United States Patent

Wegener

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[54] APPARATUS FOR STACKING UNITS OF SHEET MATERIAL

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[73] Assignee: **National Steel Corporation**

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[52] **U.S. Cl.** ..... **198/41**, 198/DIG. 11, 271/63 A, 93/93 C, 93/93 DP, 93/93 K

[51] **Int. Cl.** **B31b 1/96**, B31b 1/98, B65b 57/20

[58] **Field of Search** ..... 93/93; 198/41, DIG. 11, DIG. 13; 214/6 DS, 6 N; 271/18 A, 63 A

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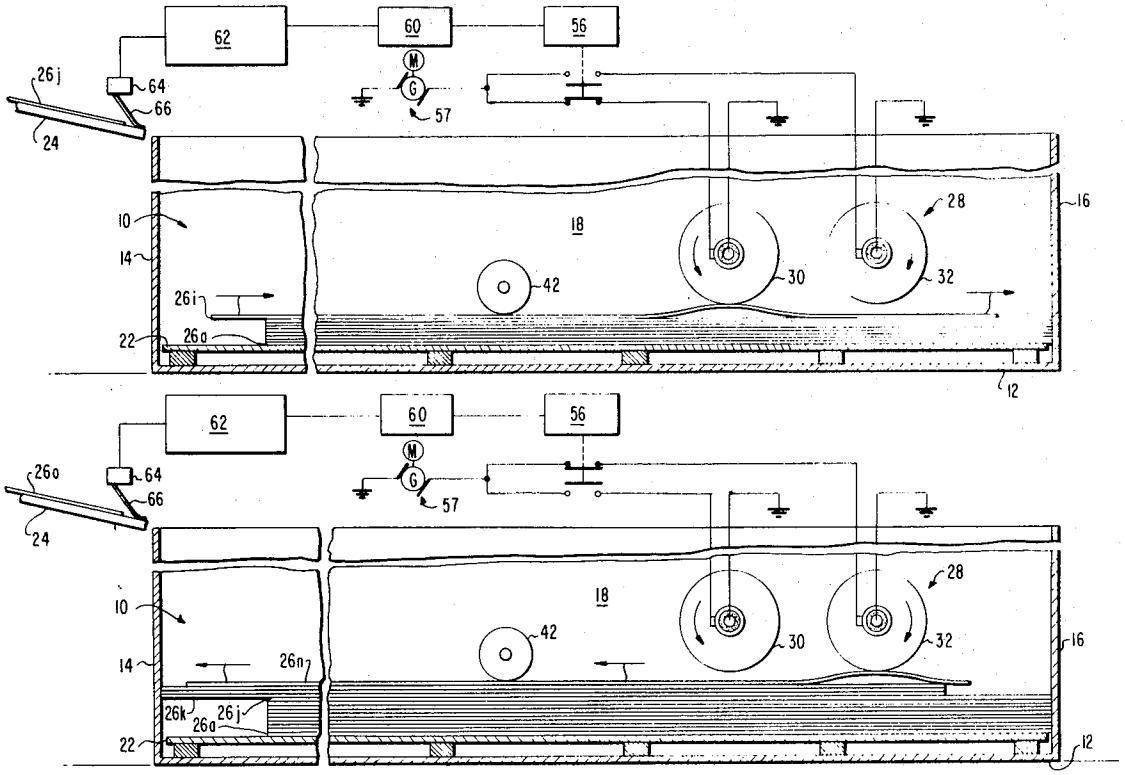
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[57] **ABSTRACT**

An apparatus for stacking units of sheet material in staggered relationship including a receiver with end plates spaced apart a distance greater than the length of the sheet material to be stacked, a feed device for feeding individual sheets into the receiver, a positioning device in the receiver for directing individual sheets against one or the other of the end plates and a control selectively directing the positioning device to achieve staggered stacking of units of sheet material.

