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Hill

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[54] **MAGNET HOLDER FOR MATERIAL HANDLING APPARATUS**

[75] Inventor: **William J. Hill,** Holden, Mass.

[73] Assignee: **Mergan Construction Company,** Worcester, Mass.

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[52] **U.S. Cl.** ..... **214/1 BT,** 214/6 FS, 294/65.5

[51] **Int. Cl.** **B66c 1/06**

[58] **Field of Search** ... 214/1 BS, 1 BT, 1 BH, 1 BV, 214/6 FS, 6.5; 294/65.5

[56] **References Cited**

FOREIGN PATENTS OR APPLICATIONS

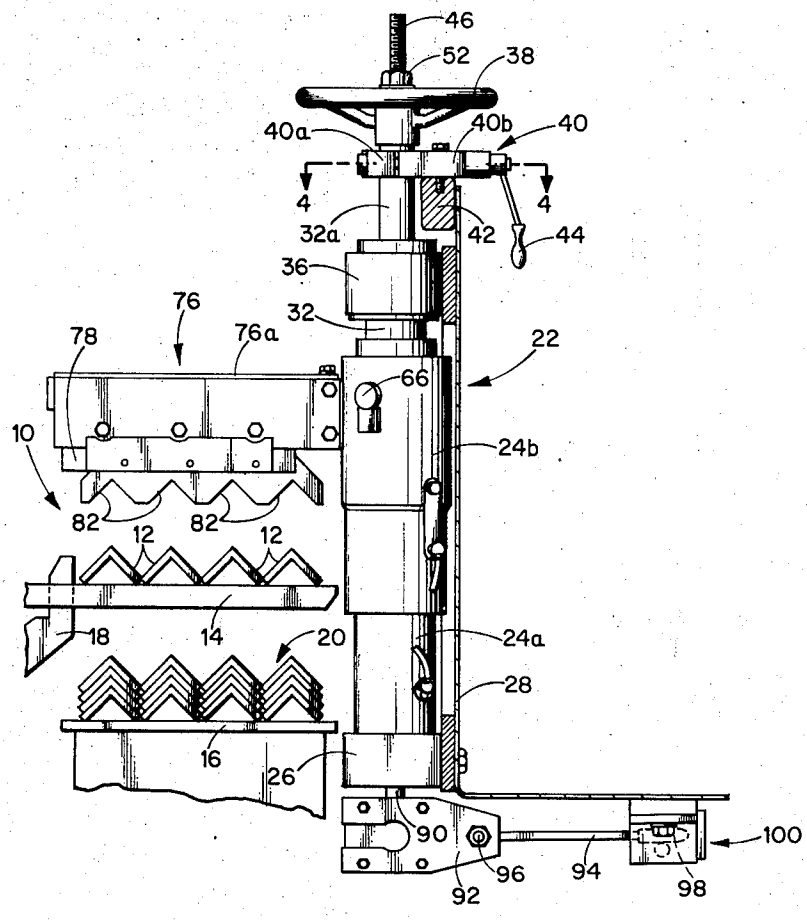
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Primary Examiner—Robert G. Sheridan
Assistant Examiner—George F. Abraham
Attorney, Agent, or Firm—Thompson, Birch, Gauthier & Samuels

[57] **ABSTRACT**

For use with an apparatus for handling elongated magnetic elements wherein the elements are initially arranged in a horizontal tier on spaced support members overlying a receiving device, such as for example vertically adjustable elevator platforms, and wherein the support members are retracted from beneath the elements to deposit the latter on the receiving device, the improvement which comprises a magnet holder located on one side of the receiving device, the said holder being movable between a raised inoperative position and a lowered operative position at which energization of the magnet which forms a part of the holder produces a magnetic force which causes the elongated elements to be held upwardly against the holder, thereby preventing the elements from turning or flipping about their longitudinal axes as the support members are retracted. Following retraction of the support members, the magnet is de-energized to drop the elements onto the underlying receiving device, and the holder is then returned to its raised inoperative position. The holder is also rotatable to a laterally remote position to one side of the receiving device.

