Aug. 20, 1935. J. T. FLAHERTY 2,011,808

MATERIAL HANDLING APPARATUS

Filed April 5, 1933 3 Sheets-Sheet 1

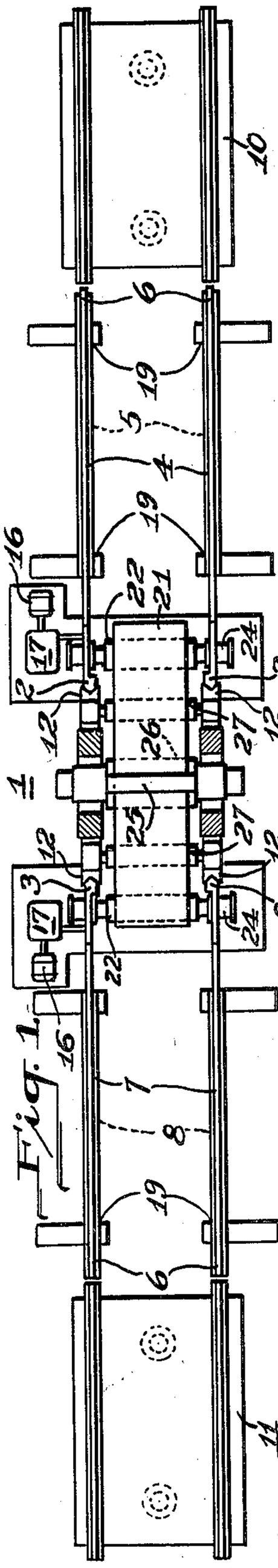

Fig. 1.

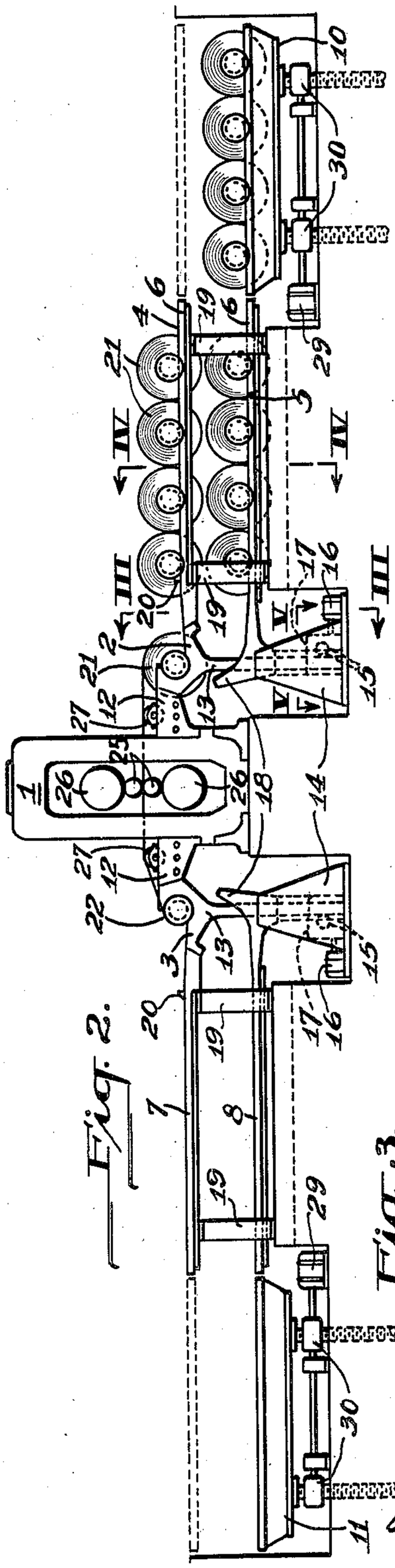

Fig. 2.

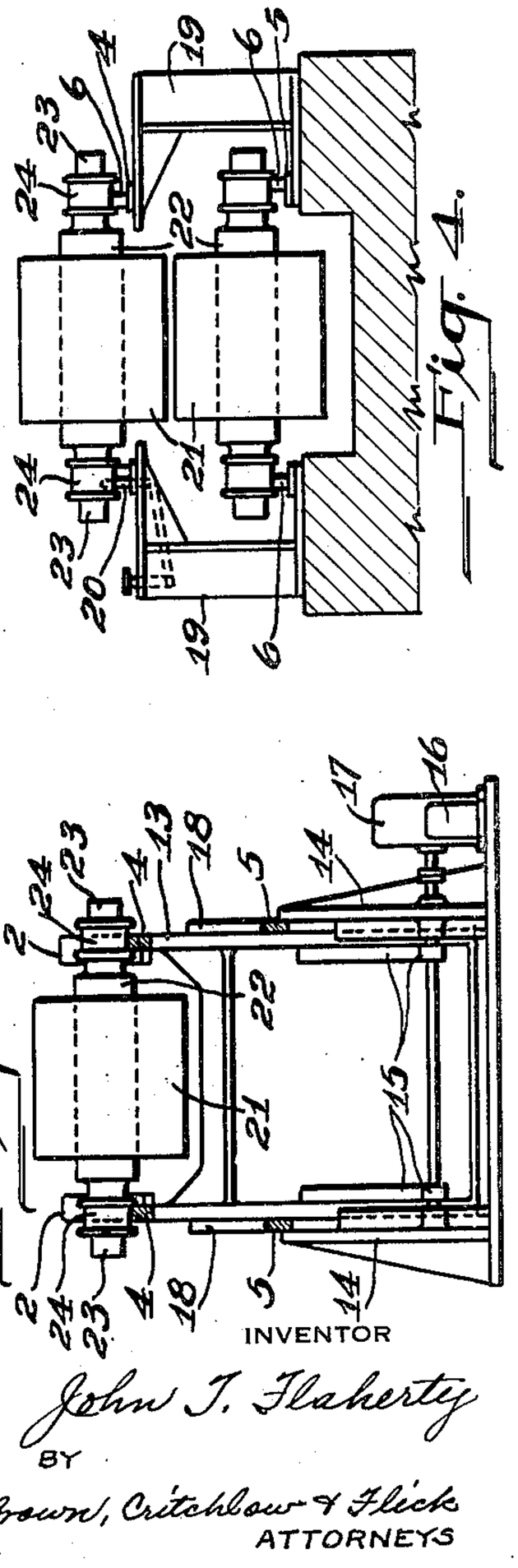

Fig. 3.