13 Claims, 4 Drawing Figures



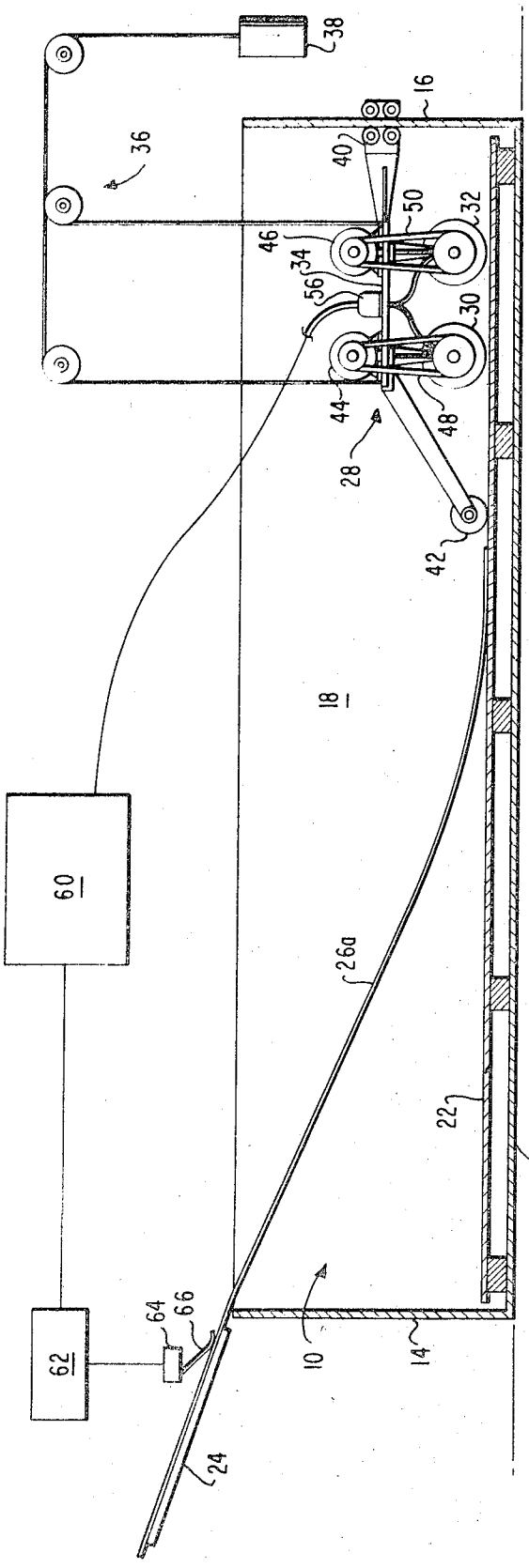


FIG. 1

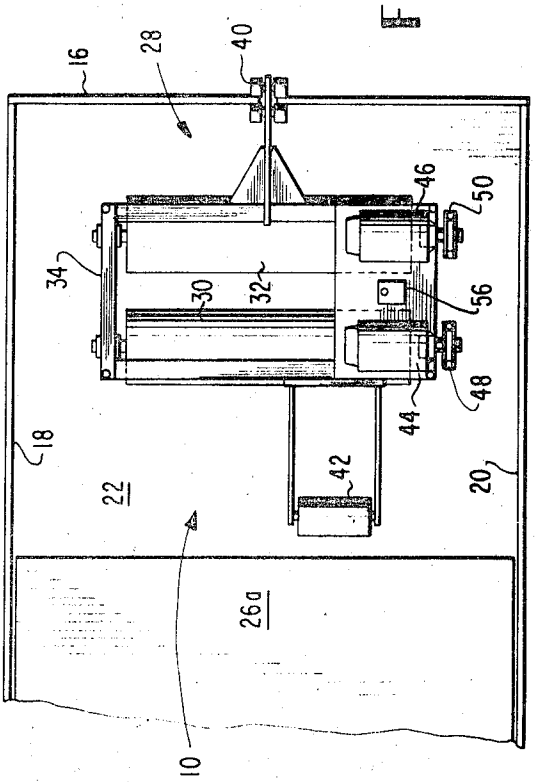


FIG. 2

