Aug. 26, 1969 J. A. ROBERTS 3,463,330

METAL SHEET HANDLING DEVICE

Filed May 12, 1967 3 Sheets-Sheet 1

FIG. 1

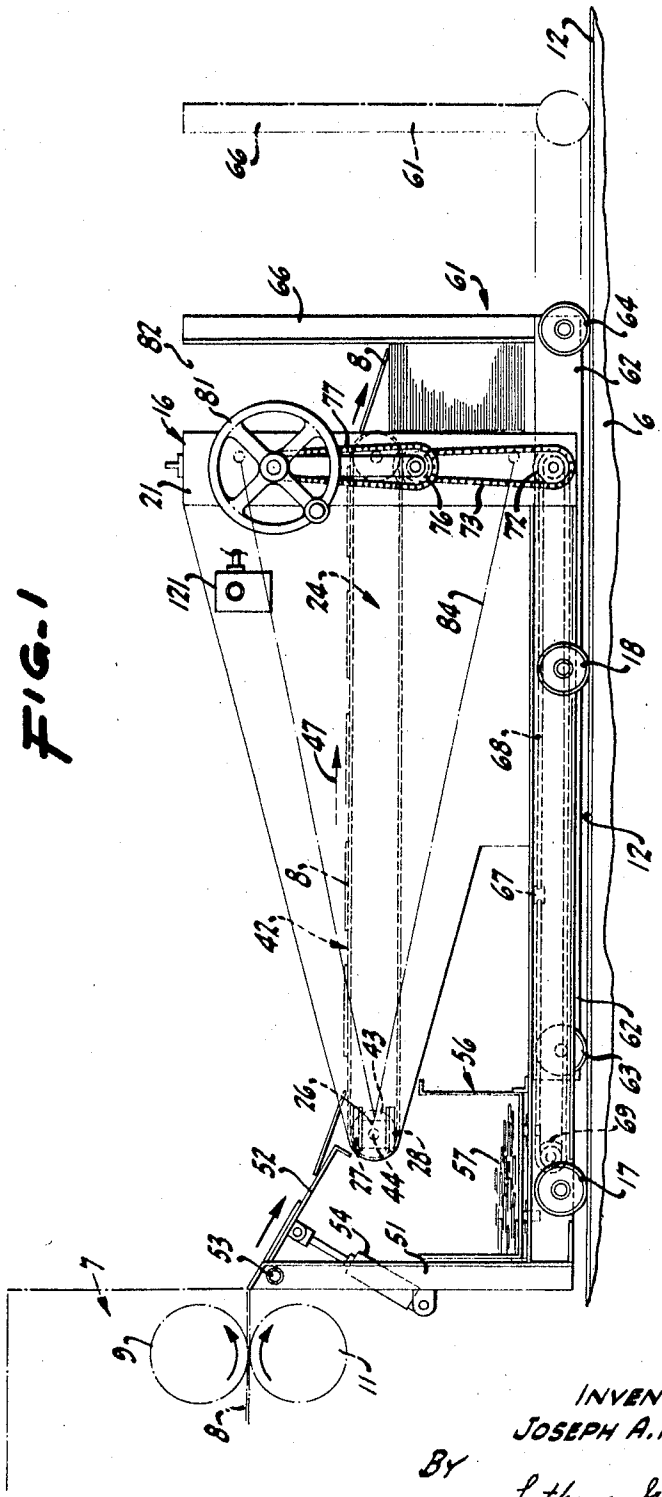

