Aug. 20, 1935. K. C. GARDNER ET AL 2,011,810

SHEET METAL HANDLING APPARATUS

Filed March 10, 1933 4 Sheets-Sheet 1

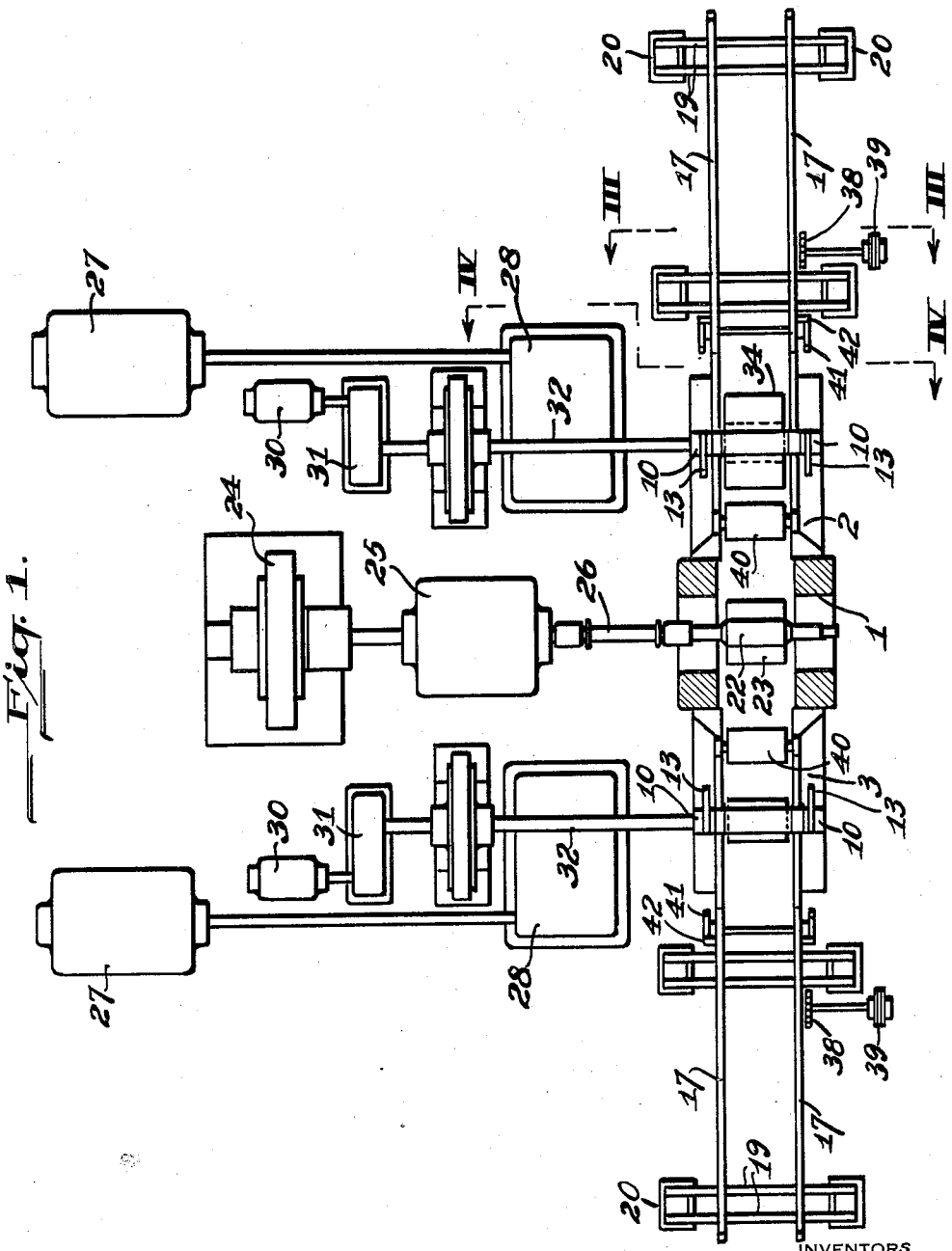

Fig. 1.