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FIG. 3

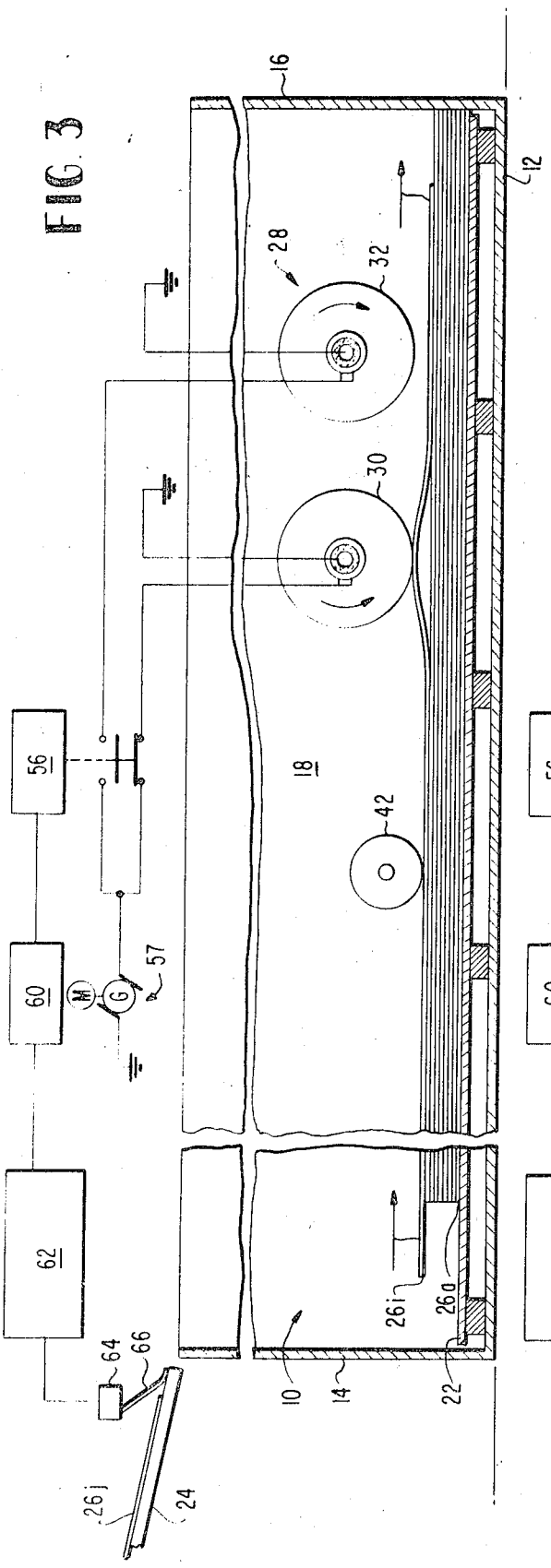
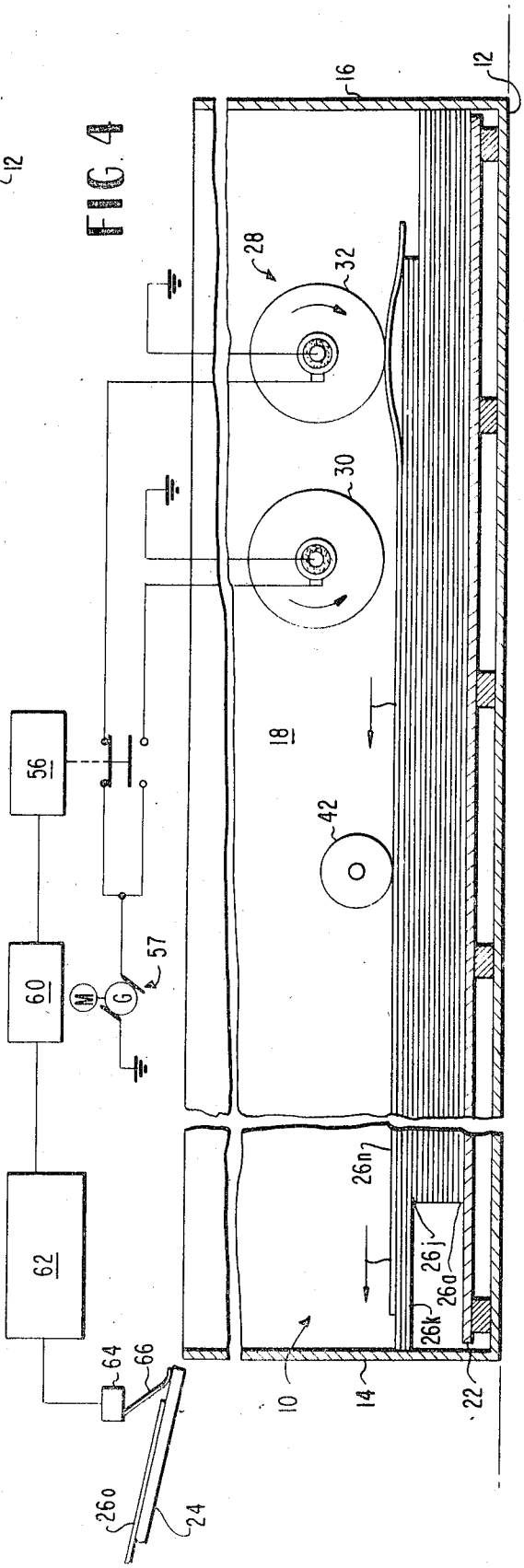