9 Claims, 6 Drawing Figures



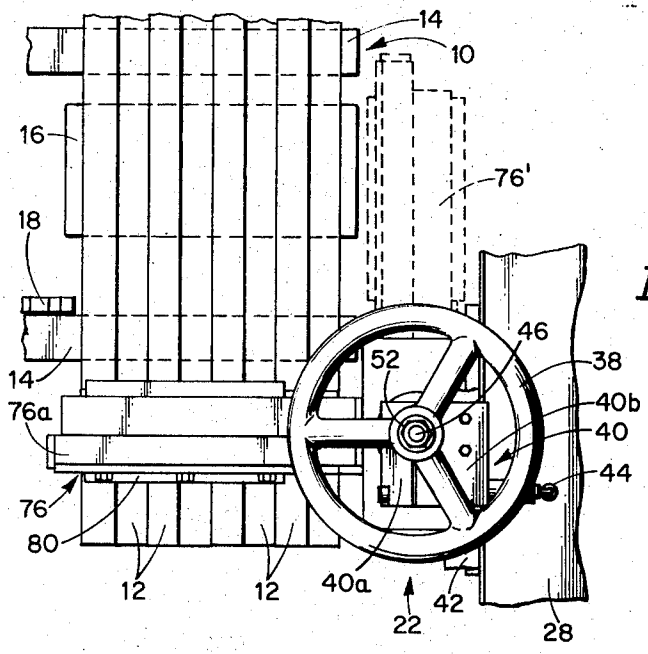


Fig. 2.

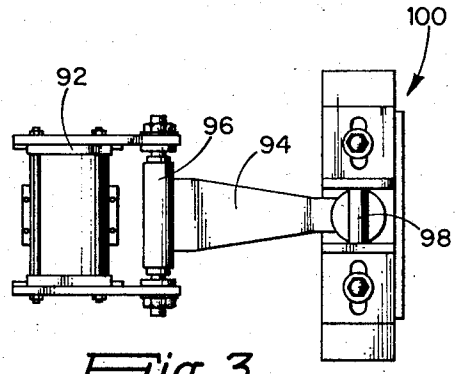


Fig. 3

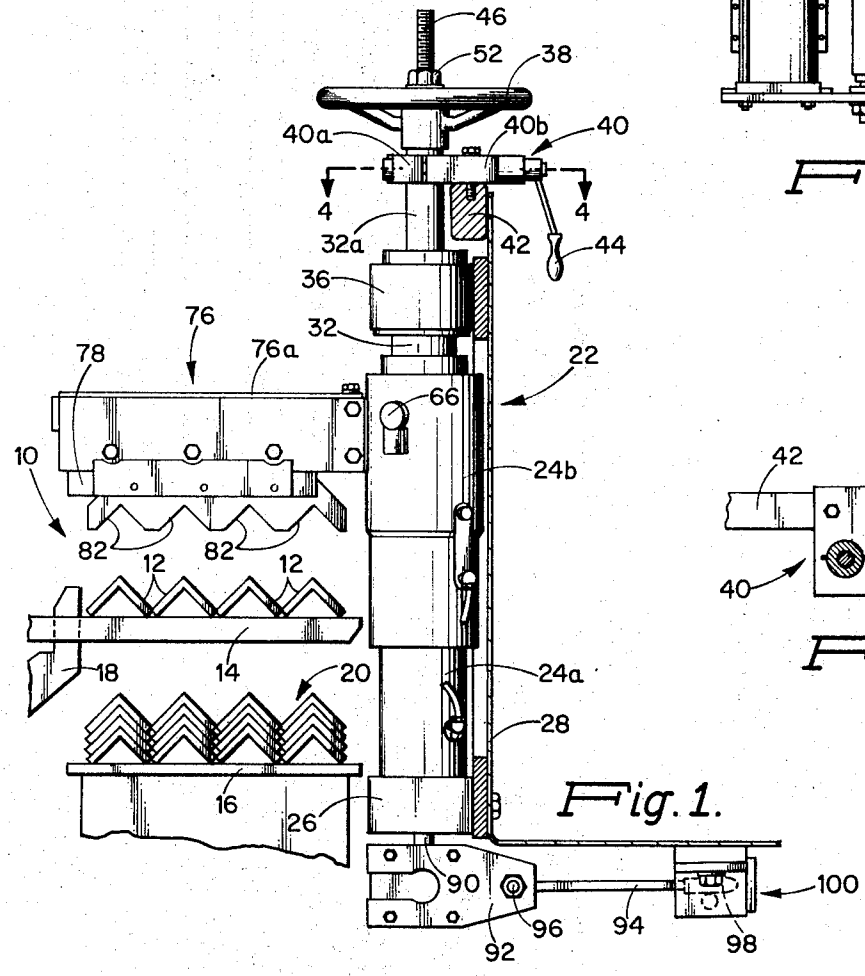


Fig. 1.