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SHEET METAL HANDLING APPARATUS

Filed March 10, 1933 4 Sheets-Sheet 2

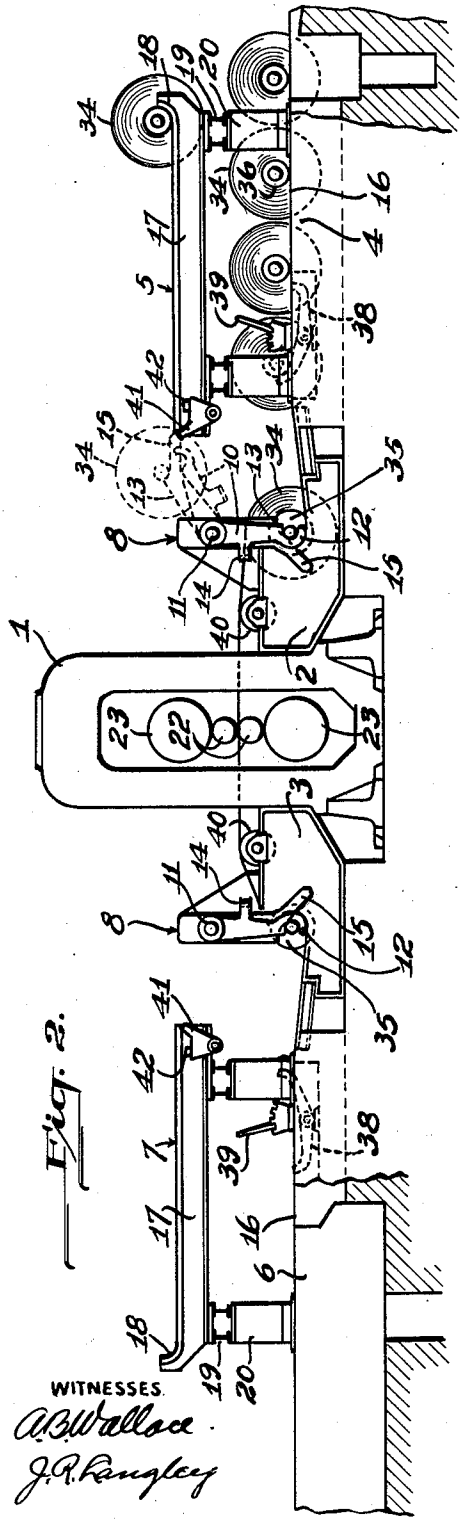

Fig. 2.

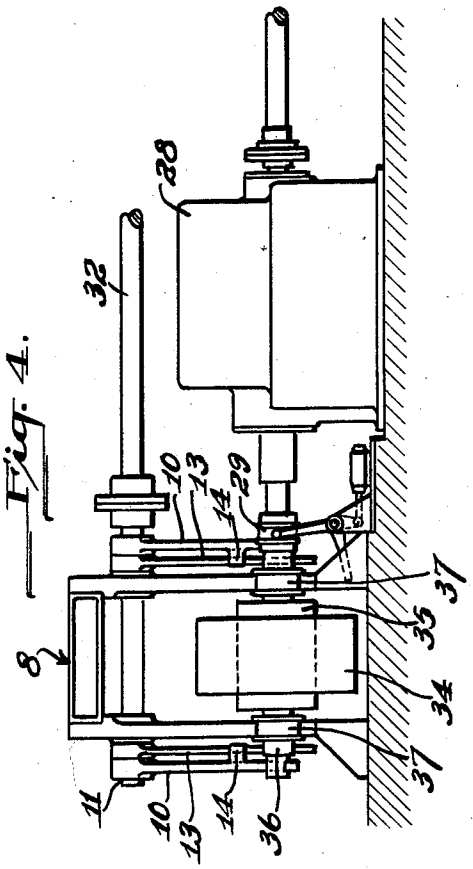

Fig. 4.