16
12
28
32
30
18
42
56
57
60
62
64
66
10
14
22
26i
26a
26j
24

FIG. 4


16
12
28
32
30
18
42
56
57
60
62
64
66
10
14
22
26n
26j
26a
26k
26o
24

APPARATUS FOR STACKING UNITS OF SHEET MATERIAL

BACKGROUND OF THE INVENTION

In stacking sheet material for storage, packaging, processing or other purposes, it is common to stack the sheets in units of a predetermined number of sheets. These units are placed in staggered relationship such that they are in offset relation to units adjacent thereto. This provides means to readily determine the total number of sheets in a stack, separate known quantities of sheet material or to remove desired quantities for packaging or further processing thereof.

This invention relates to the automatic stacking of sheet material in units disposed in staggered relationship and to a new and improved apparatus for accomplishing such stacking.

Although described hereinafter as specifically applied to the handling of sheet metal, the invention, with relatively minor modifications, can be adapted to handle material of any type.

In a preferred embodiment, the invention is directed to the handling of galvanized sheet metal and comprises a receiver or pile-forming box with end plates spaced apart a distance greater than the length of the sheet material to be stacked; a feed means for feeding individual sheets into the receiver; a positioning means including electromagnetic rollers associated with the receiver to engage and direct sheets being fed into the receiver against one or the other of the end plates; and a control means to regulate the actuation of the rollers and thereby the direction of the positioning means to provide units, consisting of a number of sheets determined by the control means, having a staggered or offset relationship to adjacent units.

The objects and other advantages of the invention will become better understood to those skilled in the art by reference to the following detailed description when viewed in light of the accompanying drawings in which like components throughout the figures thereof are indicated by like numerals and wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevational view, in section, of an apparatus in accordance with the invention;

FIG. 2 is a fragmentary plan view of a portion of the apparatus of FIG. 1;

FIG. 3 is an enlarged fragmentary view similar to FIG. 1 showing the apparatus in one phase of operation thereof; and

FIG. 4 is a view similar to FIG. 3 showing the apparatus in another phase of operation thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGS. 1 and 2, a receiver or pile-forming box, indicated generally at **10**, consists of a bottom **12**, end walls or plates **14** and **16** and sidewalls **18** and **20**. At least one of the sidewalls **18** or **20** is hingedly connected to the bottom **12** such that the wall can be swung into coplanar relationship thereto to provide access to the interior of the receiver **10** for withdrawal of material therefrom. The receiver **10** is preferably provided with a pallet or removable bottom **22** therein to facilitate removal of material as will be described in greater detail below. The sidewalls **18** and **20** of receiver **10** are spaced apart a distance about equal to the width of the sheets to be piled. The end walls **14** and **16** are spaced from one another a distance greater than the length of the sheet material to be received therebetween.

A feed means, comprising an inclined plate **24**, is disposed over one end of the receiver **10** to feed individual sheets of material to be stacked therein. As can be seen in FIG. 1, the front edge of an initial sheet **26***a* slides along the upper surface of the pallet **22** toward the end plate **16** as the sheet is fed into the receiver. Succeeding sheets similarly slide across the upper surface of the preceding sheet as they are fed into the receiver.