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FIG. 2

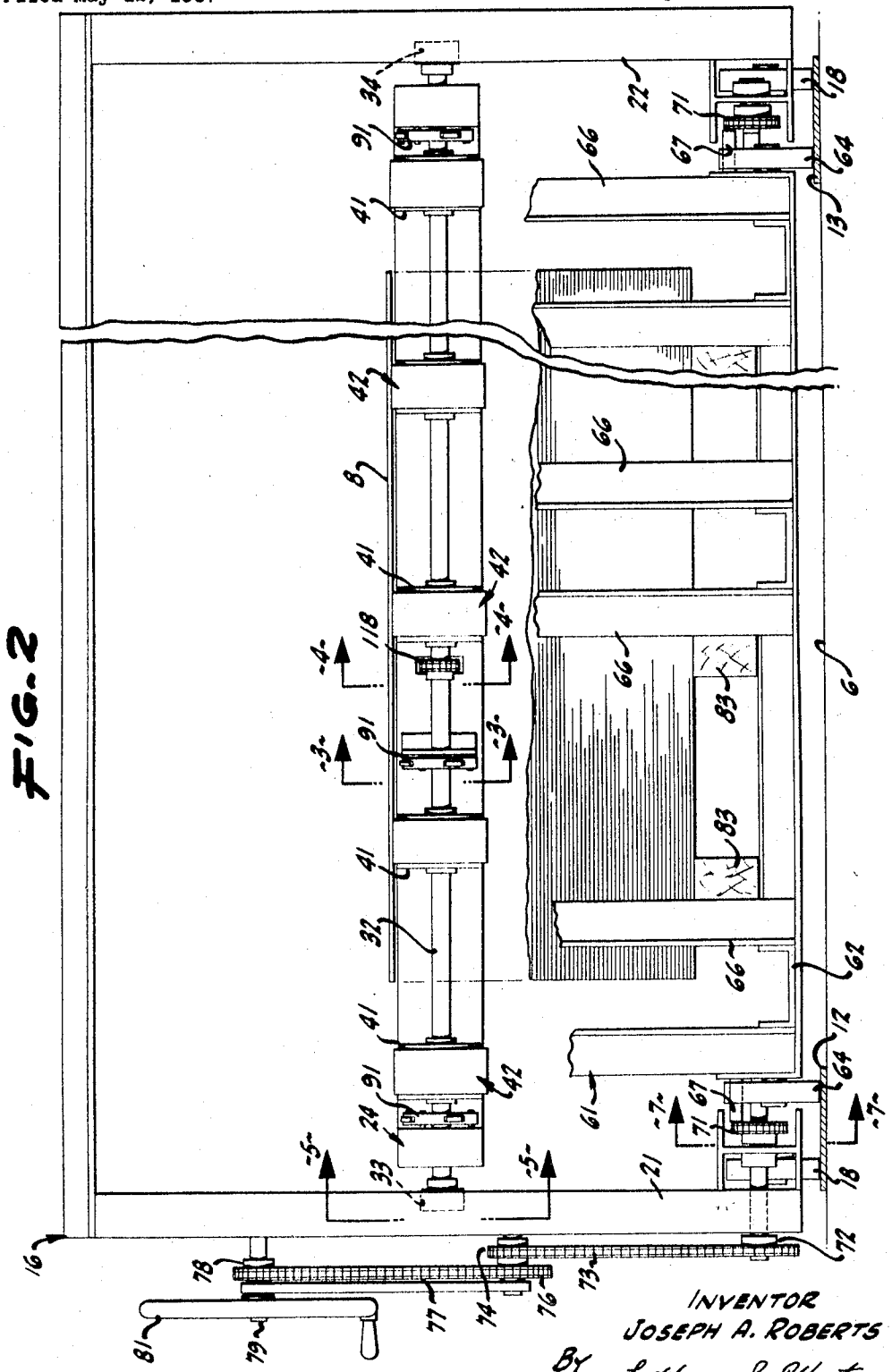

