

Feb. 11, 1964

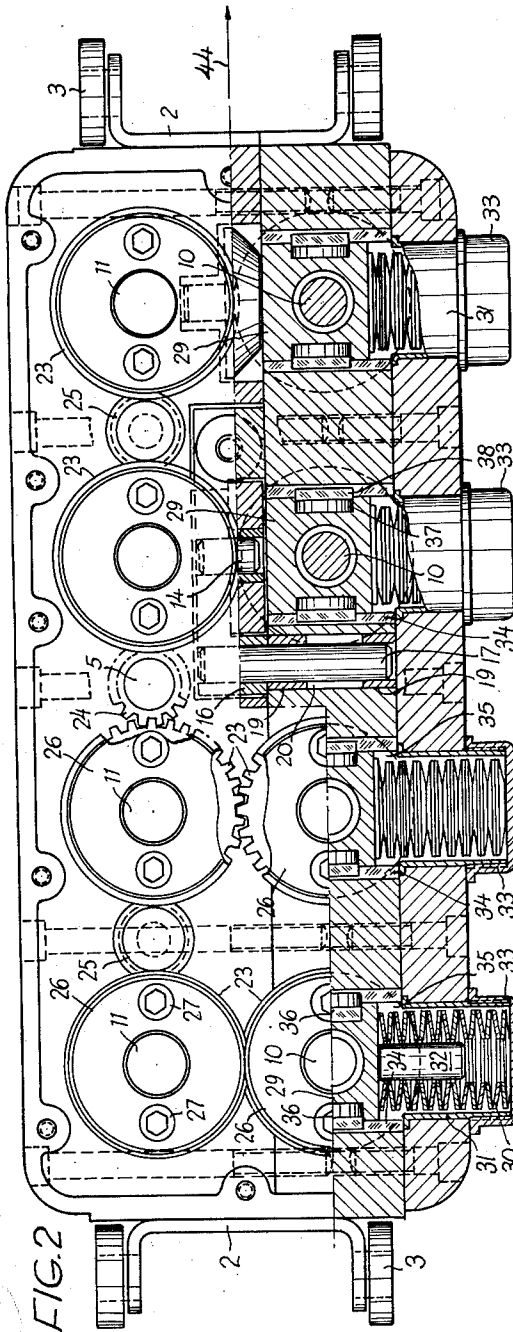
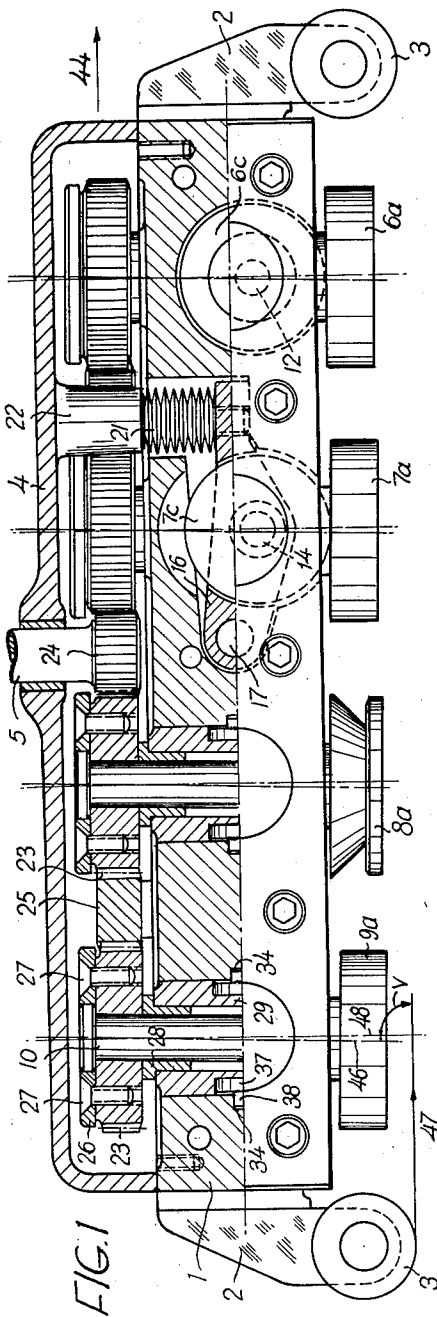
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3,120,828