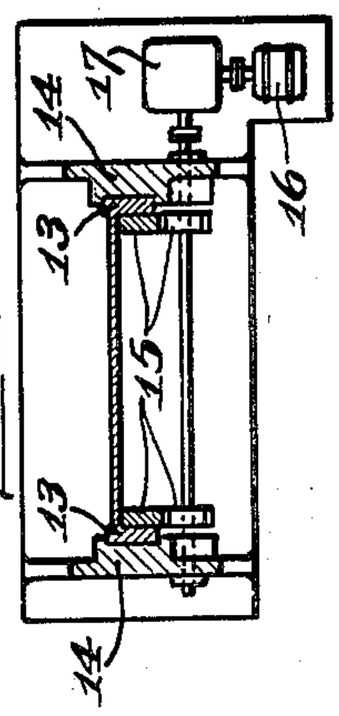

Fig. 5.

Fig. 4.

INVENTOR

John T. Flaherty

BY

Brown, Critchlow & Flick

ATTORNEYS

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MATERIAL HANDLING APPARATUS

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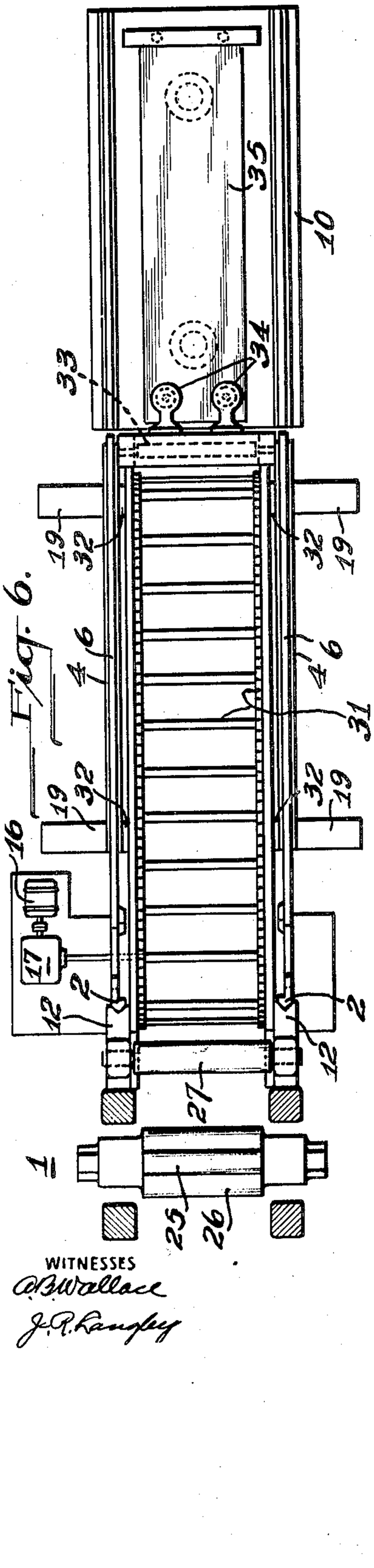

Fig. 6.

