

[54] SEAM FORMING APPARATUS

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[58] Field of Search 29/243.5, 243.58; 72/51,
72/52; 113/58, 54

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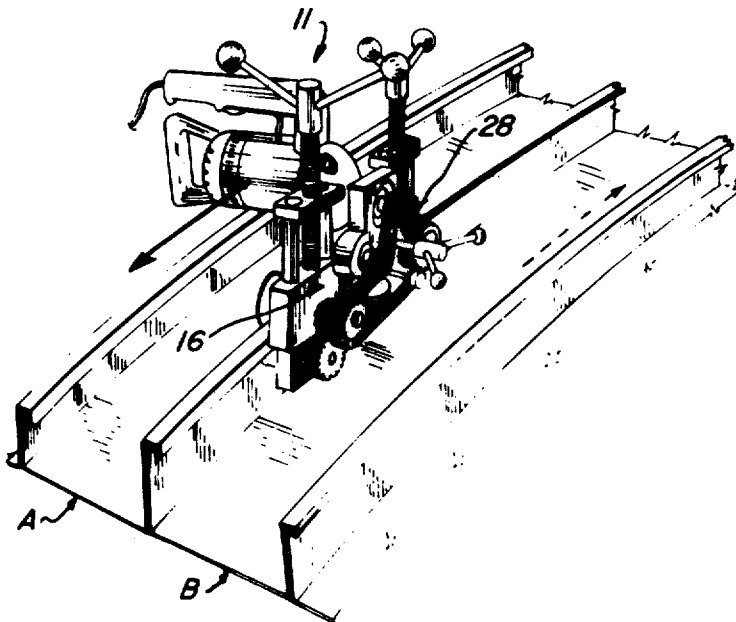
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[57] ABSTRACT

A reversible, self-propelled seam forming apparatus for connecting U-shaped building panels with specially constructed side flanges in a continuous seam to form a structure. The apparatus has two sets of upper and lower power-driven rollers with one set axially spaced from the other to operate either as a leading set or a trailing set as they are driven along and engagement with the panel flanges. The leading set drives the apparatus along the panel and pre-aligns and presses the flanges together followed by a set of intermediate idler rollers one having an inclined surface that turns a portion of the flange under the other and the trailing set of power-driven rollers turns the inclined portion under to complete the seam in a continuous operation. A motor and drive train operates the power-driven rollers in either direction so that the apparatus will run first from one end and back from the other end.