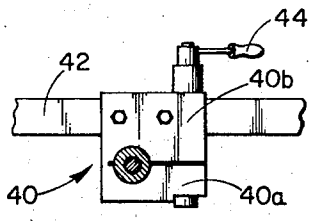


Fig. 4.

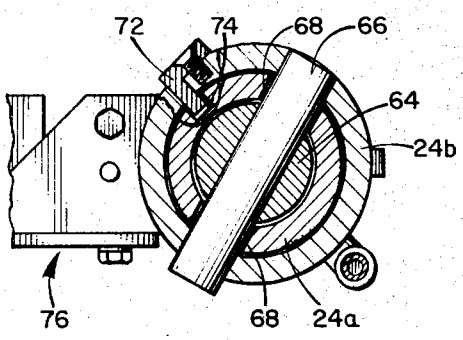

72
74
68
66
64
24b
76
68
24a

Fig. 6.

38
52
40
50
32a
46
22
42
44
32
36
30a
34
30
46a
68
48
64
66
6
62
72
24b
28
24a
61
54a
60
54
56
90
92
96
94
76
76a
6
78
10
80
12
12
12
82
82
20
74
14
18
16
26

Fig. 5.

MAGNET HOLDER FOR MATERIAL HANDLING APPARATUS

DESCRIPTION OF THE INVENTION

This invention relates generally to the art of material handling, and is particularly concerned with a novel and improved magnet holder for use with an apparatus employed to handle elongated magnetic elements, for example steel angles, channels and the like.

An object of the present invention is the provision of a means for preventing the elongated elements from turning or flipping about their longitudinal axes as they are being stripped from support skids and allowed to drop onto an underlying receiving means. To this end, the invention provides a magnet holder at a location overlying the receiving means. The magnet holder is lowered from a raised inoperative position to a lowered operative position at which energization of the magnet which forms a part of the holder will produce a magnetic force causing the elongated elements on the support skids to be held upwardly against the holder. Thereafter, the support skids are retracted from beneath the elongated elements, with the latter being prevented from turning or flipping by the attractive force of the magnet. Following retraction of the support skids, the magnet is de-energized, thereby allowing the elongated elements to drop under the influence of gravity, and without twisting or flipping, onto the underlying receiving means.

Another object of the present invention is the provision of a magnet holder which is movable vertically between a raised inoperative position and a lowered operative position as described above, and which is further rotatable to a laterally remote position when overhead access to the underlying receiving means by other equipment is required.

Other objects of the invention include the provision of means for adjusting the vertical stroke of the magnet in order to accommodate various sizes of elements, and the provision of specially designed element contacting plates against which the elements are held by the attractive force of the magnet, the said plates being suitably notched to maintain the desired spacing and/or alignment of the elements while the support skids are being retracted from therebeneath.

These and other objects and advantages of the present invention will become more apparent as the description proceeds with the aid of the accompanying drawings wherein:

FIG. **1** is a view in side elevation of a magnet holder in accordance with the present invention, with the magnet shown in the raised inoperative position;

FIG. **2** is a plan view of the apparatus shown in FIG. **1**;

FIG. **3** is a bottom view of the means employed to rotate the magnet holder;

FIG. **4** is a sectional view taken along lines **4—4** of FIG. **1**;

FIG. **5** is a vertical sectional view on an enlarged scale of the magnet holder of the present invention, with the magnet shown in its lowered operative position; and,

FIG. **6** is a sectional view taken along lines **6—6** of FIG. **5**.

Referring now to the drawings wherein like numbers designate like parts throughout the several views, there

is shown at **10** a portion of an apparatus for handling elongated magnetic elements, typically steel angles **12.** The material handling apparatus **10** does not form a apart of the present invention and hence it will not be described in any detail. The said apparatus is, however, fully described in U.S. Pat. application Ser. No. 164,601 filed on July 21, 1971 and assigned to the same assignee as that of the present invention and application.