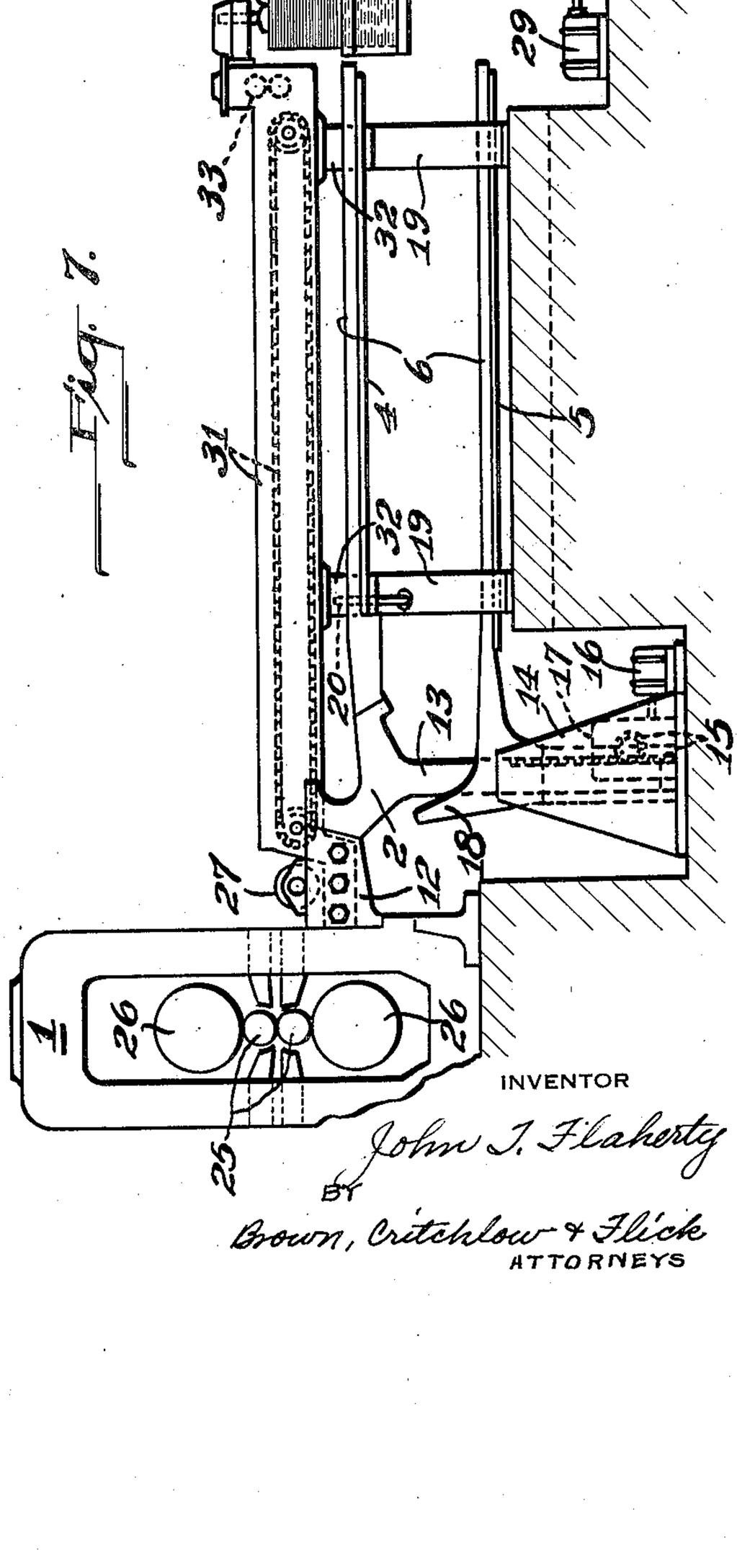

Fig. 7.

WITNESSES
A. B. Wallace
J. R. Langley

INVENTOR
John T. Flaherty
BY
Brown, Critchlow & Flick
ATTORNEYS

Aug. 20, 1935. J. T. FLAHERTY 2,011,808

MATERIAL HANDLING APPARATUS

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Fig. 8.

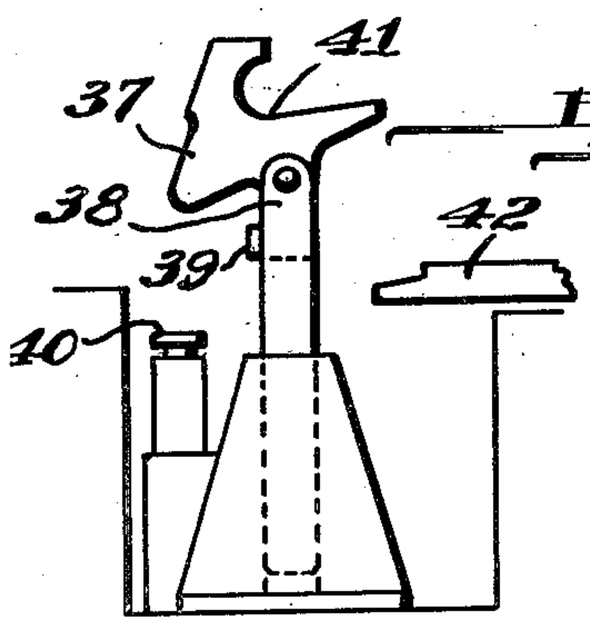


Fig. 9.

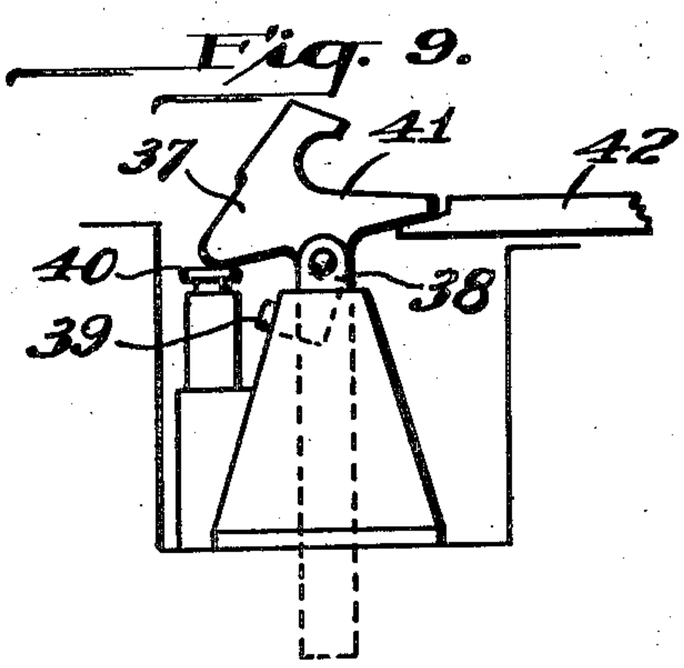


Fig. 10.

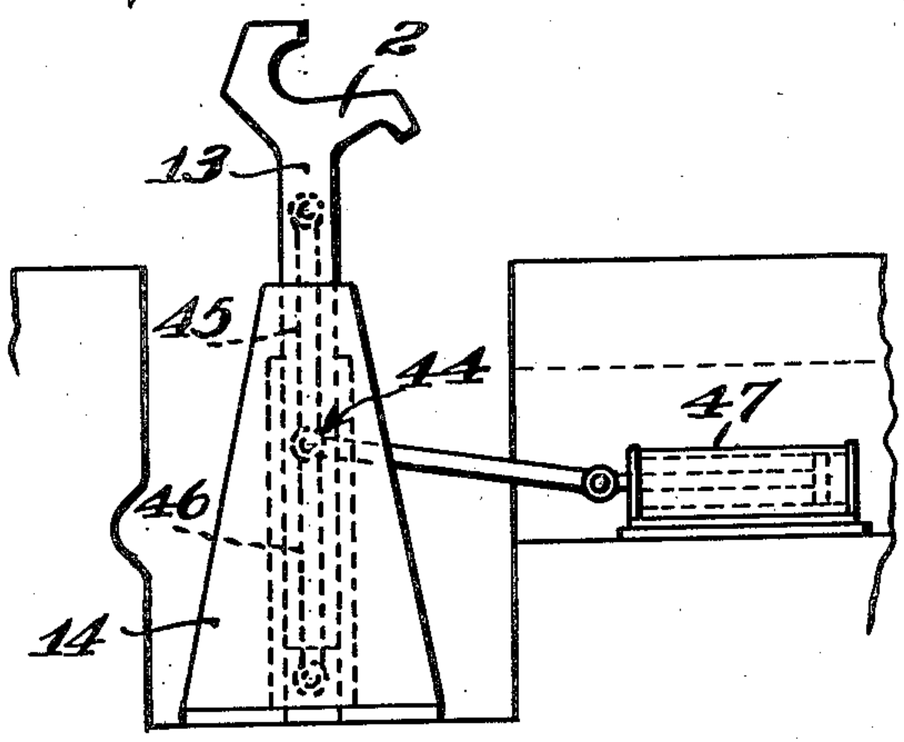


Fig. 11.