A positioning means, shown generally at **28**, is disposed proximate the other end of the receiver **10**. This means comprises a pair of rollers **30** and **32** rotatably mounted to depend from a frame **34**. The frame is suspended by means of a pulley-cable arrangement shown generally at **36**, so that the positioning means **28** is free to move vertically up or down. A weight **38**, selected to be slightly less than the effective weight of the means **28** for normal slight biasing thereof downwardly toward the bottom of the receiver **10**, is attached to the free end of the pulley-cable **36** to suspend the means **28**.

The frame **34** is provided with a guide roller structure **40** supported horizontally therefrom and extending through and engaging both sides of the end plate **16** to maintain the horizontal position of the positioning means **28**. A "feeler" roller **42** extends forwardly and downwardly from the frame to engage the sheet material being fed into the receiver **10** and elevate or vertically position the positioning means **28** as the receiver fills with sheet material. The roller **42** is positioned at a small distance below the rollers **30** and **32** such that these latter rollers are normally spaced from engagement with the upper surface of the sheet material in the receiver **10**.

The roller **42** serves an additional function in that each sheet material being fed into the receiver **10** will normally initially tend to "float" on a cushion of trapped air. The roller **42** serves to press this sheet downwardly into engagement with the next lower sheet.

A pair of drive motors **44** and **46**, preferably electrically powered, are mounted on the frame **34** and drivingly connected to corresponding rollers **30** and **32** by means of pulley-drive belt arrangements **48** and **50** respectively. The motors **44** and **46** are designed to rotate in opposite directions such that, for example as seen in FIG. 1, the roller **30** is rotated in a counterclockwise direction while the roller **32** is rotated in a clockwise direction. Other drive means, such, for example, as a single power source driving the rollers through divided, reversed pulley systems, could obviously be substituted for the system illustrated without exceeding the scope of this invention.

In the preferred embodiment, the motors **44** and **46** are continuously energized during operation of the device so that the rollers **30** and **32** are in constant opposing rotation.

This invention is specifically directed to apparatus for the handling of galvanized sheet steel. With such material, or with any other ferrous or magnetic material, it is preferred that the rollers **30** and **32** incorporate electromagnets to provide selective magnetic gripping of the sheet material for purposes to be described in greater detail below. As used herein, the term "-magnetic" as used in conjunction with the material handled, means a material which, by its composition, is subject to magnetic influence. If, however, the invention is to be utilized with other than magnetic materials such, for example, as nonferrous metal, plastic, paper products or the like, the rollers would be provided with openings over the surfaces thereof and be connected to a source of vacuum to grip the sheet material in the same manner that is accomplished by the electromagnets specifically described.

The electromagnetic rollers **30** and **32** are connected to a switch **56**, mounted on the frame **34** which, in turn, is connected to a source of electric power **57** (FIGS. 3 and 4). The switch is preferably of a two-position, solenoid-actuated type to provide alternate energization of either roller **30** or roller **32** according to the positioning of the switch.

The switch **56** is connected to a control **60** which, in turn, is connected to a counter **62**. The control **60**, actuated, for example, by signals from the counter, serves to alternately position the switch **56** to thereby reverse electromagnetic energization of the rollers **30** and **32**.

The counter **62** is connected to a pulse generating switch **64** which is actuated by a mechanical foot **66** positioned over the feed means **24**. The foot is displaced by sheet material passing thereunder in such a manner as to send a signal to the counter each time a sheet of material to be stacked is fed to the receiver **10**. The counter **62** is adjusted to signal the control **60** and reverse energization of the rollers **30** and **32** when a desired number of pulses is received thereby. The counter **60**

is preferably variable so that the number of pulses required to reverse energization of the rollers may be adjusted as desired. In this way, the number of sheets making up each unit can be varied as desired.