The apparatus **10** includes a plurality of spaced support members **14** (hereinafter referred to as "skids") onto which the elements **12** are arranged in side-by-side relation in a horizontal tier. With the elements thus arranged, the skids **14** are advanced to a delivery position overlying a receiving means, herein shown as comprising elevator platforms **16.** Once this has been accomplished, stop members **18** are raised behind the tier of elements **12.** Thereafter, the skids **14** are retracted from beneath the elements **12** and the latter are thus freed to drop under the influence of gravity onto the elevator platforms **16** where they accumulate in a stack generally indicated at **20.**

To the extent thus described, the apparatus **10** and its operation is already known. The present invention, which comprises a magnet holder generally indicated at **22,** will now be further described.

The magnet holder **22** includes a vertically upstanding housing assembly which is made up of inner and outer tubular housing sections **24***a* and **24***b*. The inner housing section **24***a* is both rotatably and vertically slidably supported by means of a lower bracket assembly **26** which is in turn affixed to an adjacent stationary support structure **28.** The upper end of the inner housing section **24***a* terminates in a cap **30** which has an integral tubular male extension **30***a* extending vertically therefrom. The male extension **30***a* is received in a tubular female member **32** and is threadably engaged therewith as at **34.** The female member **32** is rotatably supported by an upper bracket assembly **36** which is also in turn fixed to the adjacent stationary support structure **28.** The female member **32** has a vertical tubular extension **32***a* to which is attached a hand wheel **38.** A clamp assembly **40** which includes a split collar having sections **40***a* and **40***b*, surrounds the tubular extension **32***a* of female member **32.** The clamp assembly **40** is supported on a horizontal member **42** forming a part of the adjacent fixed support structure **28.** When tightened by rotation of a handle **44,** the clamp assembly locks the female member **32** and its associated hand wheel **38** against rotation.

An adjusting shaft **46** extends axially through the female member **32** and the cap **30** and its tubular male extension **30***a* with its lower end **46***a* protruding into the interior chamber **48** of the inner housing section **24***a*. The upper end of the adjusting shaft **46** is in threaded engagement as at **50** with the tubular extension **32***a* of female member **32.** A lock nut **52** cooperates with the upper threaded end of the adjusting shaft **46** to lock the latter against rotation.

The lower end of the inner housing section **24***a* is closed by a base member **54** which is secured in place by any convenient means, for example welding as at **56.** The base member includes an upstanding flange **54***a* which is attached to the bottom end of a hydraulic cylinder **58** by means of a laterally extending cross pin **60.** The cylinder **58** contains a reciprocating piston **61** to which is attached a piston rod **62.** The upper end of the

piston rod **62** terminates in a head **64** which is connected by means of a laterally extending locking bar **66** to the outer housing section **24***b*. Elongated vertical slots **68** in the inner housing section **24***a* accommodate the vertical motion of the locking bar **66** as the piston rod **62** is stroked to move the head **64** between a lowered operative position as shown by the solid lines in FIG. **5** and a raised inoperative position shown by the dot-dash lines at **64'**.

A key **72** on the outer housing section **24***b* extends into a vertical keyway **74** in the inner housing section **24***a*. The outer housing section **24***b* has attached thereto a cantilevered magnet assembly generally indicated at **76.** The assembly **76** includes a support **76***a* which carries a magnet **78.** The magnet assembly **76** further includes an element contacting plate **80** which is notched as at **82** to accommodate the shape of the elongated elements **12** being handled.

The base member **54** at the bottom of the inner housing section **24a** has a depending shaft extension **90** which is received in a commercially available rotary actuator **92,** for example the Model A–4000X 90° rotary hydraulic actuator manufactured and sold by the Flo-Tork Division of the Allen Electric & Equipment Company, located at Orrville, Ohio. The rotary actuator **92** is held against rotation by a laterally extending arm **94** which is pivotally connected at one end to the actuator as at **96,** with its opposite end both pivotally and slidably connected as at **98** by means of a bracket **100** which is secured to the underside of the adjacent stationary support structure **28.** The rotary actuator **92** operates through the depending shaft extension **90** on the base member **54** to rotate the inner housing section **24***a*, including its upper cap **30,** and the cylinder **58,** piston rod **62** and head **64.** This rotary action is transmitted through the key **72** and keyway **74** to the locking bar **76** to the outer housing section **24***b* and the magnet assembly **76** attached thereto. The rotary actuator **92** operates to impart rotation through a 90° arc and as can best be seen in FIG. **2,** this results in the magnet assembly **76** being moved between a position overlying and extending in a direction transverse to the elements **12** when the latter are in the delivery position overlying the elevator platforms **16,** and a position to one side of the aforesaid delivery positions as shown in dotted at **76'** in FIG. **2.** The magnet assembly is moved to this latter position in order to provide overhead access to the elevator platforms **16** and the stack **20** of elements being formed thereon when other material handling equipment, for example, magnetic inverters (not shown) are used to deposit an inverted tier of elements on the stack **20.**