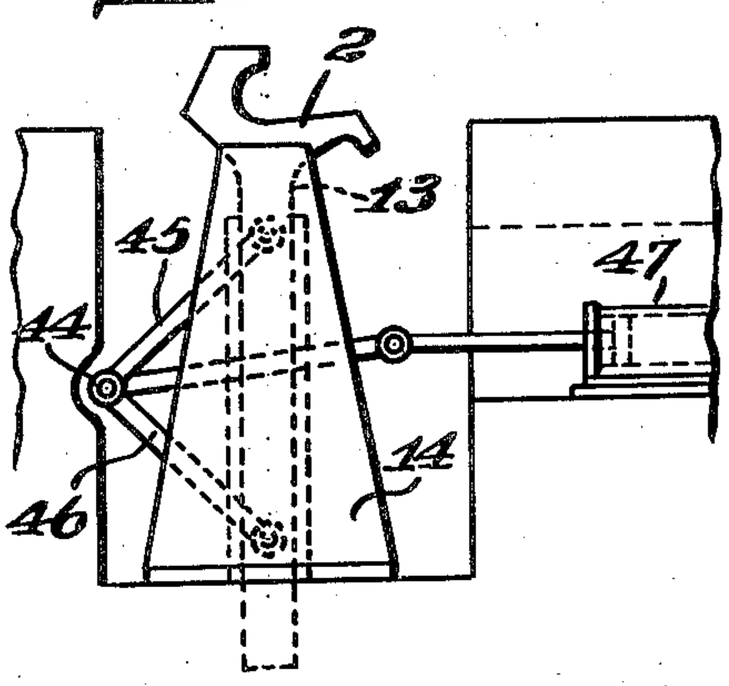


Fig. 12.

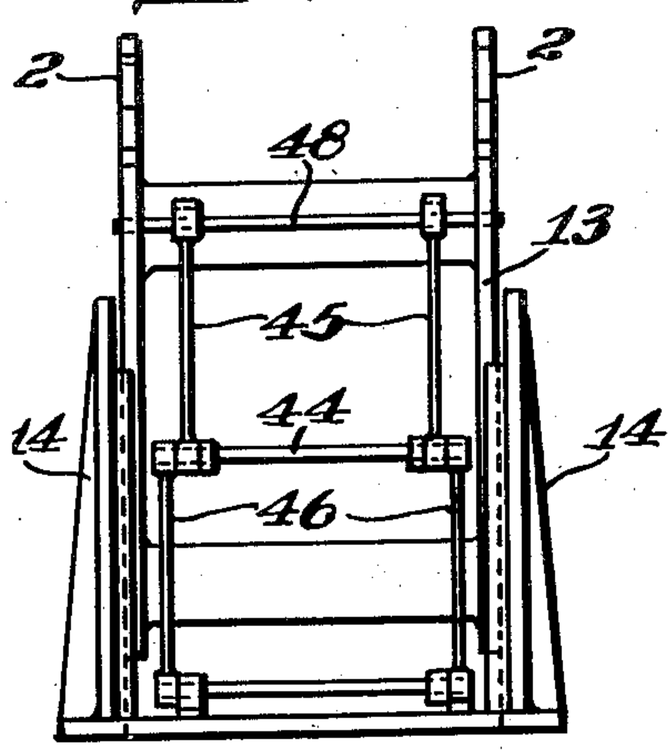
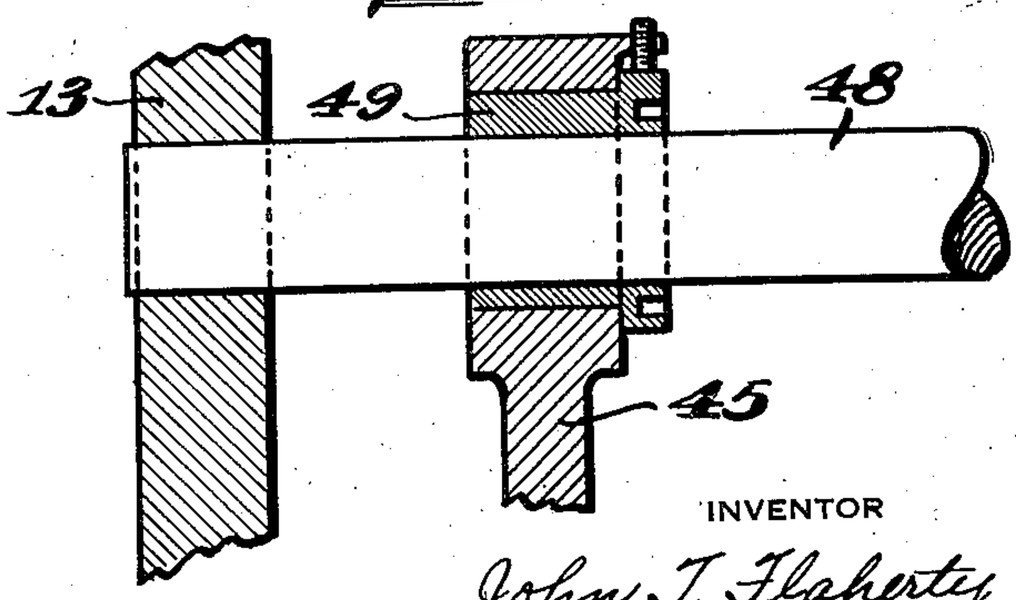


Fig. 13.