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FIG-3

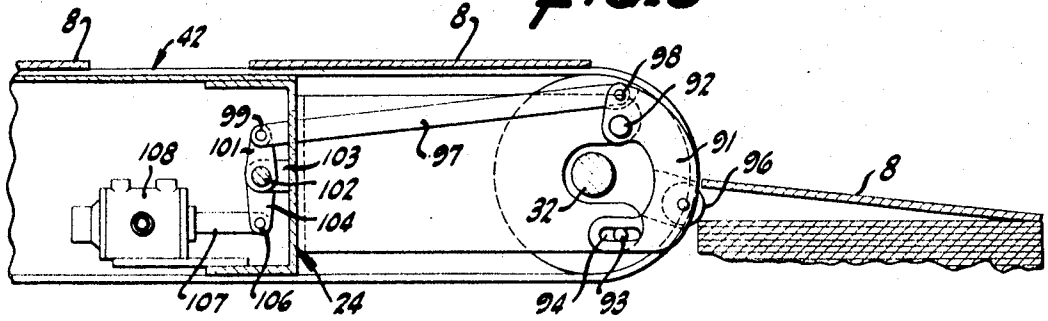
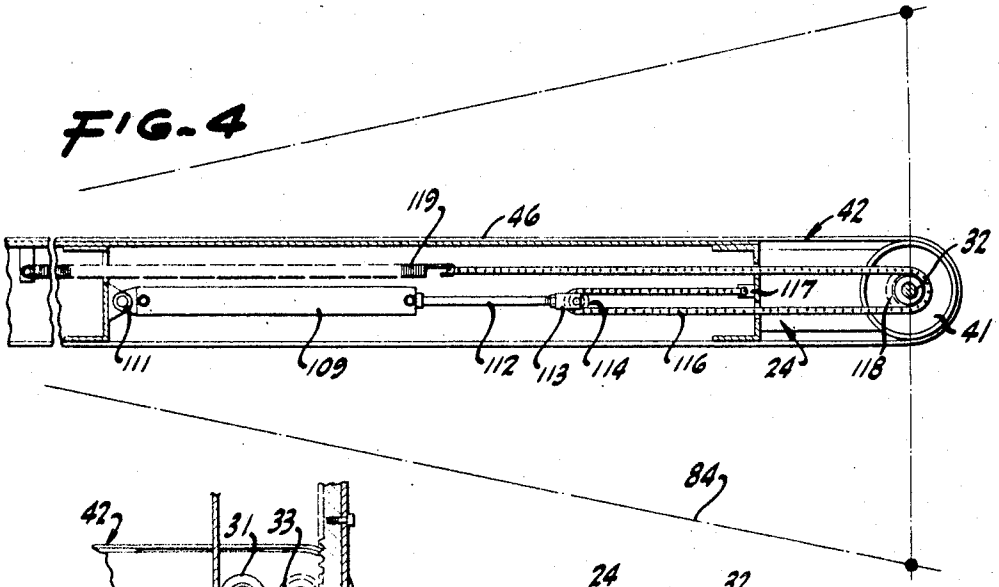