14 Claims, 10 Drawing Figures



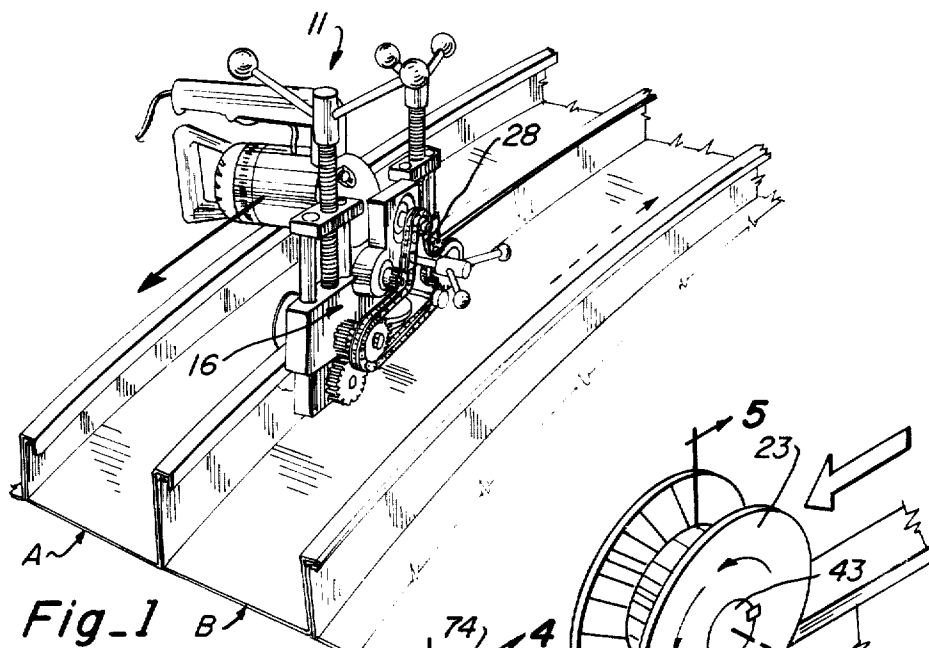


Fig-1

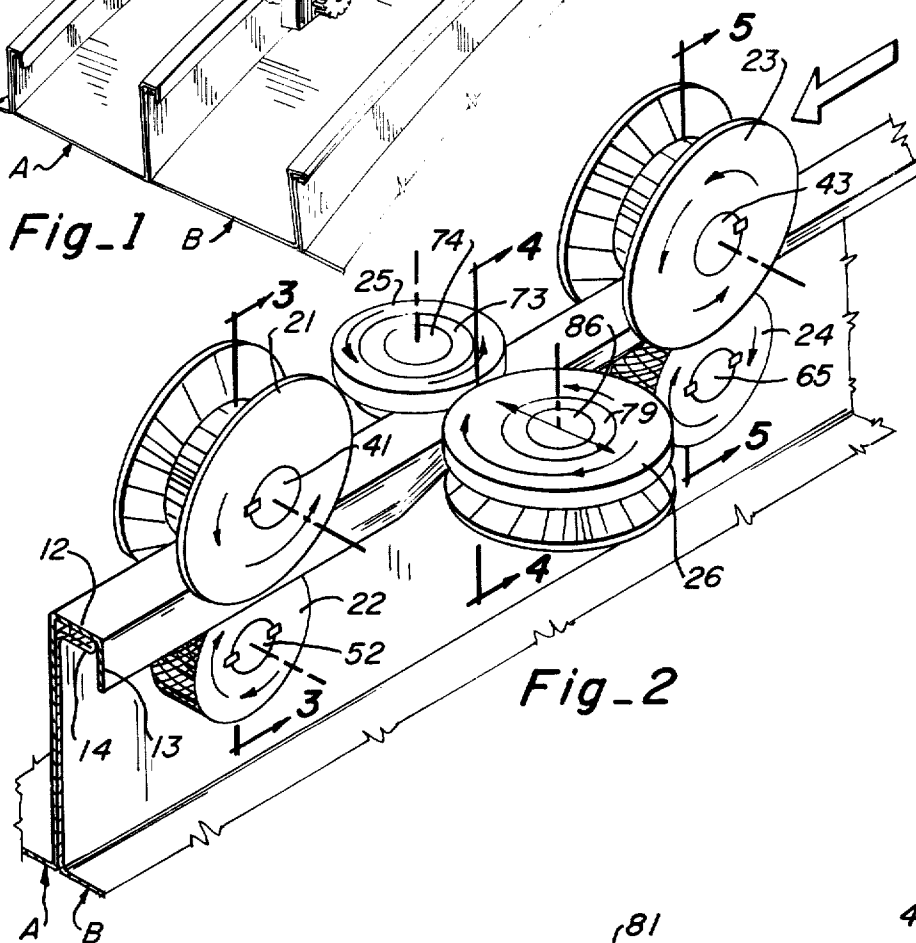


Fig-2