INVENTOR

John T. Flaherty

BY

Brown, Critchlow & Flick

ATTORNEYS

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UNITED STATES PATENT OFFICE

2,011,808

MATERIAL HANDLING APPARATUS

John T. Flaherty, Pittsburgh, Pa., assignor to United Engineering & Foundry Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application April 5, 1933, Serial No. 664,532

23 Claims. (Cl. 80—32)

My invention relates to material-handling apparatus and particularly to apparatus for handling sheet metal either in the form of coils of metal strip or of metal in sheets.

An object of my invention is to provide improved apparatus for conveniently and expeditiously supplying coils of sheet metal strip to rolling mills and removing completed coils or empty drums therefrom.

A further object of my invention is to provide an improved arrangement for handling coils of sheet metal strip and metal sheets wherein certain of the apparatus may be common to the respective systems for handling coils and sheets and whereby a rolling mill may be adapted for the handling of sheet metal in either form with a minimum expenditure of time and labor.

In the operation of rolling mills for sheet metal either in the form of sheet metal strip of metal sheets it has been difficult when the mill is arranged for operation with one form of sheet metal to adapt it for operation with sheet metal of the other form. For example, if the mill is provided with apparatus for handling coils of sheet metal strip it has been difficult to adapt the mill for handling metal sheets without dismantling at least certain of the apparatus for handling coils. The same situation has existed with respect to the adapting of mills for rolling sheet metal strip when they have been previously arranged for rolling metal sheets.

In accordance with the present invention I provide on either side of the rolling mill coil-handling apparatus which comprises two superposed coil supports for respectively supplying coils to the mill and for receiving either completed coils or empty drums therefrom. A coil box adjacent the mill is operable to transfer coils or drums from the level of one of the superposed supports to that of the other. The coils or drums are automatically ejected from the coil box when the latter is approximately in alignment with the support to which the coils or drums are to be delivered.

In order to adapt the rolling mill for rolling metal sheets, it is only necessary to place a suitable conveyor above the upper support for coils, and the conveyor is supported upon suitable means adjacent the mill and upon the upper coil support. The conveyor which operates to supply metal sheets to the mill or to receive them therefrom cooperates with a piling device at the outer end of the conveyor which also serves as a transfer device for coils when the mill is operating on metal strip. When it is desired to again adapt the mill for rolling sheet metal strip it is only necessary to remove the conveyor, the coil-handling apparatus having remained in position during the operation of rolling metal sheets.

The advantages of the arrangement described above are that the change in metal-handling apparatus that is necessary to adapt the mill for the respective forms of sheet metal requires a minimum amount of time and labor and the total amount of apparatus required for handling both types of sheet metal is materially less than would be required if the systems were independent and none of the parts were common thereto.

The details of my invention will be described in connection with the accompanying drawings in which Fig. 1 is a plan view of a rolling mill and apparatus associated therewith for handling sheet metal strip, the mill being shown in horizontal section; Fig. 2 is a view in front elevation of the apparatus of Fig. 1; Fig. 3 is a view in transverse vertical section taken on line III—III of Fig. 2; Fig. 4 is a similar view taken on line IV—IV of Fig. 2; Fig. 5 is a horizontal sectional view taken on line V—V of Fig. 2; Fig. 6 is an enlarged view of the mill having on one side thereof material-handling apparatus arranged for metal sheets; Fig. 7 is a side elevational view of the apparatus of Fig. 6; Figs. 8 and 9 are side elevational views of a movable coil box and associated mechanism, with the coil box in its upper and its lower positions respectively; Figs. 10 and 11 are similar views of another form of coil box structure and illustrating the latter in its upper and lower positions respectively; Fig. 12 is a transverse vertical section of the structure of Fig. 11; and Fig. 13 is an enlarged sectional view of an eccentric bearing portion of the mechanism of Fig. 11, parts being broken away.

Referring particularly to Figs. 1 to 5, a rolling mill 1 which is preferably of the 4-high type and adapted for cold-rolling sheet metal is provided on the respective sides thereof with coil boxes 2 and 3 for supporting coils or empty drums therefor during the process of rolling metal strip in the mill. Adjacent the coil box 2 are two superposed coil supports 4 and 5. Each support comprises horizontal rails 6 that are adapted to support coils of sheet metal strip while the latter are rolled on suitable trunnions as will be later described. Similar coil supports 7 and 8 are provided adjacent the coil box 3.

At the outer ends of the coil supports 4 and 5 is situated a lifting device 10 that is adapted to move vertically for the purpose of transferring coils or drums from the level of the lower sup-

port 5 to that of the upper support 4 which is in alignment with the floor level. The lifting device 10 also serves as a piling device upon which metal sheets may be placed for supplying them to the mill or upon which they may be piled when the metal sheets are received from the mill, as will be later described. A similar lifting device 11 is provided at the outer ends of the coil supports 7 and 8 for performing similar functions.

The coil boxes 2 and 3 are each braced laterally by a frame 12 that is secured to the housing of the mill 1. The coil boxes support the coils of metal strip when this form of sheet metal is being rolled by the mill and each is vertically movable to constitute part of mechanism for transferring coils. Each coil box is supported upon vertical posts or uprights 13 that are mounted for vertical movement in guides 14.

The vertical positions of the uprights 13 and of the coil box supported thereby are controlled by any suitable means, for example, by means of a rack and pinion mechanism 15 that is actuated by a motor 16 through suitable reduction gear mechanism 17. Adjacent the lowermost position of each coil box are two inclined arms 18 that are adapted to engage portions of the coils supported on the coil boxes to transfer them automatically to the lower coil support 5 or 8 as the case may be.

The upper coil supports 4 and 7, which are each supported by four posts 19, are inclined toward the mill and the lower supports 5 and 8 are each inclined away from the mill in order to facilitate the movement of coils therealong. Each of the supports 4 and 7 is provided adjacent its inner end with a suitable movable stop 20 for limiting the travel of the coils toward the mill.