FIG-4



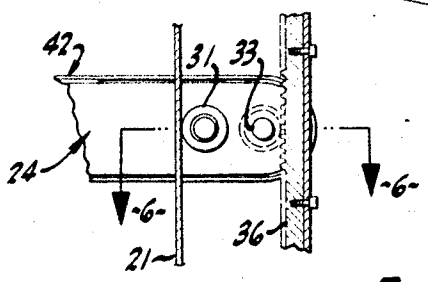


FIG-5

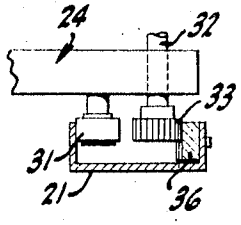


FIG-6

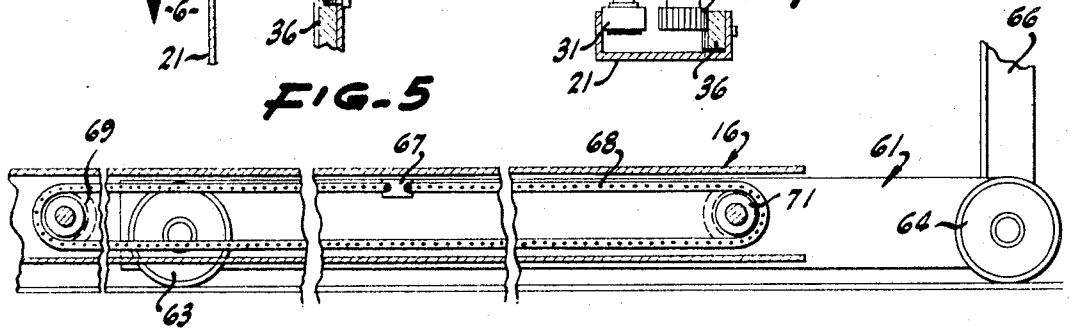


FIG-7

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United States Patent Office 3,463,330 Patented Aug. 26, 1969

3,463,330

METAL SHEET HANDLING DEVICE

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Filed May 12, 1967, Ser. No. 638,062
Int. Cl. B65g 57/112; B65h 29/18
U.S. Cl. 214—6 3 Claims

ABSTRACT OF THE DISCLOSURE

A metal sheet handling device receives metal sheets from a shear or the like and directs them to scrap or alternatively onto a substantially horizontal conveyor one end of which moves vertically to deposit the metal sheets onto the top of a stack disposed on an adjacent carriage. A feeler on the conveyor frame senses the height of the stack and controls movement of the adjacent end of the conveyor up to a corresponding height.

In the handling of metal sheets, particularly those of relatively light gauges, it is often necessary to shear or otherwise cut relatively large, usually rectangular sheets into smaller versions in the shape of realtively long narrow strips. When cut, the strips are stacked in a vertical pile for further handling. Much of this work has heretofore been accomplished by manual labor. This is attended with a number of hazards and is slow, cumbersome and likely to be nonuniform. Sometimes the cut strips are not of appropriate character or must be discarded for one reason or another. There is some difficulty in discarding some of the strips before they are assembled in the stack.

It is therefore an object of my invention to provide a metal sheet handling device which can be utilized in connection with any one of a number of different kinds of shearing or other handling devices and which will automatically assemble the cut or received strips in a neat, uniform pile or stack.

Another object of the invention is to provide a metal sheet handling device in which the strips being stacked are handled very carefully to avoid injury thereto and are gently deposited on the top of the stack being formed.

Another object of the invention is to provide a metal sheet handling device which can readily be installed in a plant and can be moved about from place to place in the plant with little difficulty.

A further object of the invention is to provide a metal sheet handling device effective to stack strips of sheet metal of varying widths and lengths.

Another object of the invention is to provide a metal sheet handling device having facility for separating or segregating unwanted from wanted strips and for disposing easily of the unwanted pieces.

Another object of the invention is in general to provide an improved metal sheet handling device.

Other objects together with the foregoing are attained in the embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIGURE 1 is a side elevation of a metal sheet handling device constructed pursuant to the invention and shown approximately in mid-position of operation;

FIGURE 2 is a plan of the metal sheet handling device, portions being broken away to reduce the length of the figure;

FIGURE 3 is a cross section, the plane of which is indicated by the line 3—3 of FIGURE 2;

FIGURE 4 is a cross section, the plane of which is indicated by the line 4—4 of FIGURE 2;

FIGURE 5 is a cross section, the plane of which is indicated by the line 5—5 of FIGURE 2;

FIGURE 6 is a cross section, the plane of which is indicated by the line 6—6 of FIGURE 5; and

FIGURE 7 is a cross section, the plane of which is indicated by the line 7—7 of FIGURE 2.

While the metal sheet handling device pursuant to the invention can be incorporated in a number of different ways, it has successfully been put to practical use in the form shown herein. In this installation the machine is installed in a factory having a supporting floor 6 on which a metal shear 7 or comparable machine is disposed. The shear forms no part of the present invention but is effective to cut a large sheet into a number of smaller strips and to expel the individual strips, such as 8, through a pair of propelling rollers 9 and 11 and discharge the strip 8 from the shear 7.