ROOF SEAMING MACHINE

Filed Oct. 12, 1960

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 3

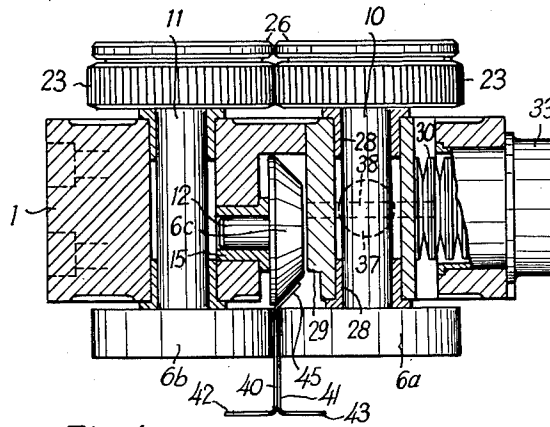


FIG. 4

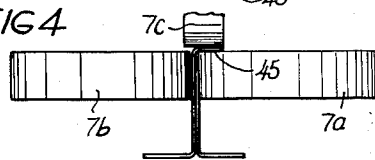


FIG. 5

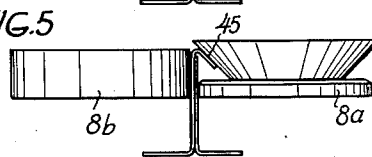
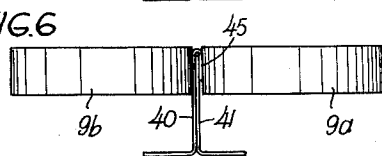


FIG. 6



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3,120,828

ROOF SEAMING MACHINE

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6 Claims. (Cl. 113—55)

Previously known roof seaming machines for forming standing seams to interconnect adjacent roofing sheets comprise a carriage with pair-wise arranged rolls which successively perform the seaming operation according as the carriage is moved along the upstanding sheet flanges. One of the rolls of each pair, hereinbelow termed the folding roll, is adapted to be swung outward relative to the other roll, herein termed the counterroll, and is acted upon by a spring such as to be forced toward the counter roll and to assist in folding the upstanding sheet flange or sheet flanges for producing a single or double seam. Movability of one roll towards and away from the other roll is necessary for the transmission of the spring action and for adapting the distance between the folding roll and the counter roll to the variable thickness of the seam.

The movability of the folding rolls toward and away from the counter rolls involves certain problems with respect to the driving of the rolls. In this connection there also arises the difficulty in maintaining the rolls in position on either side of the seam as they are advanced along the seam. When the upstanding sheet flange or sheet flanges are folded during the seaming operation, forces will result which have upwardly directed components and consequently tend to lift the carriage off the sheets and to disengage the rolls from the sheet flanges.

The object of this invention is to eliminate the above difficulties and in this connection to provide suitable bearing means for the shafts of the movable folding rolls.

In its broadest aspect the invention is characterized by the fact that the swingable folding roll is mounted on one end of a shaft the other end of which is provided with a support roll in engagement with a support roll on a shaft for the counter roll of the pair. Due to the provision of support members at the ends of the shafts, the ends will be securely maintained at a definite distance from each other, resulting in the possibility of providing a simple roll driving mechanism which is not unfavourably affected by variations of the spacing of the rolls in each pair during the seaming operation.

According to another feature of the invention the axes of rotation of the folding rolls of each pair of folding and counter rolls are located in a plane which makes an angle somewhat less than 90° with the direction of advance of the machine during the seaming operation. This inclination of the axes of rotation results in that the rolls during the forward movement of the carriage along the seam will work their way downward towards the sheet and thereby effectively counteract the upwardly directed force components of the reaction forces exerted by the sheet during the deformation (folding) thereof. This effect results in turn in that the rolls automatically are maintained in engagement with the upstanding sheet flanges during the seaming operation.

An embodiment of the invention is described hereinbelow with reference to the accompanying drawing.

FIG. 1 is a lateral elevation of the machine with the upper part shown in longitudinal vertical section and the lower part in vertical projection. FIG. 2 is a top view of the machine with the cover of the carriage omitted and partly shown in horizontal section along a plane through the axes of the springs acting upon the shafts of the rolls. FIG. 3 is a vertical cross section along a plane through the axes of rotation of the first pair of rolls. FIGS. 4, 5 and 6 illustrate in detail the second, third and fourth

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pair of rolls, respectively, as viewed in a vertical transverse projection of the carriage.