The coils 21 of sheet metal strip are wound on suitable drums 22 that are provided with trunnions 23 having thereon rotatable cylindrical sleeves 24 that are grooved on their exterior and are connected to the trunnions by means of suitable anti-friction bearings. These rotatable sleeves provide means for moving the coils without rotation along the rails of the supports, the sleeves rolling upon the rails.

When it is desired to operate the mill 1 to roll sheet metal strip, the lifting device 10 is placed at the floor level in alignment with the outer end of the coil support 4 to serve as a bridge across the gap between the floor and the coil support. A supply of coils is then rolled across the lifting device 10 to the coil support 4 in readiness to be supplied to the coil box. The lifting device may then be returned to its lowermost position as soon as desired.

When a coil 21 is in operative position in the coil box 2 the end of the sheet metal strip is loosened and inserted in the mill which is provided with working rolls 25 and backing rolls 26. The frame 12 is provided with a roller 27 which operates as a guide roller for the metal strip while the latter is being rolled, and may serve the same purpose for metal sheets that are being rolled. The sleeves 24 of the drums 22 constitute bearings supports for the latter during the rolling operation.

The metal strip passes through the mill 1 and is wound upon a drum 22 in the coil box 3. The metal may be rolled by passing it through the mill any desired number of times, and if the number of passes is even the finished metal strip will be wound upon the original drum in the coil box 2. The mill 1 and the drums are driven by any suitable means, not shown.

The completed coil is then transferred to the lower support 5 by operating the motor 16 to lower the uprights 13, whereupon the coil box 2 and the coil 21 supported thereby are lowered until the inclined arms 18 engage the sleeves 24 of the coil drum whereupon the coil is actuated to the right and along the downwardly inclined rails of the lower coil support 5 into position adjacent the lifting device 10. The coil box 2 and the uprights 13 of the transfer mechanism are then returned to their upper positions in readiness to receive a succeeding coil of sheet metal strip for the subsequent rolling operation.

The completed coils are actuated along the lower support 5 and onto the lifting device 10 until the latter is filled to its capacity whereupon the lifting device is actuated upwardly by means of a motor 29 and suitable worm gear mechanisms 30, the details of which are not illustrated. When the lifting device 10 is in alignment with the floor level the completed coils thereon are discharged therefrom to any suitable location and additional coils for rolling are actuated thereacross from the floor to the upper support 4. These various operations are repeated so long as the mill is operating with an even number of passes therethrough.

During the operation of the mill with an even number of passes it is only necessary to provide an empty coil drum 22 in the coil box 3 since the drum in the latter coil box is never provided with a coil of completed material. Accordingly, a single drum may be employed for any number of succeeding coils on the left hand side of the mill as viewed in the drawings.

In case the mill is operating with an odd number of passes the operation of supplying coils to the coil box 2 is similar to that described above, the only difference in the operation on this side of the mill being that empty drums 22 will be transferred by the coil box 2 to the lower coil support 5. The accumulating empty drums will be transferred by the lifting device 10 in the same manner as desired in connection with the completed coils.

On the other side of the mill empty drums will be supplied over the lifting device 11 to the coil support 7 and the coil box 3 and completed coils will be transferred by the coil box 3 to the lower coil support 8. Completed coils will be transferred from the lower level of the coil support 8 to the floor level by the lifting device 11 in the same manner as described in connection with the lifting device 10.

By reason of the fact that the coil boxes and coil supports and operating mechanisms therefor are symmetrical with respect to the mill, the coils of metal to be rolled may be supplied to either side of the mill and the operations that have been described above may occur in reverse order for either an odd or an even number of passes.

Referring now to Figs. 6 and 7 the mill 1 is illustrated therein as being provided with apparatus for supplying metal sheets thereto or receiving them therefrom, as the case may be. While only the apparatus on one side of the mill is illustrated it will be appreciated that the apparatus is symmetrical with respect to the mill as in the case of the coil handling apparatus above.

A conveyor 31 of any suitable type is mounted at one end upon the frame 12 and at its other

end is supported upon the coil supporting structure by means of posts or beams 32. The outer end of the conveyor 31 is provided with pinch rolls 33 and a vacuum device 34 for transferring metal sheets 35 from the lifting device 10 which now serves as a source of supply. A similar conveyor 31 is mounted on the opposite side of the mill, together with pinch rolls, and a vacuum device that are in all essential respect duplicates of those shown in Figs. 6 and 7 and described above. Their illustration has been omitted as not necessary for an understanding of the invention.

In the operation of the mill for rolling metal sheets it may be assumed that they are being supplied from the lifting device 10 by the vacuum device 34 and pinch rolls 33. The conveyor receives the sheets successively from the lifting device 10 and supplies them to the working rolls of the mill 1. When the sheets pass through the mill 1 they are received by the other conveyor and supplied to the corresponding pinch rolls which transfer them to the lifting device 11 which serves as a piling device on this side of the mill. The lifting device 10 may be adjusted to successively higher positions in order to maintain the level of the supply of sheets adjacent the vacuum device 34 and pinch rolls 33. On the other side of the mill a lifting device 11 will be lowered as necessary as the height of the pile of completely rolled sheets increases.

In the sheet handling mechanism shown and described above if it is desired that the metal have a plurality of passes it is only necessary to reverse the direction of the mill and the operations described above whereupon the metal sheets may be rolled in reverse order and the completed sheets will accumulate on the lifting device 10. It will be appreciated that by means of this arrangement metal sheets may be given any desired number of passes without any additional handling of the metal other than by reversing the direction of operation of the mechanism to pass them through the mill.

In order to restore the mill 1 to condition for rolling coils of sheet metal strip, as illustrated in Figs. 1 and 2, it is only necessary to remove the conveyors 31 and the completely rolled metal sheets from the lifting devices 10 and 11 whereupon the operation of rolling sheet metal strip may proceed in the manner previously described.