The magnet holder **22** of the present invention operates in the following manner; after the skids **14** have been extended to position a tier of elements **12** at the delivery position overlying the elevator platforms **16,** and the stop members **18** have been raised, the cylinder **58** is actuated to drop the outer housing section **24b** and its cantilevered magnet assembly **76** from the raised inoperative position shown in FIG. **1** to the lowered operative position shown by the solid lines in FIG. **5.** The elements **12** are thus seated in the notches **82** of the element connecting plate **80.** The magnet **78** is energized, either during or after the magnet assembly **76** has been lowered, thereby producing a magnetic force which attracts the elements **12** and holds them upwardly against the plate **80.** Thereafter, the skids **14** are retracted from beneath the elements **12.** The attractive force of the magnet **78** combined with the locating function of the notches **82** holds the elements **12** in a suspended condition and prevents any twisting or flipping of the elements as the skids are being retracted.

After the skids have been fully retracted, the magnet **78** is de-energized, thus freeing the elements **12** for deposit under the influence of gravity onto the elevator platforms **16** for accumulation in a stack **20.** The cylinder **58** is then actuated to raise the outer housing section **24***b* and its magnet assembly **76** back to the raised inoperative position shown by the solid lines in FIG. **1** and the dotted lines in FIG. **5.** Upward movement of the piston rod **62** is limited by contact of the head **64** with the bottom end **46***a* of adjusting shaft **46.**

In the event that smaller-sized elements of the same or different shapes are to be handled, the element contacting plates **80** may be replaced by others having suitably shaped notches **82.** To accommodate such other elements, it may also be necessary to drop the magnet assembly **76** to a lower position relative to the support skids **14.** This adjustment may be accomplished by loosening clamp assembly **40** and rotating hand wheel **38** in a counterclockwise direction. This rotation will operate through the threaded engagement as at **34** between the female member **32** and the male extension **30***a* on cap **30** to drop both the inner and outer housing sections **24***a* and **24***b*. This vertical adjustment will also affect the rotary actuator **92,** which is secured through shaft extension **90** and base member **54** to the inner housing section **24***a*. Vertical adjustment of the rotary actuator **92** will be compensated for by the pivotal connection of arm **94** as at **96,** and by the combined pivotal and slidable connection of the opposite end of arm **94** as at **98.**

When handling smaller elements it may also be desirable to limit the stroke of piston rod **62** in order to shorten cycle time. This adjustment can be accomplished by loosening lock nut **52** and screwing adjustment shaft **46** into the tubular extension **32***a* of female member **32.** This will drop the lower end **46***a* of the adjustment shaft further into the chamber **48,** thereby limiting the upward movement of the head **64** on piston rod **62.**

Finally, as previously noted, the magnet assembly **76** may be rotated to the position indicated in dotted at **76'** in FIG. **2** by operation of the rotary actuator **92.**

While only one magnetic holder **22** has been shown in the drawings, it will be understood by those skilled in the art that a plurality of such holders may be employed along the length of a stacking station to accommodate elongated elements **12** of different lengths.

It is my intention to cover all changes and modifications of the embodiment herein chosen for purposes of disclosure which do not depart from the spirit and scope of the invention.

I claim:

1. For use with an apparatus for handling elongated magnetic elements wherein the elements are initially arranged in a horizontal tier on spaced support members which are then extended horizontally to carry the tier of elements to a delivery position overlying a receiving means, and wherein the support members are thereafter retracted from beneath the elements to thereby deposit the elements on the receiving means, the improvement comprising: magnet holding means adjacent to the delivery position, first operating means

for vertically moving said magnet holding means between a raised inoperative position spaced vertically above a tier of elements on the spaced support members at the delivery position, and a lowered operative position at which energization of said magnet holding means will produce a magnetic force causing the elongated elements to be held upwardly against said magnet holding means, whereupon following retraction of the support members from beneath the elements held upwardly against said magnet holding means, the magnetic holding means may then be de-energized to release the elements for deposit onto the underlying receiving means, and second operating means for rotating said magnet holding means in a horizontal plane between said raised inoperative position and a third position at which said magnet holding means is located to one side of said delivery position.