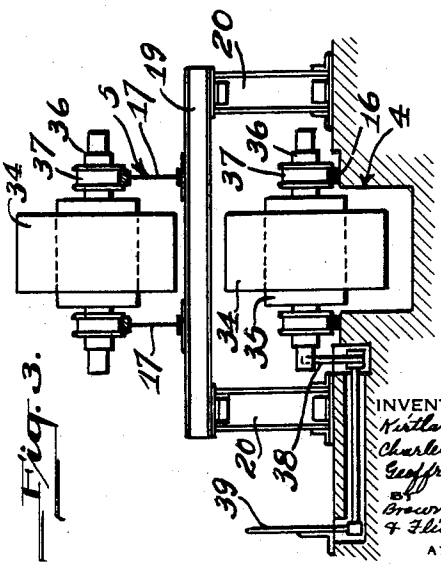

Fig. 3.

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SHEET METAL HANDLING APPARATUS

Filed March 10, 1933 4 Sheets-Sheet 3

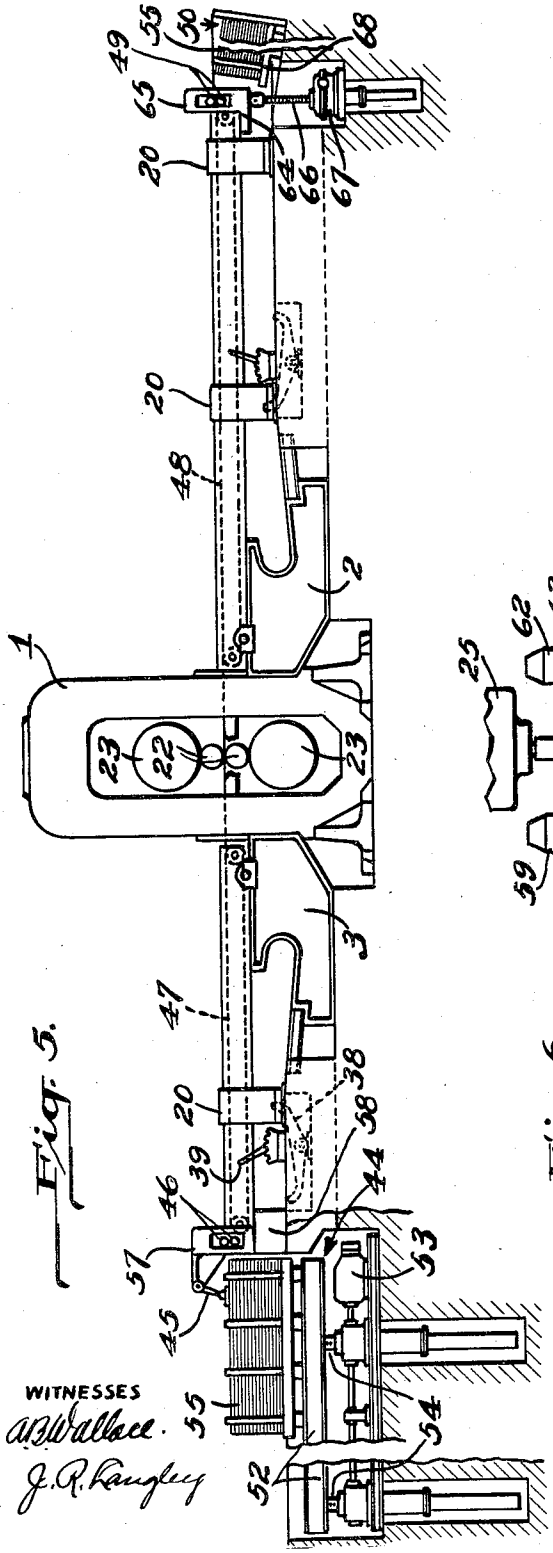

Fig. 5.