Reference may now be had to Figs. 8 and 9 in which are illustrated a modified form of apparatus for transferring coils from the level of the upper coil support to that of the lower support. A movable coil box 37, of which it is a part, is pivotally mounted on structure comprising uprights 38 that are adapted for vertical movement by any suitable mechanism, not shown, which may be, for example, similar to that shown and described in connection with Figs. 1, 2 and 5. The pivotal movement of the coil box 37 in a counterclockwise direction, as viewed in the drawings, is limited by stop members 39 which engage the uprights 38.

An abutment 40 is adapted to engage the coil box 37 when the latter approaches its lowermost position to cause the latter to rock about its pivotal support into the position shown in Fig. 9, whereupon the surfaces 41 for supporting coils thereon are downwardly inclined and a coil supported thereby is discharged therefrom by force of gravity to the rails 42 in alignment therewith. When the uprights 38 are returned toward their uppermost position the coil box 37 returns to its relative position in which it is illustrated in Fig. 8, since its center of gravity is to the left of its pivotal support, as viewed in the drawings.

An especial advantage of this form of transfer mechanism resides in the fact that the coil is automatically discharged by force of gravity and that the distance between the rails 42 may be the same as that between the rails of the upper support.

Reference may now be had to Figs. 10, 11, 12 and 13 in which are illustrated a further modification of the transfer apparatus. This form of my invention is similar in essential respects to the transfer apparatus of Figs. 1 and 2 except that a toggle mechanism 44 has been substituted for the rack and pinion mechanism of the preferred form of my invention. The toggle mechanism comprises upper arms 45 and lower arms 46 and is actuated by means of a fluid pressure motor 47.

Each of the upper arms 45 is connected to a bar 48 by means of an eccentric bearing sleeve 49 that may be secured in a desired angular position by means of a set-screw 50. The sleeve 49 may be adjusted by means of a spanner wrench or similar suitable tool in order to vary the height of the coil box 2 in its final upper position to insure that it will be closely in engagement with the stationary members including the frame 12 with which it cooperates.

In the operation of the latter form of my invention it may be assumed that the coil box is in its uppermost position as shown in Fig. 10, and that it is desired to lower a coil supported thereby. The fluid pressure motor 47 is operated to break the toggle and the coil box 2 is lowered, as shown in Fig. 11. Any suitable means may be employed to regulate the speed at which the coil and its supporting mechanism are lowered. The fluid pressure cylinder is supplied with compressed air or other fluid to actuate the toggle to the position in which it is shown in Fig. 10.

It will be noted that I have provided extremely simple and efficient apparatus for expeditiously handling sheet metal whether in the form of metal sheets or of coils of metal strip. The apparatus for handling sheet metal of above forms may be employed successively in connection with the same rolling mill with comparatively small expenditure of time and labor. The adapting of the mill for either form of metal is a comparatively simple matter, since it is unnecessary to remove the apparatus for handling coils to adapt the mill for metal sheets, and it is only necessary to remove the conveyors to restore the mill to condition for rolling sheet metal strip.

The lifting devices for transferring coils serve also as piling devices for supplying metal sheets to the mill or receiving them therefrom in accordance with the direction of operation of the mill.

The arrangement for transferring coils or drums from the level of the upper supports to that of the lower supports is extremely simple inasmuch as the coils are automatically discharged therefrom upon the movable portion of the coil box approaching the level of the lower coil support.

While I have shown and described the coil transfer mechanism of my invention as adapted for transferring coils from an upper to a lower level, it may be adapted by obvious modifications to transfer coils in the opposite direction. The transfer mechanism of my invention is also adapted for use in connection with printing ma-

chinery or other apparatus in connection with which it is desirable to transfer rolls of material, such as paper or other fabric, from one level to another. Such modifications are within the spirit and the scope of the present invention.

The foregoing and other advantages will be apparent to those skilled in the art to which my invention relates.

I claim:

1. Sheet metal handling apparatus comprising a mill for rolling sheet metal, means comprising upper and lower members for supporting coils of metal strip for actuation toward or away from said mill, and a coil box for supporting said coils adjacent said mill, said coil box being vertically movable to transfer said coils between the upper and the lower members.

2. Sheet metal handling apparatus comprising a mill for rolling sheet metal, means comprising upper and lower members for supporting coils of metal strip for actuation toward or away from said mill, respectively, and a coil box for receiving coils from the upper members and supporting them during the rolling of the material thereon, said coil box having at least a portion thereof that is vertically movable to transfer said coils to said lower members.

3. Sheet metal handling apparatus comprising a mill for rolling sheet metal, a coil box adjacent said mill for receiving coils of sheet metal strip for rolling in said mill, said coil box being vertically movable for transferring coils from one level to another, and means comprising a toggle mechanism for controlling the vertical position of said movable portion.

4. Sheet metal handling apparatus comprising a mill for rolling sheet metal, a coil box adjacent said mill for receiving coils of sheet metal strip for rolling in said mill, said coil box being vertically movable for transferring coils from one level to another, and means comprising a toggle mechanism and a motive device therefor for controlling the vertical position of said movable portion.

5. Sheet metal handling apparatus comprising a mill for rolling sheet metal, a coil box adjacent said mill for receiving coils of sheet metal strip for rolling in said mill, said coil box being vertically movable for transferring coils from one level to another, and means comprising a gear mechanism for actuating said movable portion between said levels.

6. Sheet metal handling apparatus comprising a mill for rolling sheet metal, a coil box adjacent said mill for receiving coils of sheet metal strip for rolling in said mill, said coil box being vertically movable between an upper and a lower position and means comprising an inclined member for actuating said coils from said coil box when the latter approaches its lowermost position.

7. Sheet metal handling apparatus comprising a mill for rolling sheet metal, a coil box adjacent said mill for receiving coils of sheet metal strip for rolling in said mill, said coil box being vertically movable between upper and lower positions, and means comprising curved rails for actuating coils from said coil box when the latter is approximately in its lowermost position.