In the embodiment illustrated, the carriage comprises a frame block or frame 1 which may be rectangular and the ends of which are provided with brackets 2 for supporting wheels 3 or other supporting means adapted to support and guide the carriage on the roofing sheets to be connected by seams. Thus, during operation, the plane defined by the roofing sheets contacted by the wheels may be termed as a tangent plane to the supporting means of the frame. The carriage has a cover 4 through which extends a shaft 5 which is mounted in the cover and which can be connected to a crank, a drive motor or other drive mechanism for operating the machine. On the lower side of the carriage there are four pairs of folding and counter rolls 6a, 6b, 7a, 7b, 8a, 8b and 9a, 9b. The folding rolls 6a, 7a, 8a and 9a are carried by shafts 10 which are mounted for lateral swinging in the frame, whereas the counter rolls 6b, 7b, 8b and 9b are secured to shafts 11 which are non-displaceably mounted in the frame block 1. There are further provided means to overturn the upstanding flanges of the sheets to be secured in cooperation with the folding rolls and counter rolls, said means comprising two edge folding rolls 6c and 7c mounted on transverse shafts 12 and 14, respectively. The shaft 12 is journaled in a bearing bushing 15 (FIG. 3) secured to the frame block 1, whereas the shaft 14 is mounted on an arm 16, one end of which is secured to a transverse shaft 17 which is mounted in bushings 19 in a bore 20 in the frame block 1. The other end of the arm 16 is acted upon by a spring 21 which bears on a projection 22 on the inside of the cover 4.

Keyed onto the upper end of each shaft 10 and 11 is a toothed wheel or gear 23, and the drive shaft 5 has secured to it a pinion 24 which meshes with the gears 23 on the shafts 11 on either side of the pinion 24. By means of intermediate toothed wheels or gears 25, these gears 23 in turn mesh with gears 23 on the shafts 11 which carry the first counter roll 6b and the last counter roll 9b in the row in which the counter rolls are disposed one behind the other in the carriage. The gears 23 on each pair of shafts 10, 11 also mesh with each other. Consequently, all of the shafts of the folding and counter rolls 6a—9a and 6b—9b respectively are driven by the shaft 5 by means of gears.

Each shaft 10 and 11 is provided with a support roll or disk 26 which is connected to the shaft preferably through the toothed wheel 23. As will be seen from FIGS. 1 and 2, the support roll 26 is fastened to the upper side of the toothed wheel 23 by means of screws 27. The support rolls 26 on the toothed wheel 23 in each pair of shafts 10, 11 are in peripheral engagement with each other and define a minimum distance between the upper ends of the shafts, thereby preventing the teeth of the wheels 23 from getting wedged to each other when the folding roll moves outwards away from the counter roll.

The shaft 10 of each folding roll 6a and 9a is mounted, for instance by means of bushings 28, in a sleeve 29 which is laterally displaceable towards and away from the opposite shaft 11 of the corresponding counter roll 6b—9b. The sleeve 29 is laterally acted upon by a spring means which in the embodiment illustrated consists of a plurality of superposed resilient rings or washers 30 guided in a spring case 31 on a stud 32 which bears on the outwardly directed plane side of the sleeve 29. The outer end of the spring bears upon a screw threaded cap 33 which can be screwed inwards and outwards on the outer screw threaded end of the spring case to adjust the tension of the spring.

A cavity 35 in the frame block 1 has guide grooves 34

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by means of which the sleeve 29 is guided such as to be displaceable towards and away from the shaft 11. To this end the sleeve 29 has on either side thereof bearing members 36 each of which has a disk or cylindrical portion 37 and a straight portion 38. The disk or cylindrical portion 37 is mounted in a corresponding recess in the side of the sleeve 29, whereas the straight portion 38 is a block which slidably fits the guide groove 34. When the folding roll 6a is moved toward the counter roll 6b, the sleeve 29 will be displaced and simultaneously turned on the bearing members 36 around an axis transversely of the shaft 10, the straight portions 38 of the bearing member 36 sliding along the guide grooves 34. During this movement the support rolls 26 at the upper ends of the appertaining shafts 10, 11 maintain their engagement with each other, thereby preventing the corresponding gears 23 from getting wedged to each other and further preventing noticeable axial displacement of the folding rolls 6a—9a relative to the counter rolls 6b—9b.