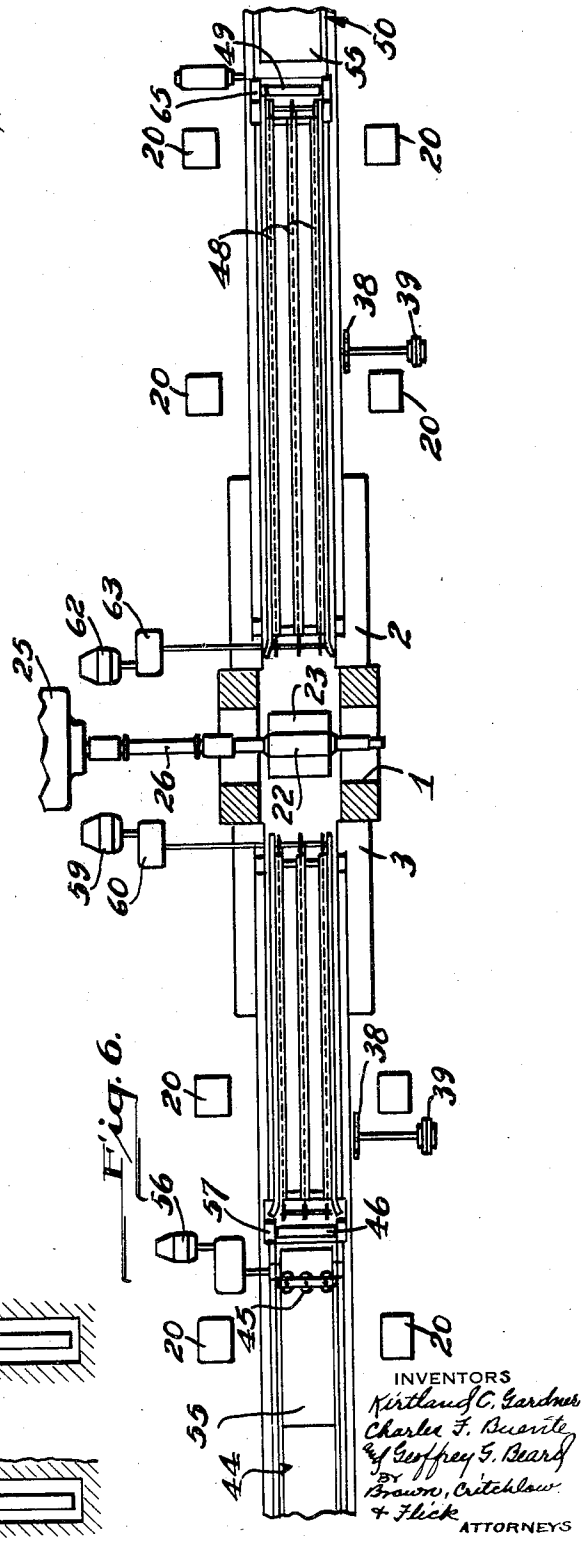

Fig. 6.

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SHEET METAL HANDLING APPARATUS