8. Sheet metal handling apparatus comprising a mill for rolling sheet metal, a coil box adjacent said mill for receiving coils of sheet metal strip for rolling in said mill, said coil box being tiltable and vertically movable for transferring coils between upper and lower levels, and means for tilting said coil box in one of its positions to discharge a coil therefrom.

9. Sheet metal handling apparatus comprising a mill for rolling sheet metal, a coil holder adjacent said mill for receiving coils of sheet metal strip for rolling in said mill, said coil holder being tiltable and vertically movable for transferring coils between upper and lower levels, and a stationary abutment for tilting said coil holder as it is lowered to thereby discharge a coil therefrom.

10. Sheet metal handling apparatus comprising a mill for rolling sheet metal, means for receiving a coil of sheet metal strip adjacent said mill, superposed supports for coils for actuation toward or from the receiving means, and a lifting device for receiving coils from the lower support and transferring them to the level of the upper support, said device serving also to support coils being actuated thereacross to the upper support.

11. Sheet metal handling apparatus comprising a mill for rolling sheet metal, means for receiving a coil of sheet metal strip adjacent said mill, superposed supports for coils, the upper support being inclined toward the mill for supplying coils to the receiving means, and the lower support being inclined away from the mill to conduct coils away from the receiving means, and a lifting device for receiving coils from the lower support and transferring them to an upper level for discharge therefrom, said device serving also to support coils supplied to the upper support.

12. Sheet metal handling apparatus comprising a mill for rolling sheet metal, means for receiving a coil of sheet metal strip adjacent said mill, superposed supports adapted to support coils for actuation toward or from the receiving means and also adapted to support, a conveyor for metal sheets, a conveyor for metal sheets adapted to be supported upon the upper of said supports, and a lifting device for transferring coils from one level to another when sheet metal strip is being rolled and for serving as a piling device for metal sheets when the latter are being rolled by said mill.

13. Sheet metal handling apparatus comprising a mill for rolling sheet metal, means for receiving a coil of sheet metal strip adacent said mill, superposed supports adapted to support coils for actuation toward or from the receiving means and also adapted to support a conveyor for metal sheets, a conveyor for metal sheets adapted to be supported upon the upper of said supports, and a lifting device adjacent outer ends of said supports and said conveyor for transferring coils from one level to another when sheet metal strip is being rolled and for supplying metal sheets to or receiving them from said conveyor when metal sheets are being rolled by said mill.

14. Sheet metal handling apparatus comprising a mill for rolling sheet metal, means for receiving a coil of sheet metal strip adjacent said mill, superposed supports adapted to support coils for actuation toward or from the receiving means, and also adapted to support a conveyor for metal sheet, a conveyor for metal sheets adapted to be supported upon said receiving means and upon the upper of said supports, and a lifting device having a portion for supporting coils or metal sheets thereon according as the mill is rolling sheet metal strip or metal sheets.

15. Sheet metal handling apparatus comprising a mill, a coil box on opposite sides thereof, superposed supports adapted to support coils of sheet metal strip adjacent each coil box, and also adapted to support a conveyor for metal sheets, a conveyor for metal sheets adapted to be sup-

ported adjacent said mill and upon the upper of said superposed supports, and a vertically movable lifting device adapted to move to the level of either of said supports, and of said conveyor for transferring coils between different levels or for supplying metal sheets to or receiving them from said conveyor.

16. In material handling apparatus, a movable holder for supporting a coil drum for a roll of strip material, an upper supporting means for a plurality of coil drums, a lower supporting means for a plurality of coil drums, and means for actuating said holder to transfer said coil drums from either one of the said supoprting means to the other.

17. In material handling apparatus, a holder for rotatably supporting a core for a roll of material, an upper supporting means comprising a storage space for a plurality of coil cores and inclined toward said holder, a lower supporting means comprising a storage space for a plurality of coil cores and inclined away from said holder, said holder being adapted to receive a core from one of said supporting means and vertically movable in a plane extending transversely of said supporting means to transfer said core to the other of said supporting means, and means for moving said holder from one support to the other.

18. In coil handling apparatus, a coil box that is movable vertically in a plane perpendicular to the horizontal for receiving and delivering coils in different positions, a pair of superposed coil supports between which said coil box moves, means for moving said coil box from one of said supports to the other, and means for automatically discharging a coil from said coil box as it is moved into registration with one of said coil supports.

19. In a coil handling apparatus, a movable coil box for supporting a coil while it is being wound or unwound, means for supporting a plurality of coils to be delivered to said coil box, means disposed below said first mentioned coil supporting means for receiving coils from said coil box, and means disposed below both of said coil supporting means for moving said coil box to transfer a coil from said delivering means to said receiving means.

20. In a coil handling apparatus, a movable coil box for supporting coils during rotation thereof, means for supporting coils to be delivered to said coil box, means for receiving coils from said coil box, and means operable in a vertical plane extending transversely of said coil supporting storage means for moving said coil box to receive a coil from said first-mentioned coil support and to transfer a finished coil to said receiving means.

21. Sheet metal handling apparatus comprising a mill for rolling sheet metal, superposed means adjacent said mill for storing a plurality of loaded and unloaded coil drums for delivery to and from said mill, a coil holder arranged between said support means and said mill, means for moving said coil holder from one coil support to another, and means for automatically discharging a coil from said coil holder onto one of said coil supports as it is moved into registration therewith.

22. The combination with a rolling mill of duplicate sheet metal handling apparatus on opposite sides thereof comprising superposed means for storing a plurality of loaded and unloaded coil drums for delivering strip metal to and from the mill, a coil holder arranged between said support means and said mill, and means for moving said coil holder between said supporting means.

23. Apparatus for handling strip material which is wound upon a spool or the like, comprising a storage means for loaded spools, a storage means for empty spools disposed below said first mentioned storage means, a holder disposed adjacent the forward ends of said storage means for receiving a loaded spool and rotatably supporting it until the strip material has been uncoiled therefrom, and means for moving said holder vertically in a transverse plane to deliver an empty spool to said second mentioned storage means.

JOHN T. FLAHERTY.