When the machine is to be used it is placed at one end of the upstanding flanges 40, 41 of two adjacent sheets 42, 43 which are to be connected by seams (FIG. 3). Then the carriage is moved in the direction indicated by the arrow 44 such that the rolls 6a, 6b will be disposed on either side of the upstanding sheet flanges 40, 41. In case of single overseaming a portion 45 of one sheet flange extends above the other flange, as shown in FIG. 3. The projecting portion 45 comes into engagement with the conical edge folding roll 6c. The rotation of the shaft 5 will be imparted to all of the shafts 10, 11. The rolls 6a, 6b are kept in firm engagement with the sheet flanges 40, 41 by means of the springs 30, and upon rotation of the rolls 6a, 6b by means of their shafts 10, 11 the carriage will be moved along the sheet flanges, while the projecting portion 45 is folded or turned over the sheet flange 41 by the conical face of the edge folding roll 6c, as shown in FIG. 3. Upon continued movement of the carriage the edge folding roll 7c is brought into engagement with the projecting portion 45 which will be turned down against the upper side of the folding roll 7a under the action of the spring 21 which acts upon the arm 16 that carries the roll 7c, FIG. 4. The sheet edge 45 is then further turned downwards between the rolls 8a and 8b, the roll 8a having a conical portion to effect this downward folding, as shown in FIG. 5. Finally, the portion 45 is folded inwards against the sheet flange 41 between the last pair of rolls 9a, 9b, as shown in FIG. 6.

When the rolls 6c, 7c and 8a are folding down the sheet flange portion 45 there arise reaction forces which tend to push the carriage upwards away from the sheets 42, 43. This effect is counteracted due to the fact that the axes of the shafts 10, 11 and of the rolls 6a—9a and 6b—9b are inclined towards the sheets (or, more exactly, form an angle slightly less than 90° with a plane tangent to the supporting wheels 3) as viewed in the direction of advance, and as a result thereof will work their way downward against the sheets during their rolling movement along the seam. The inclination of the rolls is due to the fact that the shafts 10, 11 of the rolls are mounted in the frame block 1 in a manner such as to make an angle somewhat less than 90° with the tangent plane and the direction of advance. In FIG. 1, the axis of the shaft 10 is denoted by a chain-dotted line 46, and the direction of advance or the plane tangent to the supporting wheels is denoted at 47, the angle ν between these lines 46, 47 being consequently smaller than 90°. Numeral 43 denotes the 90°-line.

The machine can be used not only to produce the described single seam, but also to make a double seam. To make such double seam, the single seam shown in FIG. 6 is folded again. This can be readily performed by means of the machine described which permits of a relatively great lateral movability of the folding rolls 6a—6b away from the counter rolls 6b—9b. The ma-

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chine can be used for forming seams of thin and soft sheets as well as stiff and thick plates of various kinds. The tension of the springs 30 can be adapted to the nature of the material by corresponding adjustment of the screw cap 33 on the spring case 31.

What I claim is:

1. A machine for forming standing seams on flanged roofing sheets, comprising a frame, shafts arranged in pairs with the axis of each pair being coplanar and supported within the frame, said frame including guides for each pair of shafts extending substantially transversely of the shafts, one shaft of each pair being mounted for lateral swinging with respect to the other shaft thereof, means mounted on said frame for simultaneously driving the shafts, folding and counter rolls carried by said shafts of each pair and being adapted to receive and grip the upstanding flanges of the sheets between the rolls of each pair for folding the flanges into seams, a sleeve forming a bearing for each swingable shaft, said sleeve having bearing recesses in diametrically opposite sides thereof, and pivot means for each sleeve, each pivot means comprising a disc engaging one of said recesses and a straight portion engaging one of said guides whereby the sleeve and the shaft journaled therein are guided during the swinging.

2. A machine for forming standing seams on flanged roofing sheets, comprising a frame, shafts arranged in pairs with the axis of each pair being coplanar and supported within the frame, said frame including guides for each pair of shafts extending substantially transversely of the shafts, one shaft of each pair being mounted for lateral swinging with respect to the other shaft thereof, means mounted on said frame for simultaneously driving the shaft, folding and counter rolls carried by said shafts of each pair and being adapted to receive and grip the upstanding flanges of the sheets between the rolls of each pair for folding the flanges into seams, a sleeve forming a bearing for each of said swingable shafts, spring means to force said sleeves and the shafts therein towards the companion shaft of the pair to press the rolls of the pair in engagement with the upstanding flanges, and means to guide each sleeve displaceably and pivotally with respect to the frame, said sleeve guiding means comprising bearing recesses located in diametrically opposite sides of each sleeve and pivot means for each sleeve, each pivot means comprising a disc engaging one of said recesses and a straight portion engaging one of said guides whereby the sleeve and the shaft journaled therein are guided during the swinging.