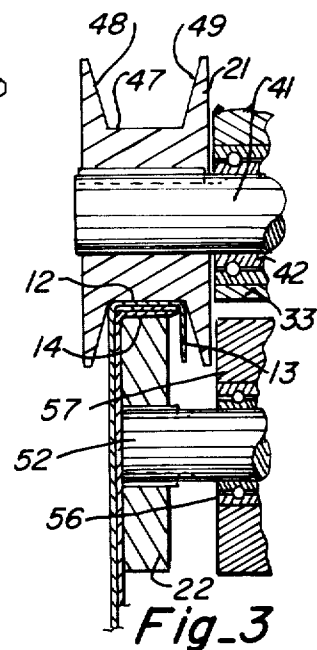


Fig-3

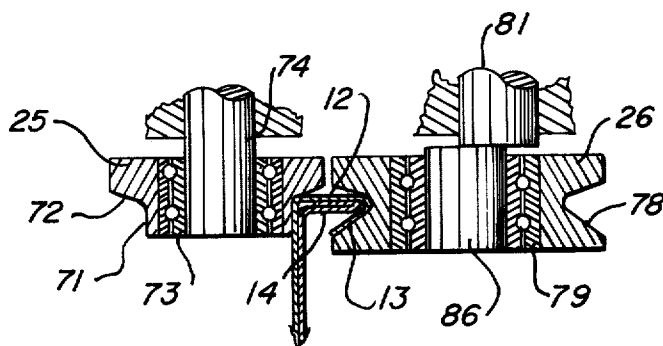


Fig-4

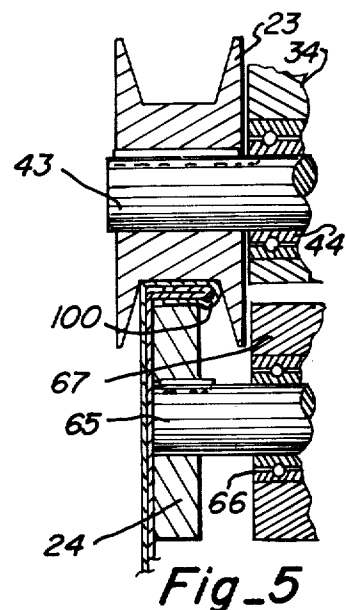