Pursuant to the invention, I preferably mount on the floor 6 a number of supporting metal plates 12 and 13 (FIGURE 2) and on those plates support a main frame 16. The frame is a structure made up of angles, shapes, braces and the like and is generally rectangular in plan. At opposite ends the main frame is provided with a pair of supporting wheels 17 and 18 adapted to roll on the subjacent metal plates 12 and 13. Mounted on the main frame at opposite forward corners thereof are channel uprights 21 and 22. The main frame can be rolled into close juxtaposition with the frame of the shear 7 and can be secured, if desired, by appropriate anchoring means, not shown.

A belt conveyor frame 24 also made up of various structural shapes and having a generally rectangular configuration is mounted on the main frame. The end of the belt conveyor frame nearest the shear carries a pivoted block 26 at each corner designed to slide within horizontal guides 27 and 28 secured to the sides of the main frame. The forward end of the belt conveyor frame 24 carries a pair of rollers 31 each adapted to rest against the inner side of the adjacent one of the upright channels 21 and 22. Spanning the width of the belt conveyor frame is a cross shaft 32 appropriately journalled in the horizontal belt conveyor frame and at its opposite ends carrying pinions 33 and 34, each of which is in mesh with the corresponding one of a pair of associated racks 36 arranged along the inside of another flange of the uprights 21 and 22, particularly as illustrated in FIGURES 5 and 6.

With this arrangement, the belt conveyor frame at its one end adjacent the uprights 21 and 22 moves substantially in up-and-down directions in a vertical plane, while the other end of the belt conveyor frame is substantially stationary except for a small amount of to-and-fro movement between guides 27 and 28. While the arcuate motion of the belt conveyor frame produces some change in relationship between the rollers 31 and the pinions 33, there is enough clearance in these parts so that the difference between the arcuate inclination of the frame and the rectilinear translation is immaterial. However, since the pinions 33 are fastened at the opposite ends of the shaft 32 and are in mesh with their respective racks 36, the leading end of the belt conveyor frame always remains parallel to itself and in a horizontal attitude.

The belt conveyor frame at its forward end is provided with a number of pulleys 41 freely journalled on the cross shaft 32 so that they can turn individually. Surrounding each of the spaced pulleys 41 is an individual one of a number of looped belts 42 which also extend around the respective ones of a number of pulleys 43 on a shaft 44 journalled at the rear end of the main frame adjacent the shear 7. Appropriate means are provided for rotating the shaft 44 and so propelling all of the belts 42 with the upper run 46 of the

belts travelling in the direction of the arrow **47** in FIGURE 1; that is, from a location adjacent the shear **7** to a location adjacent the uprights **21** and **22**.

Also pursuant to the invention, the main frame adjacent the shear **7** has a pair of uprights **51** at its opposite corners. These carry a diverter plate **52** mounted for pivotal movement on pivot pins **53** at the upper ends of the uprights **51**. The plate **52** is rotated between limits about the pivots **53** under the influence of a pneumatic or hydraulic jack cylinder **54** controlled by the operator of the shear, usually through a foot treadle, not shown. When the plate **52** is in its normal, uppermost position as shown in FIGURE 1, it forms substantially a continuous path from the rollers **9** and **11** to the adjacent end of the belts **42**. However, when the cylinder **54** is actuated by the operator, the plate **52** drops into substantially a vertical position. Thereupon any material discharged by the rolls **9** and **11** instead of travelling onto the conveyor belts, rather falls by gravity into a channel-shaped scrap receptacle **56** disposed on the adjacent end of the main frame. When an appropriate number of scrap pieces **57** have been accumulated, the scrap container **56** is removed endwise and is restored empty. By operating his control, therefore, the shear operator can divert an imperfect strip to the scrap container or, alternatively, can direct an acceptable strip to travel directly from the rolls **9** and **11** onto the conveyor belts. Since the conveyor belts advance in the direction of the arrow **47**, the strip, which usually spans a number of the separate conveyor belts, at least two, travels forwardly and is discharged over the leading edge of the belt conveyor.