3. A machine for forming standing seams on flanged roofing sheets, comprising a frame, shafts arranged in pairs with the axis of each pair being coplanar and supported within the frame, said frame including guides for each pair of shafts extending substantially transversely of the shafts, one shaft of each pair being mounted for lateral swinging, means with respect to the other shaft thereof, means mounted on said frame for simultaneously driving the shafts, folding and counter rolls carried by said shafts of each pair and being adapted to receive and grip the upstanding flanges of the sheets between the rolls of each pair for folding the flanges into seams, a sleeve forming a bearing for each swingable shaft, spring means mounted to press the sleeve and the shaft therein towards the companion shaft of the pair, said spring means including a tubular spring case, a cap having screwed threaded engagement with said spring case and springs in said spring case adjustable by screwing the cap inwards and outwards on said spring case, and means to guide each sleeve displaceably and pivotally with respect to the frame, said guide means comprising bearing recesses located in diametrically opposite sides of each sleeve and pivot means for each sleeve, each pivot means comprising a disc engaging one of said recesses and a straight portion engaging one of said guides, whereby the sleeve and the shaft journaled therein are guided to turn around an axis at right angles to that of the shaft during the lateral swinging.

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4. A machine for forming standing seams on flanged roofing sheets comprising a frame, shafts arranged in pairs with the axis of each pair being coplanar and supported within the frame, said frame including guides for each pair of shafts extending substantially transversely of the shafts, one shaft of each pair being mounted for lateral swinging with respect to the other shaft thereof, driving means mounted in the frame for simultaneously driving the shafts, a folding roll mounted at one end of one shaft of each pair, a counter roll mounted at the corresponding end of the other shaft of each pair, said folding rolls and said counter rolls being mounted to receive and grip the upstanding flanges of the sheets therebetween, a sleeve forming a bearing for each swingable shaft, said sleeve having bearing recesses in diametrically opposite sides thereof, pivot means for each sleeve, each pivot means comprising a disc engaging one of said recesses and a straight portion engaging one of said guides whereby the sleeve and the shaft journalled therein are guided during the swinging, means movable in correspondence with said rolls to overturn at least one of said flanges in cooperation with the rolls, and supporting rolls mounted at the other end of the shafts of each pair to fix the distance between the shafts of each pair at the latter end of the shafts.

5. A machine for forming standing seams on flanged roofing sheets comprising a frame, shafts arranged in pairs with the axis of each pair being coplanar and supported within the frame, one shaft of each pair being mounted for lateral swinging with respect to the other shaft thereof, a folding roll mounted at one end of one shaft of each pair, a counter roll mounted at the corresponding end of the other shaft of each pair, said folding rolls and counter rolls being mounted to receive and grip the upstanding flanges of the sheets therebetween, toothed wheels keyed to the other ends of the shafts of each pair, driving means mounted in said frame to drive said toothed wheels simultaneously, means movable in correspondence with said rolls to overturn at least one of said flanges in cooperation with the rolls, and a supporting roll mounted immediately adjacent the toothed wheel at said other end of each shaft, the two supporting rolls on each pair

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of shafts being in engagement with each other at a point which is also the pivoting point for the lateral swinging of said one shaft.

6. A machine for forming standing seams on flanged roofing sheets on a roof, comprising a frame, means for guiding and supporting the frame on the roof, shafts arranged in pairs with the axis of each pair being coplanar and supported within the frame, said frame including guides for each pair of shafts extending substantially transversely of the shafts, one shaft of each pair being mounted for lateral swinging with respect to the other shaft thereof, driving means mounted in said frame for driving the shafts simultaneously, gripping and folding rolls mounted at one end of the shafts for engagement with the upstanding flanges to be folded, a sleeve forming a bearing for each swingable shaft, spring means engaging each sleeve to press the swingable shaft journalled therein toward its companion shaft, means to guide each sleeve displaceably and pivotally with respect to the frame, said sleeve guiding means comprising bearing recesses located in diametrically opposite sides of each sleeve and pivot means for each sleeve, each pivot means comprising a disc engaging one of said recesses and a straight portion engaging one of said guides, and supporting rolls mounted at the other end of the shafts, the supporting roll of one shaft of a pair engaging the supporting roll of the other shaft of said pair, the axes of rotation of the folding and gripping rolls of each pair of shafts being disposed in a plane making an angle slightly less than 90° with a plane defined as a tangent plane of said means for guiding and supporting the frame on the roof.

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