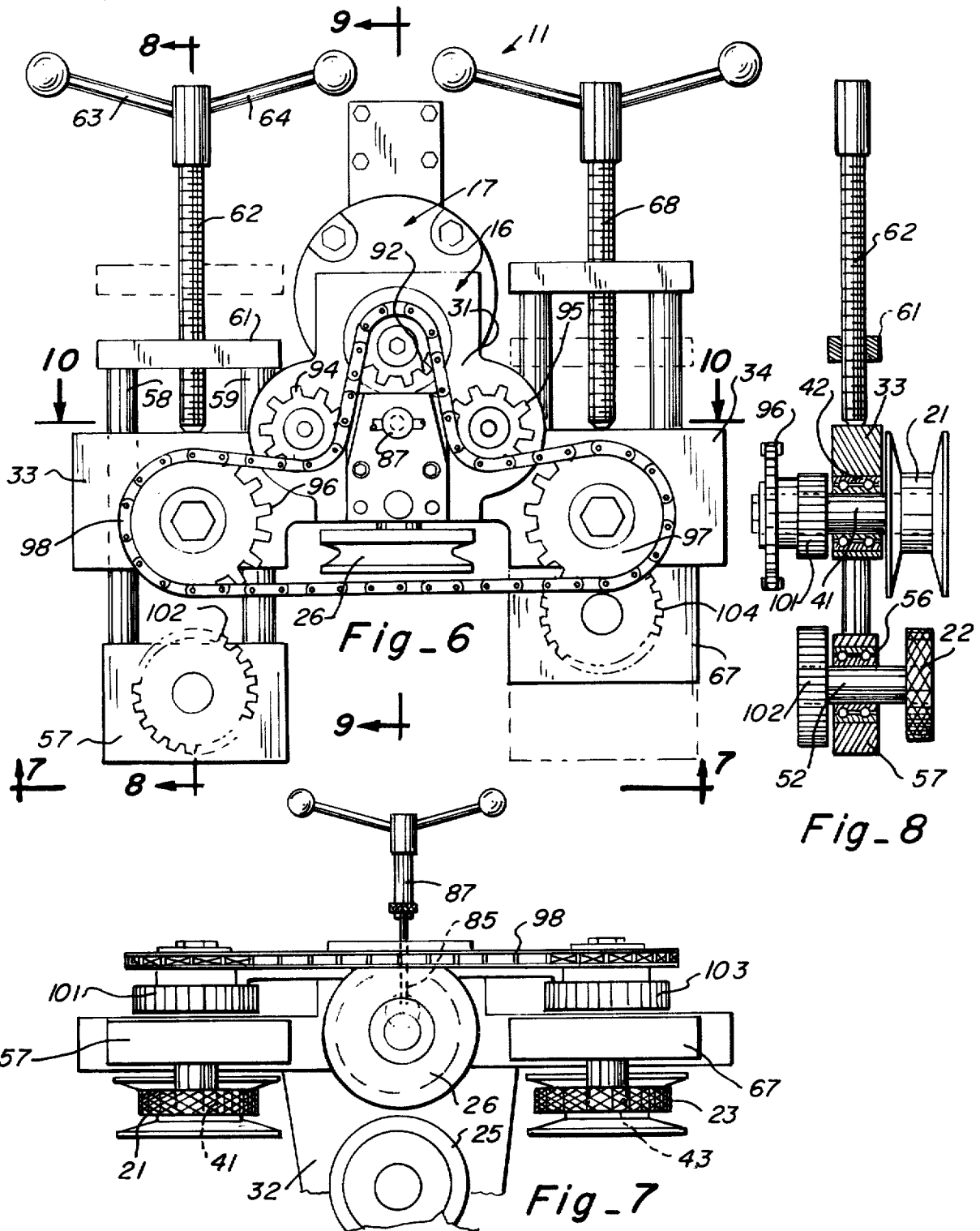
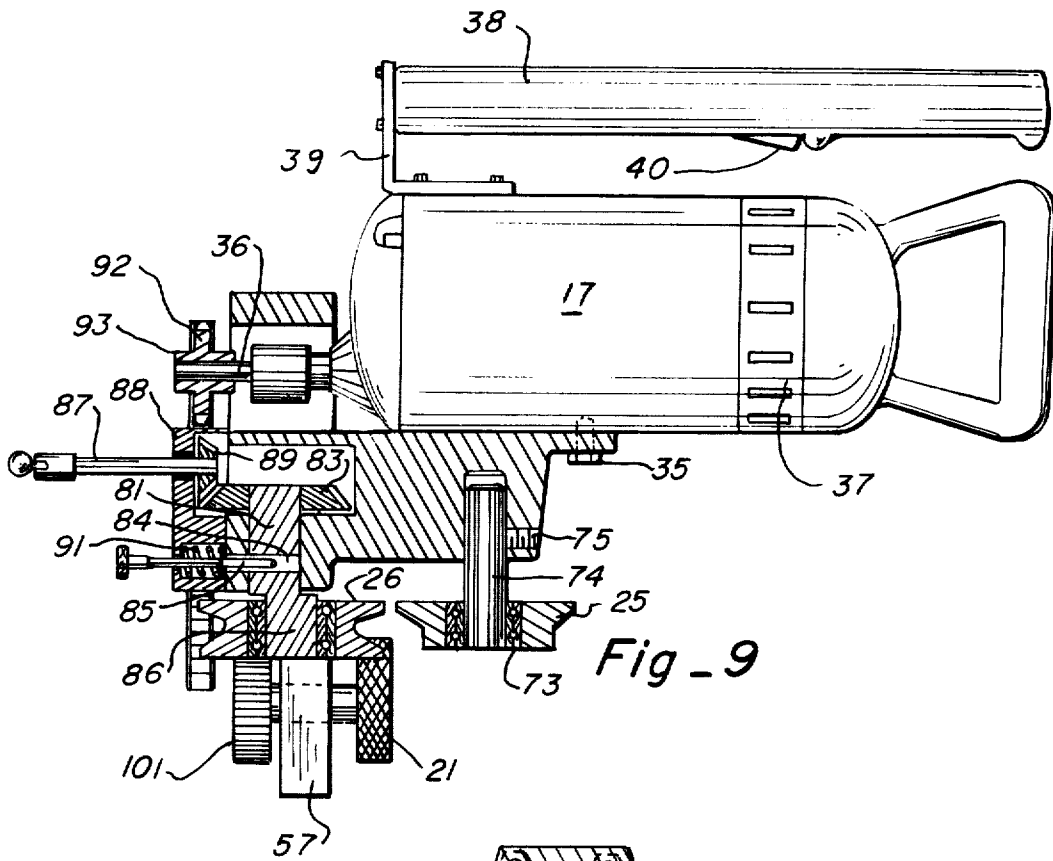
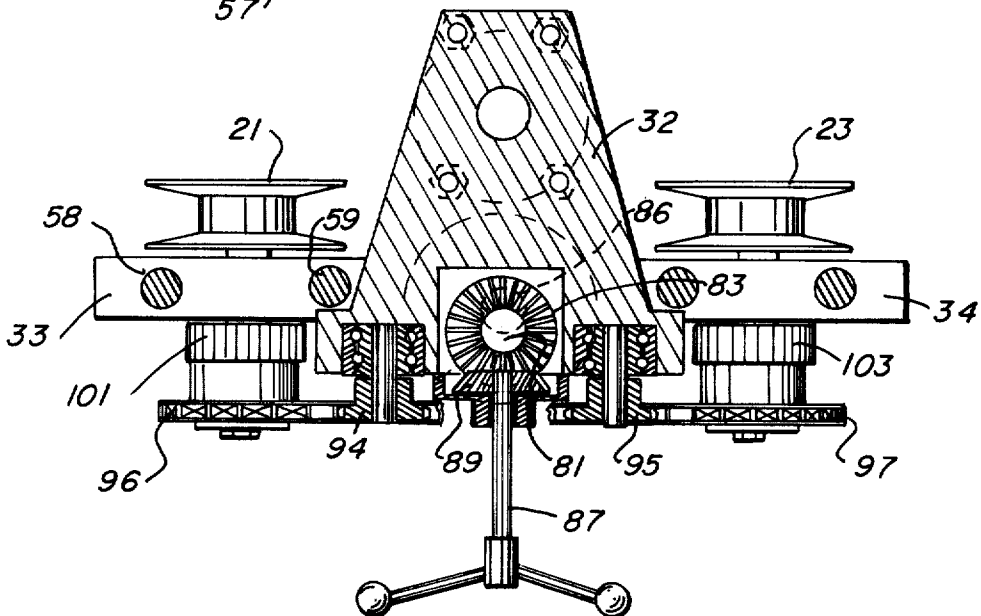


