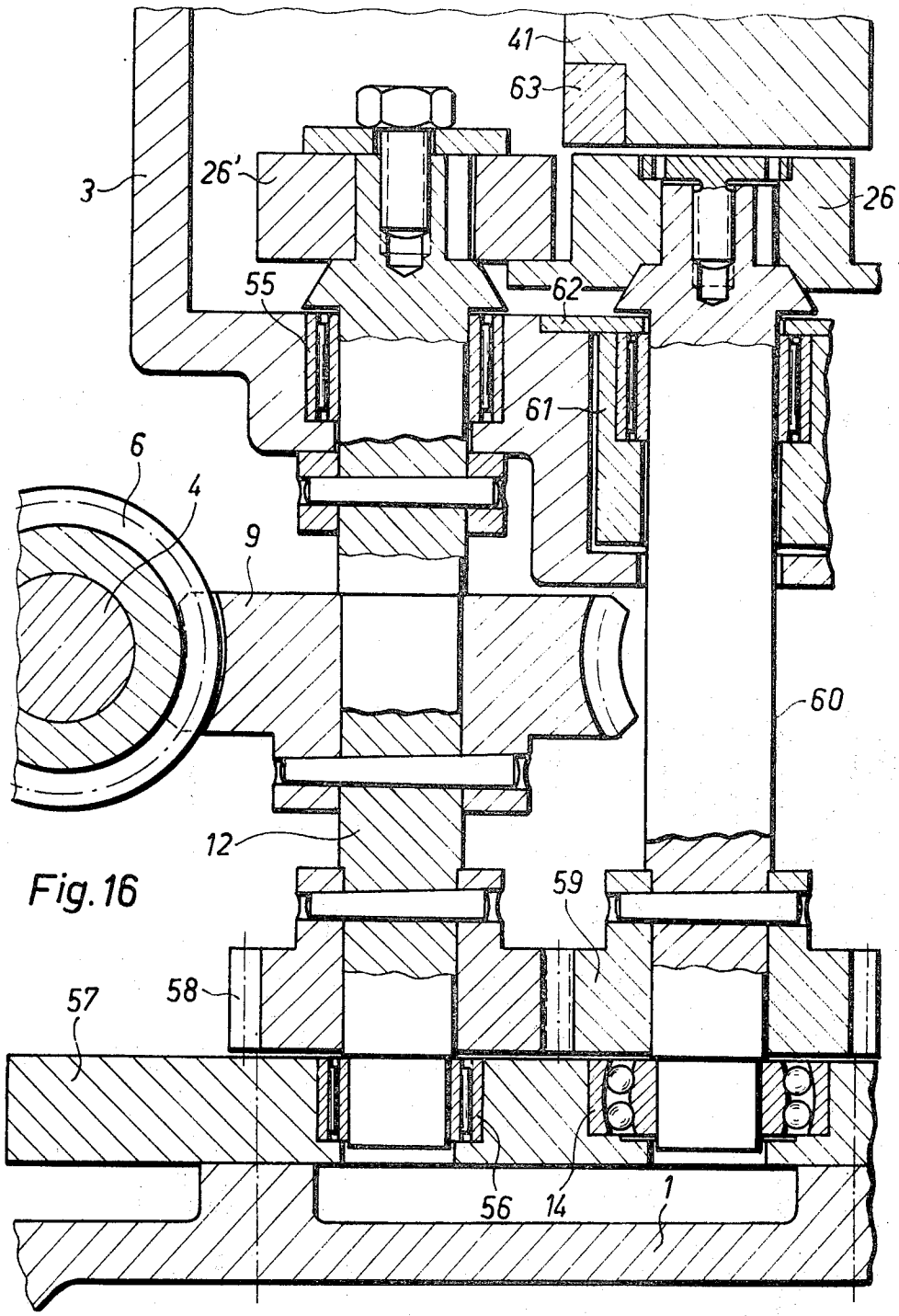


Fig. 16

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United States Patent Office 3,528,167 Patented Sept. 15, 1970

3,528,167

METHOD FOR CONNECTING EDGES OF SHEET METAL

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Original application Oct. 7, 1965, Ser. No. 493,737, now Patent No. 3,407,640, dated Oct. 29, 1968. Divided and this application June 13, 1968, Ser. No. 736,661
Claims priority, application Germany, Jan. 30, 1965, L 49,857
Int. Cl. B21d *39/00*; B23p *11/00*
U.S. Cl. 29—509
3 Claims

ABSTRACT OF THE DISCLOSURE

A method of foldably interconnecting sheet metal portions which are perpendicular to each other. The mutually perpendicular sheet metal portions extend parallel to each other, and while their edges are spaced from and parallel to each other one of these edges is bent through an angle of 90°. Then this bent portion is placed against the other sheet metal portion at a location spaced slightly from the free edge of the latter. This latter free edge is then bent around the first bent free edge portion. Then the folded edge portions are together folded against the surface of the first sheet.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a division of copending application Ser. No. 493,737, filed Oct. 7, 1965, now Pat. No. 3,407,640, and entitled "Device for Connecting Edges of Sheet Metal."

BACKGROUND OF THE INVENTION

The present invention relates to a method for connecting edges of sheet metal.

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.

SUMMARY OF THE INVENTION

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, provided 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 pressure 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 pivotally 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 aixs 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 workpiece;

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 adjacecnt 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 sheet **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 bent 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 method for connecting a pair of sheet metal portions which respectively terminate in free edge regions, comprising the steps of arranging said sheet metal portions in mutually perpendicular planes, respectively, with said free edge regions thereof spaced from and parallel to each other, folding the free edge region of one of said sheet metal portions through 90° so that it extends parallel to the other of the sheet metal portions, displacing the folded free edge region of said one sheet metal portion to a location next to and extending along the other sheet metal portion with the free edge region of the latter extending beyond the folded free edge region of said one sheet metal portion, then folding the free edge region of said other sheet metal portion through approximately 180° around the folded free edge region of said one sheet metal portion so that the folded free edge region of said one sheet metal portion is received within the 180° fold of said other sheet metal portion, and then folding the 180° folded region of said other sheet metal

portion with the 90° folded free edge region of the said one sheet metal portion therein against a surface of said one sheet metal portion.

2. The method of claim 1, and pressing the folded regions of said sheet metal portions into said one sheet metal portion at an exterior surface of the latter to an extent sufficient to render the folded edge regions flush with said exterior surface of said one sheet metal portion.

3. The method of claim 1 and wherein the folding of said edge regions of said sheet metal portions takes place in 45° stages.

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U.S. Cl. X.R.

29—243.5