Referring now to FIG. 3, a first cycle of operation of the apparatus is illustrated. In the configuration of FIG. 3, the switch **56** is positioned so that roller **30** is energized and in such case sheets being delivered to the receiver **10** each have a portion lifted slightly into engagement with the roller **30** and, due to the counterclockwise rotation thereof, are directed against the end plate **16**. A unit of sheets **26*a*** through **26*i*** is thereby being formed against that end plate. Rotation and energization of the roller is continuous as long as the switch **56** is in the configuration of FIG. 3 so that each sheet **26*a*** to **26*i*** will be moved along in controlled fashion until the leading edge thereof abuts the end plate **16** after which time it will be maintained in contact with the end plate due to continued frictional contact with the roller **30** until the next sheet **26*j*** intervenes therebetween. Such continued contact eliminates the "bounce back" which might occur if the sheet were freely delivered against the end plate.

After the feeding of a predetermined number of sheets (**10** are illustrated), as determined by the setting of the counter **62**, a signal is sent by counter **62** to the control **60** and the switch **56** is actuated to the configuration of FIG. 4 thereby reversing energization of the rollers so that roller **30** is deenergized and roller **32** is energized. In this configuration, the sheets being fed into the receiver **10** are engaged by the roller **32** and, due to the clockwise rotation thereof, are displaced until the trailing edge thereof engages the end plate **14** so that a unit of sheets **26*k*** through **26*n*** is being formed against that end plate, offset or in staggered relationship to the first formed unit of sheets **26*a*** through **26*j***. The stacking of sheets in offset units is continued as above until the desired height of the pile or the capacity of the receiver **10** is reached. As an alternate, the receiver can be provided with a vertically movable or moving floor such that the floor can be continuously moved downwardly as sheet material is deposited thereon. When the capacity of the receiver **10** is reached, wall **18** is lowered to coplanar relation with the floor **12** for pickup of the pallet **22** and stacked sheet material by a fork lift or other material handling means.

It will be obvious that instead of each of rollers **30** and **32** turning in the same direction but opposite to the direction of the other roller and being alternately energized magnetically during the first and second cycles of FIGS. 3 and 4 respectively, the same desired result could be accomplished by continuously energizing both rollers magnetically and driving the rollers first in a counterclockwise direction at the time of the first cycle of operation illustrated in FIG. 3 and then driving the rollers in a clockwise direction when they are in the second cycle of operation illustrated in FIG. 4. Operating in this manner both rollers **30** and **32** could work together or one could be eliminated altogether. Also the electromagnetic means need be energized only during the first and second cycles and not continuously.

With either method of operation, viz unidirectional rotation of the rollers during the first and second cycles or reversed rotation of the rollers during the first and second cycles, the counting mechanism actuates the sheet positioning mechanism to reverse the direction of the action thereof on the sheets entering the receiver.

Although the invention has been described in connection with a preferred embodiment, modification of that embodiment can be made without departing from the principles of the invention. Such modifications are within the scope of the appended claims.

I claim:

1. An apparatus for stacking units of sheet material in staggered relationship comprising:
   a. a receiver having end plates at opposite ends thereof, said end plates being spaced from one another a distance greater than the length of said sheet material,
   b. feed means disposed to feed the sheet material in individual sheets into the receiver,
   c. sheet-positioning means comprising at least one rotating roller means associated with the receiver having an axis of rotation normal to the path of sheet material fed thereto, and means associated with the roller means to cause the roller means to grip the topmost sheet received by the receiver and move it in a horizontal plane into engagement with one of the end plates, and
   d. control means to actuate the sheet positioning means selectively to position each sheet against a desired one of the plates.

2. An apparatus for stacking units of sheet material in staggered relationship comprising:
   a. a receiver having end plates at opposite ends thereof, said end plates being spaced from one another a distance greater than the length of said sheet material,
   b. feed means disposed to feed the sheet material in individual sheets into the receiver,
   c. sheet-positioning means disposed to engage each of the sheets fed to the receiver and to selectively move each sheet to place an edge of each sheet against one of the end plates, and
   d. control means to actuate the sheet positioning means selectively to position each sheet against a desired one of the end plates, including a counting means to actuate the positioning means selectively to position a plurality of sheets in engagement with a desired one of the end plates and then to position a plurality of sheets in engagement with the other one of the end plates.

3. An apparatus in accordance with claim 1 wherein the sheet material is magnetic and wherein the means associated with the roller means comprise an electromagnet.