Fig-5





SEAM FORMING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to a novel seam forming apparatus for connecting building panels in a continuous seam along adjacent side edges of two building panels in the construction of a building or like structure.

In an earlier filed patent application Ser. No. 226,173 and later applications Ser. Nos. 408,936, 408,942 and 408,937 based thereon, there is shown and described unique U-shaped building panels with seam-forming side flanges that are readily made by a roll-forming type machine at a job site location and cut to the required length with each length connected side by side in a continuous seam to form buildings and like structure. In general, a machine takes a roll of flat prefinished sheet metal and forms a building panel of a selected length and cuts the panels and the panels are subsequently joined side by side placing one flange into another and bending one of the flanges relative to the other on the adjacent panels. The top panels are formed in an arc and end walls are formed straight with side flanges that are joined in a similar manner. A typical span for the arched section is 60 feet using a 20 to 24 gauge sheet metal. The present invention is directed to seam forming apparatus for joining the building panels of the type disclosed in the earlier referred to applications in a highly efficient manner.

Accordingly, it is an object of this invention to provide a novel seam forming apparatus for connecting building panels to one another in a fast and efficient manner and forming a strong, water-tight, weather-resistant seam.

Another object of this invention is to provide a novel seam forming apparatus that is reversible and self-propelled so as to be able to run along the panels being connected in one direction and back in the opposite direction from opposite sides of the building at a relatively fast rate so as to conserve time in the assembly of the building.

Yet a further object of this invention is to provide a novel seam forming apparatus that maintains accurate alinement of the panels being connected and is highly effective in joining two panels using a side flange in the form of an inverted channel on one panel and an inturned side flange on the other panel that is nested in the channel of the adjacent panel.

Another object of this invention is to provide a highly portable seam forming apparatus that is readily operated at the job site to join building panels along adjacent sides.

Other objects, advantages and capabilities of the present invention will become more apparent as the description proceeds taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view showing fragments of two similar building panels that are being joined side by side by a seam forming apparatus constructed in accordance with the present invention;

FIG. 2 is a fragmentary perspective view showing the arrangement of the three sets of rollers and their direction of rotation in relation to the two building panels being joined;

FIG. 3 is a sectional view taken along lines 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 2;

FIG. 5 is a sectional view taken along lines 5—5 of FIG. 2;

FIG. 6 is an elevation view of the seam forming apparatus looking toward the drive train with one of the bearing blocks raised to a closed position and the other lowered to an open position;

FIG. 7 is a bottom plan view of a fragment of the seam apparatus;

FIG. 8 is a sectional view taken along lines 8—8 of FIG. 6;

FIG. 9 is a sectional view taken along lines 9—9 of FIG. 6; and

FIG. 10 is a sectional view taken along lines 10—10 of FIG. 6.

Referring now to FIGS. 1 and 2, there is shown a self-propelled seam forming apparatus made in accordance with the present invention generally designated by numeral 11 mounted in an operative position for connecting two arched building panels A and B. The building panels are of a construction similar to that described in more detail in the above-identified pending patent applications. The panels A and B shown are of an identical size and shape and briefly are generally U-shaped with a bottom wall and opposed spaced upright side walls with one side wall formed with an outturned flange portion 12 and a downturned terminal portion 13 forming an inverted channel that receives a doubled over inturned flange 14 projecting in from the side wall on the adjacent other panel. While not specifically shown in the present drawings, the bottom wall of the panels A and B is laterally bowed or arched and the sides and bottom are corrugated as shown and described in the above-identified prior applications describing the panels in detail.

The seam forming apparatus 11, in general, is comprised of a main support frame 16, a motive power source mounted on the support frame in the form of an electric gearmotor 17 and a panel-engaging assembly in the form of three sets of rollers comprised of a set of upper power-driven roller 21 and lower power-driven roller 22, another set of upper power-driven roller 23 and lower power-driven roller 24 axially spaced from the first set and a third intermediate set of laterally spaced rollers 25 and 26 disposed midway between the other two sets. The rotary motion or power of the gearmotor is coupled to the two sets of upper and lower rollers 21 through 24, via a drive train designated generally by numeral 28.

As best seen in FIGS. 6 through 10, the main support frame 16 is made as a one-piece casting having a central portion 31, a rearwardly projecting cantilever-like base portion 32 and a pair of similar outwardly projecting side or wing portions 33 and 34.

The gearmotor 17 is mounted on the base portion 32 and is affixed thereto by one or more bolts 35. The gearmotor 17 has an output shaft 36 and a direction control ring 37 which when turned to one position will cause the output shaft 36 to rotate in one direction and when turned to another position will cause the shaft 36 to rotate in the opposite direction. The electric gearmotor 17 is comprised of an electric motor portion and a gear box portion having a $\frac{1}{4}$ Hp rating with the output shaft rotating at approximately 450 rpm. The apparatus will move along the panels at the rate of about 40 to 60 feet per minute. A commercially available gearmotor for this purpose is presently sold by Black and Decker, Model No. 1405. A handle 38 is attached to the top of

the gearmotor housing by a bracket 39 and has an on-off trigger 40 that controls the electric power to the gearmotor.

Each of the two sets of upper and lower power-driven rollers 21 and 22 and upper and lower power-driven rollers 23 and 24 are of an identical construction and mounting so that a description of one applies to both. Referring to the leading set of rollers, with reference to the direction of movement shown in FIG. 2, upper leading roller 21 is affixed to an upper shaft 41 rotated in a bearing 42 in the frame wing portion 33 displaced below and to one side of the gearmotor shaft 36 while upper trailing roller 23 is affixed to an upper shaft 43 rotated in a bearing 44 in the frame wing portion 34 disposed and equal distance below and to the other side of the gearmotor shaft 36. Upper roller 21 is shown to have a grooved rim characterized by outwardly inclined side portions 48 and 49 and a flat inner peripheral portion 47 of reduced diameter 47 that is in a frictional engagement with the top surface of the out-turned flange portion 12 of the panel. The use of an inclined groove side in the upper roller provides an anti-abrasive guide for the metal being shaped. Upper roller 23 has a similar grooved rim. The lower rollers 22 and 24 have a knurled rim to prevent slippage.