Filed March 10, 1933 4 Sheets-Sheet 4

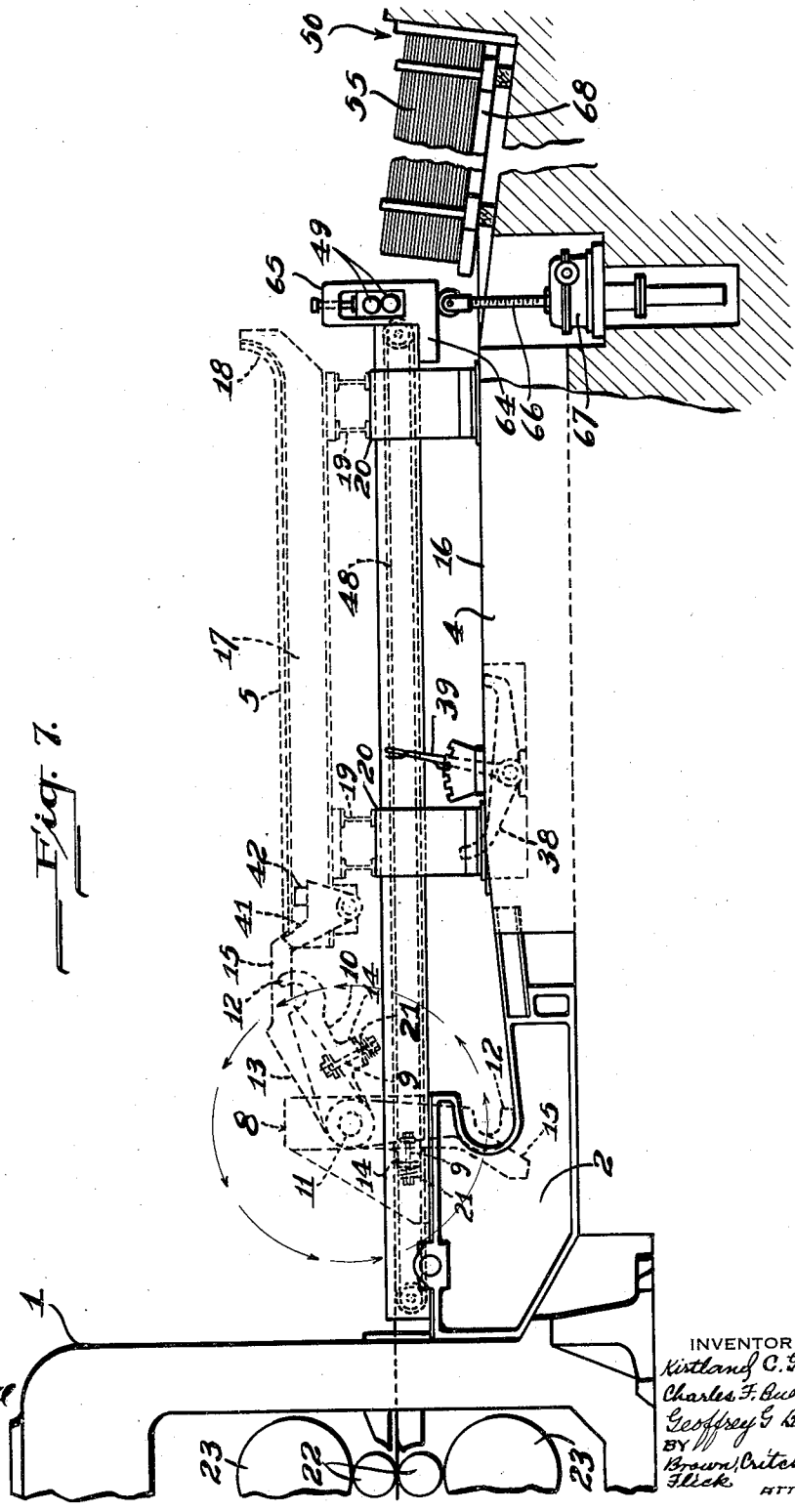

Fig. 7.

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UNITED STATES PATENT OFFICE

2,011,810

SHEET METAL HANDLING APPARATUS

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Application March 10, 1933, Serial No. 660,272

16 Claims. (Cl. 80—43)

Our 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.

One object of our invention is to provide 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 our invention is to provide simple and efficient apparatus for supplying metal sheets to rolling mills and for removing the rolled sheets therefrom for piling or storage.

A still further object of our invention is to provide an 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.

In the operation of rolling mills for sheet metal, either in the form of sheet metal strip or 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. That is, for example, if the mill is provided with apparatus for handling coils of sheet metal strip, it has been difficult, without dismantling the entire material-handling apparatus, to adapt the mill for handling metal sheets. The same has been true of mills adapted for rolling metal sheets in adapting them for rolling sheet metal strip.

In accordance with the present invention, we provide coil-handling apparatus which comprises two superposed coil supports for respectively supplying coils to the mill and for receiving completed coils therefrom. A simple and convenient transfer mechanism lifts the coils from a coil box adjacent the mill to the upper coil support. The completed coils may be removed from the latter by means of a crane or other suitable hoisting mechanism.