4. An apparatus for stacking units of magnetic sheet material in staggered relationship comprising:
   a. a receiver having end plates at opposite ends thereof, said end plates being spaced from one another a distance greater than the length of said sheet material,
   b. feed means disposed to feed the sheet material in individual sheets into the receiver,
   c. sheet positioning means comprising at least one rotating roller means associated with the receiver having an axis of rotation normal to the path of the sheet material fed thereto, and means comprising an electromagnet associated with the roller means to cause the roller means to engage the topmost sheet received by the receiver for movement of the topmost sheet by the roller means into engagement with one of the end plates, and
   d. control means to actuate the sheet positioning means selectively to position each sheet against a desired one of the end plates, including a counting means to actuate the sheet-positioning means selectively to position a plurality of sheets in engagement with a desired one of the end plates and then to position a plurality of sheets in engagement with the other one of the end plates.

5. An apparatus for stacking units of magnetic sheet material in staggered relationship comprising:
   a. a receiver having end plates at opposite ends thereof, said end plates being spaced from one another a distance greater than the length of said sheet material,
   b. feed means disposed to feed the sheet material in individual sheets into the receiver,
   c. sheet-positioning means comprising at least one rotating roller means associated with the receiver having an axis of rotation normal to the path of the sheet material fed thereto, and means comprising an electromagnet associated with the roller means to cause the roller means to engage the topmost sheet received by the receiver for movement of the topmost sheet by the roller means into engagement with one of the end plates, and
   d. control means to actuate the sheet-positioning means selectively to position each sheet against a desired one of the end plates, including a counting means for reversing

direction of the action of the electromagnet and roller means after receipt of a predetermined number of the sheets in the receiver.

6. An apparatus for stacking units of sheet material in staggered relationship comprising:

a. a receiver having end plates at opposite ends thereof, said end plates being spaced from one another a distance greater than the length of said sheet material,

b. feed means disposed to feed the sheet material in individual sheets into the receiver,

c. sheet-positioning means comprising at least one rotating roller means associated with the receiver having an axis of rotation normal to the path of the sheet material fed thereto, and means associated with the roller means to cause the roller means to engage the topmost sheet received by the receiver for movement of the topmost sheet by the roller means into engagement with one of the end plates, and

d. control means to actuate the sheet positioning means selectively to position each sheet against a desired one of the end plates, including a counting means to actuate the positioning means selectively to position a plurality of sheets in engagement with a desired one of the end plates and then to position a plurality of sheets in engagement with the other one of the end plates.

7. An apparatus for stacking units of sheet material in staggered relationship comprising:

a. a receiver having end plates at opposite ends thereof, said end plates being spaced from one another a distance greater than the length of said sheet material,

b. feed means disposed to feed the sheet material in individual sheets into the receiver,

c. sheet positioning means disposed to engage each of the sheets fed to the receiver and to selectively move each sheet to place an edge of each sheet against one of the end plates and comprising a pair of roller means rotating in opposite directions, and

d. control means to actuate the sheet positioning means selectively to position each sheet against a desired one of the end plates.

8. An apparatus in accordance with claim 7 wherein the sheet positioning means include means for holding each of the sheets in frictional contact with the sheet positioning means whereby the sheet positioning means is enabled to move each sheet into engagement with one of the end plates.

9. An apparatus in accordance with claim 7 wherein the control means include means to actuate selectively alternate ones of the roller means to alternate the direction of movement of the sheets as a function of the direction of rotation of the roller means energized.

10. An apparatus in accordance with claim 7 wherein the control means include a counting means to actuate the positioning means selectively to position a plurality of sheets in engagement with a desired one of the end plates and then to position a plurality of sheets in engagement with the other one of the end plates.

11. An apparatus in accordance with claim 8 wherein the control means include means to actuate selectively alternate ones of the roller means to alternate the direction of movement of the sheets as a function of the direction of rotation of the roller means actuated.

12. An apparatus in accordance with claim 6 wherein the roller means include means for holding a sheet in frictional contact with the roller means whereby rotation of the roller means moves each sheet into engagement with one of the end plates.

13. An apparatus in accordance with claim 6 wherein the control means include a counting means to actuate the positioning means selectively to position a plurality of sheets in engagement with a desired one of the end plates and then to position a plurality of sheets in engagement with the other one of the end plates.

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