Each of the lower rollers 22 and 24 are mounted for vertical adjustment relative to the associated upper roller in a similar manner using separate vertically adjustable bearing blocks. With reference to lower roller 22, it is affixed to a shaft 52 rotated in a bearing 56 in a vertically adjustable bearing block 57. The bearing block 57 is adjustably supported in a depending manner from the wing portion 33 by means of two parallel, spaced slide rods 58 and 59 that are held apart at the top by a pressure bar 61 and each bar extends down through a hole in the wing portion 33 of and extend down into the bearing block 57 at their lower ends and are affixed thereto. The holes in the wing portions are sized to allow the slide rods to slide freely therein. The pressure bar 61 has an adjustment bolt 62 threaded therein having its lower end bearing against the top of the wing portion 33. Bolt 62 has a handle comprised of a head on the bolt with diametrically opposed handle rods 63 and 64 at the upper end. As the adjustment bolt 62 is turned in one direction, the bearing block 57 is raised and in the other direction, the bearing block is lowered. The bearing block has an up or closed position in which the lower roller is being driven over the panel in a frictional engagement therewith and a down position as shown in FIG. 6 in which the panel flanges may be slipped between the upper and lower rollers to place the apparatus in an operable position on the panels. In the closed or raised operative position, the lower roller is disposed in the channel in frictional engagement with a surface of the panel flange. When the lower roller is in a leading position, it engages the undersurface of the inturned flange portion 14 to pre-align the panels and press the flanges together as well as to drive the apparatus along the panels as they are being connected and when in the trailing position it moves against the terminal portion 13 to flatten it against the underside of the inturned portion in a final connecting operation as well as drive the apparatus as best seen in FIG. 5.

In a like manner, the lower roller 24 is mounted on a shaft 65 rotated in a bearing 66 and bearing block 67 that is adjustably mounted to be moved up and down by the rotation of an adjustable bolt 68 with a similar

structural support operable in the same manner as bearing block 22.

The intermediate roller 25 functions as a guide for the panels and has a half-groove with a rim portion 71 of a reduced diameter that engages the inside of the panel channel opposite the terminal portion and an inclined portion 72 projecting up at an angle therefrom to form an anti-abrasive guide. Roller 25 is an idler roller mounted in a bearing 73 on a vertical shaft 74 that depends from the underside of the frame base portion 32 and is held thereon by a set screw 75. In this way, the axis of rotation of the guide roller 25 is fixed.

Intermediate roller 26 has a generally modified V-shaped groove in the rim providing opposed inclined surfaces with inclined panel-engaging surface designated 78 that engages the terminal portion 13 of the panel and turns it in at an incline under the inturned portion of the other panel as best seen in FIG. 4. Roller 26 is also an idler roller mounted in the bearing 79 of a vertical shaft 81 supported in the support frame. The vertical shaft 81 for roller 26 has a laterally movable axis arranged to move between two positions. In the extended or open position roller 26 is axially spaced sufficiently from roller 25 to permit the unconnected panel flanges to be inserted between rollers 25 and 26. To facilitate the shifting between the two positions, shaft 81 has an offset section 86 at the lower end. A bevel gear 83 is affixed to the upper end of vertical shaft 81 and it also has a slot 84 arranged to receive a locking pin 85 that will lock the shaft and roller 26 in the open or closed position. The roller 26 is moved to the extended position by means of a shaft 87 with a handle mounted for rotation in a removable casting member 88 mounted on the support frame. Shaft 87 has a bevel gear 89 meshing with the bevel gear 83 so that upon the rotation of the shaft 87, the roller 26 is rotated about the axis of shaft 81 through an angle and held by the reinsertion of the pin thereinto. The pin 85 has a manually manipulated outer knob and is spring-biased to an in-position by a spring 91.

In the drive train 28 between the gearmotor and the two power-driven roller sets above described, the output shaft of the gearmotor carries a chain sprocket 92 held by a sprocket retainer 93. On each side of and below the sprocket 92 there is mounted on the support frame idler sprockets 94 and 95 suitably mounted on shafts supported by bearings (FIG. 10) one idler sprocket for each set of power-driven rollers. A chain sprocket 96 is mounted on shaft 21 and a sprocket 97 on shaft 23 and an endless drive chain 98 extends around the drive sprocket 92, under idler sprockets 94 and 95 and around sprockets 96 and 97 to transmit rotary power directly to the upper rollers 21 and 23. In the secondary drive train for the lower rollers, shaft 41 carries a gear 101 that meshes with a gear 102 on the shaft of the lower roller 22 when disposed in the raised position to transmit rotary power from the upper shaft 41 to the lower shaft 52 to drive the lower roller 22. In a like manner, upper shaft 43 carries a gear 103 that meshes with gear 104 to drive lower roller 24.