In order to receive the strips so discharged, I preferably provide a carriage **61** adapted to cooperate with the main frame. The carriage includes its own auxiliary frame **62** made up of various shapes and angles supported on pairs of wheels **63** and **64** designed to run on the floor plates **12** and **13**. The carriage **61** likewise has a number of upstanding, forward uprights **66** to serve as a forward barrier.

Preferably, the carriage and the main frame are interrelated or spaced at a predetermined amount of gap. For that reason, the carriage **61** is provided with a block **67** (FIGURE 1) to which the opposite ends of a sprocket chain **68** are fastened. The chain **68** travels around a sprocket **69** mounted on the main frame and also around another sprocket **71** mounted on the main frame. Connected to the sprocket **71** is a driven sprocket **72** about which a chain **73** is trained. At its other end the chain **73** extends around a sprocket **74** joined to a sprocket **76**. Another chain **77** extends around the sprocket **76** and likewise goes over a sprocket pinion **78** on the shaft **79** journalled on the upright **21** and carrying a control wheel **81**.

When the hand wheel **81** is rotated, the various chains are correspondingly moved and the block **67** is advanced or retracted. If the main frame is anchored, as above indicated, the carriage is propelled or retracted with respect to the main frame and is moved an appropriate amount to leave a gap **82** of the desired width between the uprights **66** and the uprights **21** and **22**, thereby providing a transverse slot or space to receive snugly the strips which are discharged from the belts **42**.

As an aid to maneuvering the mechanism, it is also possible to anchor the carriage **61** to the floor and release the fastening of the main frame thereto. When that occurs, rotation of the hand wheel **81** then moves the main frame toward and away from the shear **7**. This is useful in facilitating cleaning in and around the machine and for actually advancing the machine over the floor since the main frame and the carriage can be alternately blocked.

As the various strips are discharged from the belts **42**, they fall by gravity in a generally flat attitude onto the carriage **61**. If desired, the carriage can be provided with some sort of a pallet arrangement or can simply be provided with spacing blocks **83** so that a sling or fork lift can ultimately engage under the deposited strip or strips.

In order to preclude excessive fall of the strips from the belt **42** and to make sure that they are deposited gently in their stack, I prefer to start the stack with the conveyor belt frame depressed into a lowermost position indicated by the broken line **84** in FIGURE 1. In that attitude of the belt conveyor frame the strips gently round the discharge end of the belts and move gently into their rest position on the carriage so that they are not subject to malformation or bending.

As successive strips are deposited on the stack being formed, the stack height gets closer to the upper level of the conveyor belt. In order that the optimum relationship between the discharge height of the belt and the height of the stack be preserved throughout the stacking operation, I preferably provide means sensitive to the height of the stack for correspondingly lifting or moving upwardly the adjacent end of the conveyor belt frame. For that reason, particularly as shown in FIGURE 3, I provide on the conveyor belt frame a number of feelers **91**. These feelers are distributed across the width of the machine so that they can be sensitive to the height of the stack at various places. This is especially useful when relatively short strips are being stacked at a random location across the machine. There is always available at least one feeler to sense the stack height.

Each of the feelers comprises an arcuate lever having a pivot mounting **92** on the belt conveyor frame and being guided by a pin **93** disposed in a lever slot **94**. Intermediate its ends, the lever carries a roller **96** which in one position projects beyond the periphery of the belt **42** extending around the adjacent roller. The relationship is such that when the roller **96** is in advanced position it is abutted by the uppermost strip arriving on the stack. As the strip positions itself, it displaces the roller **96** radially inwardly, rocking the feeler lever **91** in a clockwise direction as seen in FIGURE 3. This motion is transmitted by a link **97** joined at one end to the lever by a pivot pin **98** and joined at the other end by a pivot pin **99** to a lever **101**. This is mounted on a cross shaft **102** supported by brackets **103** extending from part of the frame of the belt conveyor mechanism. Since there are a number of feelers, the shaft **102**, being connected to all of them in a similar fashion, can be rotated by tripping or actuation of any one of the feelers. When the strip being deposited is relatively long, say the full width of the machine, all of the feelers are tripped simultaneously or substantially so. However, when only relatively short strips are being stacked, perhaps only one feeler is tripped by that stack. In any event, the shaft **102** is correspondingly rocked. A lever **104** depending from the shaft **102** is connected by a loose pivot **106** to the actuating stem **107** of a hydraulic valve **108**.