2. The apparatus as claimed in claim **1** further characterized by support means for said magnet holding means, said support means including vertically arranged inner and outer tubular housing sections, the said outer tubular housing section having said magnet holding means horizontally affixed thereto in cantilever fashion and being slidable axially over said inner housing section.

3. The apparatus as claimed in claim **2** wherein said first operating means is comprised of a cylinder contained within and fixed in relation to said inner tubular housing section, a piston mounted for reciprocating movement in said cylinder, a piston rod connected at one end to said piston, the other end of said piston rod terminating in a head member, elongated slot means in said inner housing section, and means extending through said slot means for connecting said head member to said outer tubular housing section.

4. For use with an apparatus for handling elongated magnetic elements wherein the elements are initially arranged in a horizontal tier on laterally spaced support members, which support members are extendable horizontally to carry the tier of elements to a delivery position overlying a receiving means, and wherein the support members are thereafter retractable from beneath the elements to deposit the latter on the receiving means, the improvement comprising: an inner tubular housing section supported in relation to an adjacent fixed structure in a rotatable upstanding vertical position on one side of said delivery position, an outer tubular housing section surrounding said inner housing section and being movable axially in relation thereto, a magnet holding means affixed to and extending horizontally from said outer tubular housing section, a first operating means for vertically moving said outer tubular housing section in relation to said inner tubular housing section between a first position at which said magnet holding means is spaced vertically above a tier of elements on the spaced support members at the delivery position, and a second operative position at which energization of said magnet holding means will produce a magnetic force which will cause the elongated elements to be held upwardly against said magnet holding means while the support members are retracted from therebeneath, whereupon subsequent de-energization of the magnet holding means will result in the elongated elements being deposited on the underlying receiving means, and a second operating means for rotating said inner and outer housing sections to move said magnet holding means between said first position and a third position located to one side of and generally parallel to said delivery position.

5. The apparatus as claimed in claim **4** further characterized by adjustment means for vertically adjusting the position of said inner tubular housing section in relation to said adjacent fixed structure.

6. The apparatus as claimed in claim **5** wherein said adjustment means is comprised of a threaded male member extending vertically from the upper end of said inner housing section, a female threaded member in threaded engagement with said male member, said female threaded member being rotatably mounted on said adjacent fixed structure, and means for rotating said female member to impart axial movement to said male member and said inner housing section relative to said adjacent fixed structure.

7. The apparatus as claimed in claim **6** wherein said first operating means is comprised of a cylinder contained within and fixed relative to said inner housing section, a piston reciprocally movable in said cylinder, a piston rod having one end connected to said piston, the other end of said piston rod terminating in a head member, slot means in said inner housing section, and means extending laterally from said head member through said slot means to said outer housing section, whereupon vertical movement of said piston within said cylinder will impart corresponding vertical movement to said outer housing section and the magnet holding means extending horizontally therefrom.

8. The apparatus as claimed in claim **7** further characterized by adjustable stop means for verticalaly limiting the upward axial movement of said head member relative to said inner housing section, said stop means extending vertically through and being adjustable axially in relation to said male and female members.

9. For use with an apparatus for handling elongated magnetic elements wherein the elements are initially arranged side-by-side in a horizontal tier on laterally spaced suport members which overlie a receiving means, and wherein the support members are then retracted from beneath the elements to deposit the latter on the receiving means, the improvement comprising: a vertically upstanding housing assembly located to one side of said receiving means, said housing assembly including inner and outer tubular housing sections, the said outer housing section surrounding and being movable axially relative to the said inner housing section, the said inner housing section being rotatably supported by means of an adjacent fixed structure; a magnet holding means affixed to and extending horizontally from said outer housing section; a first operating means contained within said inner housing section and connected to said outer housing section, said first operating means being operative to vertically reciprocate both said outer housing section and said magnet holding means between a raised inoperative position and a lowered operative position at which energization of said magnet holding means will produce a magnetic force causing the elongated elements on the support members to be attracted upwardly and held against said magnet holding means, thereby permitting the support members to be retracted from beneath the elements without the latter turning or twisting about their longitudinal axes whereupon a subsequent de-energization of said magnet holding means will release the elongated elements for deposit under the influence of gravity onto the receiving means; a second operating means for rotating said housing assembly relative to said stationary support structure; and an adjustment means for axially adjusting said housing structure relative to said stationary support structure.

* * * * *