OPERATION

In a full sequence of operation the lower power-driven rollers 22 and 24 are moved to a lowered position by turning shafts 62 and 68 and the bending roller 26 is moved to an out position by rotating shaft 87. The top rollers 21 and 23 are placed on the flange portion

12 and the lower rollers are raised so that the associated gears mesh with the gears on the upper shafts and the lower roller is in the inverted channel of the panel. The bending roller 26 is moved to the in position and the locator pin 85 inserted into slot 84 to hold it in place. The apparatus is placed at one end of the panels and the lead lower roller is tightened to a snug condition while the trailing lower roller is left loose to pick up the extra thickness of the terminal portion.

The direction control ring 37 is set for the correct direction and the trigger 40 is engaged to actuate the gearmotor and both sets of upper and lower rollers are driven via the drive train. The leading set of upper and lower rollers are in a firm frictional engagement with the panel surfaces as illustrated in FIG. 3 and pre-align the flanges and press them together cause the assembly to be driven along the panels guided by the lower rollers in the flange channel. In the intermediate stage, the roller 25 holds the inside of the panel along the channel and roller 26 turns the terminal portion in on an incline while the trailing sets of power-driven rollers as shown in FIG. 5 press the terminal portion 13 against the underside of inturned flange portion 14 to complete the seam. While the leading set of rollers provide a major portion of the driving force to cause the apparatus to move and be self-propelled, the trailing set also contributes to the propelling thereof. By running the lower rollers inside the channel the apparatus is maintained in alinement. In the operation, it is highly important that the flanges of the panels are pulled tightly together before the bend of the terminal portion takes place, which is accomplished by the leading set of rollers. In this reversible arrangement, the machine moves up from one side of the building, the motor is reversed by resetting ring 37 and is returned from the opposite side.

As best seen in FIG. 5, the lower trailing roller is inset relative to the outer extremity of the intermediate peripheral flat surface of reduced diameter of the upper roller to form a depending bead 100 along the outer underside of the seam which bead has been found effective in causing moisture to fall down therefrom and not penetrate the seam.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made by way of example and that changes in details of structure may be made without departing from the spirit thereof.

I claim:

1. In seam forming apparatus for connecting a pair of adjacent panels, one panel having an outturned flange portion and a downturned terminal portion forming an inverted connecting channel and the other panel having an inturned flange portion positioned in the connecting channel of the one panel, said seam forming apparatus comprising, in combination;

first and second sets of upper and lower power-driven rollers with the first set of upper and lower power-driven rollers axially spaced from the second set to dispose said sets along the panels to alternately serve as the leading and trailing rollers depending on the direction of movement of the apparatus relative to the panels being connected together, the lower roller of each of said sets being positioned in the connecting channel and the upper roller of each set above the outturned flange portion with both the rollers of each of said sets being in engagement with adjacent surfaces of the panels causing

said rollers to move along to the panels upon the conjoint rotation thereof; and

an intermediate set of laterally spaced idler rollers disposed between said first and second set of rollers and movable therewith, the leading of said first and second sets pre-aligning the panels and pressing the flange portions together, the intermediate set of rollers bending the downturned terminal portion under the inturned terminal portion at an angle, the trailing of said first and second sets of rollers flattening the angularly disposed downturned terminal portion against the underside of the inturned flange portion as said sets of rollers are moved conjointly along the panels.

2. In seam forming apparatus as set forth in claim 1 wherein each of said upper rollers of said first and second sets and each roller of said intermediate set are mounted on a separate shaft rotated in a bearing on a common support frame.

3. In seam forming apparatus as set forth in claim 1 wherein each of said lower rollers of said first and second set are mounted on a shaft rotated in a bearing in a separate bearing support block vertically adjustably movable relative to the associated upper roller to permit placement of the rollers on the flange portions of the panels.

4. In seam forming apparatus as set forth in claim 1 wherein one of said rollers of said intermediate set is adjustably movable relative to the other to adjust the spacing therebetween so as to permit the placement of the rollers on the flange portions of the panels.

5. In seam forming apparatus as set forth in claim 4 wherein said one roller is mounted on an offset portion of a supporting shaft, and manually operable handle means to rotate the supporting shaft to shift the position of said one roller relative to the other roller of said intermediate set.

6. In seam forming apparatus as set forth in claim 5 including means to lock the supporting shaft in a closed panel-bending position and in an open position.

7. In seam forming apparatus as set forth in claim 1 wherein a single output drive shaft is coupled through separate drive trains to conjointly drive the upper and lower rollers of said first and second sets.