A hydraulic pressure and return system is provided. This is of standard form and is not disclosed in detail. The valve **108** is included in the system and serves as a controller for the operation of a hydraulic cylinder **109** mounted on the conveyor belt frame. One end of the cylinder is joined by a pin and clevis mounting **111** to the frame, whereas the other end of the cylinder serves to guide a piston rod **112** having a clevis **113** at its end in which a small sprocket **114** is journalled. A sprocket chain **116** at one end is connected to an anchor **117** joined to the framework of the belt conveyor. The chain **116** extends around the sprocket **114** and then also extends around another sprocket **118** secured to the shaft **32** at the ends of which the pinions are anchored. The chain end as it leaves the sprocket **118** extends through a portion of the framework and is connected to an elongated helical spring **119** also secured to the belt conveyor frame.

With this mechanism, as the valve **108** controls the fluid flow, the piston rod **112** is advanced or retracted. This moves the chain to rotate the shaft **32**, the free end portion of the chain being maintained in tension by the spring. Rotation of the shaft **32** also rotates the pinions **33** and thus causes a rising movement of the entire belt

conveyor frame. Each time a new strip is deposited at the top of the stack, the appropriate roller or rollers **96** of the adjacent feelers is displaced and the valve **108** is correspondingly operated to produce a lifting movement of the belt conveyor frame. In some instances, it is preferred to await the deposit of several sheets before lifting the belt conveyor frame. This can be accomplished by decreasing the sensitivity of the entire sensing or feeler mechanism.

In the usual case, as the stack grows or increases in height, the belt conveyor increases its angularity so that the strips are always directly fed to the top of the growing stack until the capacity of the machine is reached. Thereupon the user customarily withdraws the accumulated stack of strips and by manually operating a control **121** appropriately reverses the valve **108** so that the chain mechanism is paid out by the piston rod **112** and the weight of the belt conveyor frame is sufficient to cause reverse rotation of the pinions **33** and the entire frame to drop down to the lowermost position indicated by the line **84**. The cycle can then be repeated.

I claim:

1. A metal sheet handling device comprising a main frame, a generally horizontal belt conveyor frame, means mounting said belt conveyor frame on said main frame for movement of one end of said belt conveyor frame in a vertical direction and for horizontal sliding movement of the other end thereof, a belt conveyor on said belt conveyor frame and adapted to advance from the other end of said frame to said one end, means on said main frame for directing metal sheets onto the other end of said belt conveyor, receiving means adjacent said one end for receiving, in a rising stack, metal sheets discharged over said one end of said belt conveyor, means for lifting said one end of said belt conveyor frame, and actuating feeler means located on said belt conveyor frame and projecting beyond said one end and mounted for movement generally longitudinally of said conveyor frame

and into the path of a sheet descending from said belt conveyor for momentarily actuating said lifting means in response to engagement of a sheet therewith.

2. A device as in claim **1** in which said receiving means is a carriage movable toward and away from said main frame to vary the gap therebetween, and including means interconnecting said main frame and said carriage for moving said main frame and said carriage toward and away from each other.

3. A device as in claim **1** including a rotary drum mounted at said one end of said belt conveyor frame and over which said conveyor belt is trained and in which said actuating means includes a feeler movable with respect to said belt conveyor frame and projecting beyond the periphery of said belt on said drum.

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U.S. Cl. X.R.

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