When the rolling mill is adapted for rolling metal sheets a portion of the coil-handling apparatus is removed and is replaced by suitable conveyors for handling metal sheets, the conveyors cooperating with certain of the remaining apparatus which has not been removed, and which is therefore common to the apparatus for handling sheet metal of both types. When it is desired to adapt the mill for rolling sheet metal strip, it is only necessary to remove the conveyors and replace certain of the mechanism for handling coils.

The advantages of an arrangement of the character described above resides in the fact that the change in material-handling apparatus that is necessary to adapt the mill for the respective forms of sheet metal requires comparatively little time and labor, and the amount of apparatus for handling both types of sheet metal is materially less than would be required if the systems were entirely independent and no parts were common thereto.

The details of our 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 coils of sheet metal strip, the mill being shown in section; Fig. 2 is a view in front elevation of the apparatus of Fig. 1, parts being shown in section; Fig. 3 is a view in vertical transverse section taken on line III—III of Fig. 1; Fig. 4 is a similar view taken on line IV—IV of Fig. 1; Fig. 5 is a view in front elevation of the mill and associated apparatus for handling metal sheets, parts being shown in section; Fig. 6 is a plan view of the apparatus of Fig. 5, the mill being shown in section; and Fig. 7 is an enlarged view of a portion of the apparatus of Fig. 5 with the coil-handling apparatus which has been removed shown in dotted lines superimposed thereon.

Referring particularly to Figs. 1 to 4, a rolling mill 1 preferably of the 4-high type and adapted for the cold rolling of 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 in the mill. Adjacent the coil box 2 is a horizontal coil support 4 and a second horizontal coil support 5 that is superposed with respect to the coil support 4. Similar coil supports 6 and 7 are provided adjacent and in alignment with the coil box 3.

Each of the coil boxes is provided with a transfer mechanism 8 for transferring coils or drums therefor from a coil box to the coil support 5 or 7, as the case may be. The transfer mechanism comprises a pair of spaced arms 10 pivoted at 11 above the coil box, extending adjacent the sides of the latter, and having hook portions 12 at the outer ends thereof for suitably engaging the trunnions of coil drums during their transfer, as will be later described.

The transfer mechanism 8 also comprises a pair of arms 13 within and adjacent the arms 10, and each of the latter has a projecting lug 14 extending in rear of the adjacent arm 13 whereby when the arms 10 are rotated in directions to lift the coils engaged thereby the arms 13 are rotatable therewith. In order to limit rel-

ative movement between the arms 10 and 13, each of the latter is connected to the cooperating lug 14 by means of a rod 9 and a spring 21. The arms 13 have integral therewith members 15 that extend at an angle thereto for a purpose to be later described.

The coil support 4, which is substantially in horizontal alignment with the coil box 2, consists of two parallel horizontal beams 16, the upper edges of which provide rails along which coils may be moved horizontally toward the coil box. The coil support 5 comprises two horizontal beams 17 that are suitably spaced to support coils thereon and are provided at their outer ends with curved portions 18 for limiting the outward movement of coils that have been transferred thereto. The beams 17 are supported upon horizontal beams 19 transverse thereto, and which in turn are supported upon relatively widely spaced vertical posts 20. The coil supports 6 and 7 are similar to the corresponding coil supports 4 and 5.

The mill 1 is provided with two relatively small working rolls 22 and two large backing rolls 23. As best shown in Fig. 1, the working rolls 22 are driven by an electric motor 24 that is connected thereto by means of intermediate gear mechanism 25 and suitable universal couplings 26.

Coils mounted in the respective coil boxes 2 and 3 are each driven by a motor 27 by means of suitable intermediate gear mechanisms 28 and a pneumatically-controlled slidable clutch 29. The transfer mechanism 8 of each coil box is driven by a motor 30, suitable intermediate gear mechanisms 31 and a shaft 32.