8. In seam forming apparatus as set forth in claim 7 wherein each said drive train includes a gear on said output shaft, a gear on the shaft for each upper roller, an idler gear between the output shaft gear and each of said gears for each upper roller, a chain around the output shaft gear and the gears for the upper rollers and against the idler gear, and a drive gear between each upper roller shaft and the associated lower roller shaft which mesh when the lower roller shaft is in the raised position to transmit rotary power from each upper roller shaft to each lower roller shaft.

9. In seam forming apparatus as set forth in claim 1 wherein each of said upper rollers of said first and second sets has a tapered groove with an intermediate peripheral flat surface of reduced diameter that engages the outturned flange portion of the panel.

10. In seam forming apparatus as set forth in claim 9 wherein the lower roller is inset relative to the outer extremity of the intermediate peripheral flat surface of the upper roller to form a depending bead along the outer underside of the seam to cause moisture to drip therefrom.

11. In seam forming apparatus as set forth in claim 1 wherein each of said lower rollers has a knurled surface that engages the adjacent panel surface in the connecting channel.

12. In seam forming apparatus as set forth in claim 1 wherein one of the rollers of said intermediate set has an inclined surface to partially turn the downturned terminal portion in at an angle as the panels are moved between the third set of rollers and the other of the rollers of said third set has a rim portion of reduced diameter that engages the inside of the channel opposite the downturned terminal portion and an inclined portion projecting up at an angle therefrom.

13. In reversible, self-propelled seam forming apparatus for connecting a pair of similar adjacent panels having opposed upright side wall portions together at a seam along adjacent side wall portions thereof with one of said panels having preformed seam parts including an outturned flange portion and a downturned terminal portion from one of its side wall portions forming an inverted connecting channel in which an inturned flange portion projects from the upright side wall portion of the other panel is positioned, said apparatus comprising in combination:

first and second sets of upper and lower rollers arranged in axially parallel relation with the first set of upper and lower rollers axially spaced from the second set to dispose said sets along the panels to alternately serve as the leading and trailing rollers depending on its direction of movement of the apparatus relative to the panels being connected together, the lower roller of each of said sets being positioned in the connecting channel and the upper roller of each set above the channel with both the rollers of each of said sets being in frictional engagement with the adjacent surfaces of the panels at the channel, said to cause the first and second set of upper rollers to move along the panels upon the conjoint rotation thereof,

an intermediate set of laterally spaced idler rollers having their axis normal to those of said first and second set rollers and disposed between said first and second set of rollers and movable therewith, the leading of said first and second sets prealigning the panels and pressing the flange portions together, said intermediate set of rollers bending the downturned terminal portion under the inturned terminal portion of the panels at an angle as the trailing of said first and second set flattens the angularly disposed downturned terminal portion against the underside of the inturned flange portion, and

motive power and drive train means to conjointly drive said first and second set of rollers to effect the movement of all of said sets of rollers along the panels.

14. In reversible, self-propelled seam forming appa-

ratus for connecting a pair of similar adjacent building panels, each panel having a bottom and opposed side walls, one of said panels having an outturned flange portion and a downturned terminal portion projecting from one of its side walls forming an inverted connecting channel and the other of said panels having an inturned flange portion projecting from one of its side walls positioned in the connecting channel, said seam forming apparatus comprising in combination:

a support frame having a central body portion a base portion projecting from one side of the body portion and a pair of opposed wing portions,

a reversible drive motor means mounted on said base portion having an output shaft positioned midway between and above said wing portions,

a first set of upper and lower power-driven rollers driven by said drive motor through a drive train, said upper roller being mounted for rotation on one of said wing portions and the lower roller being adjustably movable relative to said upper roller,

a second set of upper and lower power-driven rollers driven by said drive motor means through a drive train, said upper roller of said second set being mounted for rotation on the other of said wing portions and the lower roller of said second set being adjustably movable relative to the associated upper roller,

said first and second set of rollers being axially spaced from one another and arranged axially parallel to one another to alternately serve as the leading and trailing rollers depending on the direction of movement of the apparatus relative to the panels being connected together the lower roller of each of said sets being positioned in the connecting channel and the upper roller of each set above the outturned flange portion with both of the rollers of each of said sets being in frictional engagement with the adjacent surfaces of the panels causing the first and second set of upper rollers to move along to the panels upon the conjoint rotation thereof,

an intermediate set of laterally spaced bending rollers arranged on the central body portion vertically in line with the output shaft of the gearmotor and midway between said first and second set of rollers having their axis disposed normal to those of said first and second set of rollers, the leading of said first and second sets of rollers prealigning the panels and pressing the flange portions together, the intermediate set of rollers bending the downturned terminal portion under the inturned terminal portion of the panels at an angle, the trailing of said first and second sets of rollers flattening the angularly disposed downturned terminal portion against the underside of the inturned flange portion as said sets of rollers are moved conjointly along the panels.

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