In the operation of the coil-handling apparatus described above, it may be assumed that coils 34 of sheet metal strip to be rolled are supplied to the outer end of coil support 4 by any suitable means, such, for example, as a crane or other suitable transfer or hoisting mechanism. In accordance with the usual practice the coils are wound upon drums 35 having trunnions 36 extending axially thereof. Each of the trunnions is provided with a cylindrical sleeve 37 having a suitable anti-friction bearing upon the trunnion, the sleeve 37 being suitably grooved to roll upon the rails of the coil supports.

By means of the rotatable sleeves 37, the coils may be moved along the several supports without rotation of the coils, the sleeves 37 rolling upon the respective rails. The innermost coil 34, as shown in Fig. 2, is prevented from rolling into the coil box 2 until released by a suitable stop mechanism 38 that is controlled by a manually operable lever 39.

When a coil 34 is in operative position in the coil box 2, the end of the strip is loosened and inserted between the working rolls 22 in any usual or suitable manner. The coil box 2 is provided with a roller 40 thereon which operates as a guide roller for the metal strip while the latter is being rolled. The sleeves 37 constitute bearing supports for the coil drums 35 during the rolling operation.

The metal strip passes through the mill 1 and is wound upon a drum 35 in the coil box 3. The metal may be rolled by passing through the mill any desired number of times, and if the number of passes is even the completed metal strip will be wound upon the drum 35 in the coil box 2.

The completed coil is then transferred from the coil box 2 to the coil support 5 by the lifting mechanism 8. The motor 30 and the intermediate mechanism are operated to rotate the arms 10 and the arms 13 therewith in a counter-clockwise direction, as viewed in Fig. 2, to lift the coil 34 to the position indicated by dotted lines.

The inclined portions 15 of the arms 13 have each engaged a pivoted latch member 41 on the respective beams 17 to rotate the latches about their pivotal supports and to open a limit switch 42. The motor 31 is brought to rest when the arms 13 have passed beyond the respective latch members 41, whereupon the latter return into position to support the outer ends of the inclined members 15.

The motor 30 is then reversed to cause the arms 10 to release the trunnions 36 of the coil drum, and the arms 10 are then returned substantially to the positions indicated by dotted lines in Fig. 2. The coil 34 thereupon rolls by gravity down the inclined track provided by the inclined members 15 and onto the coil support 5.

When the coil has been thus transferred, the motor 30 is again operated in the original direction to cause the arms 10 and 13 to complete their rotation to return them to the positions indicated by full lines, Fig. 2, in readiness for the transfer of a succeeding coil. Coils 34 are removed from the coil support 5 by any suitable means, such, for example, as a crane or other hoisting mechanism.

When the mill is operating with an even number of passes of the metal the succeeding operations are similar in all essential respects to those described above, a new coil of material to be rolled being transferred to the coil box while the previous coil of completed material is being transferred to the upper coil support 5.

During the operation of the mill with an even number of passes, it is only necessary to provide an empty coil drum 35 in the coil box 3, since the drum in the latter is never provided with a coil of completed material. Accordingly, a single drum may be employed for any number of succeeding coils on the opposite side of the mill.

In case the mill is operated 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 will be transferred by the lifting mechanism 8 to the upper coil support 5. On the other side of the mill empty drums will be supplied to the coil box 3 by the coil support 6, and the lifting mechanism 8 will operate in the manner described in connection with the lifting mechanism 8 for the coil box 2 to transfer completed coils from the coil box 3 to the upper coil support 7.

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. 5 and 6, apparatus for handling metal sheets in connection with the mill 1 will now be described. It will be noted that the coil supports 5 and 7 have been removed as have the lifting mechanisms 8 for the coil boxes 2 and 3. The rollers 40 on the coil boxes have also been removed. The coil boxes 2 and 3, the lower coil supports 4 and 6, and the posts 20 are left in position.

The apparatus for handling metal sheets comprises a piling device 44 for supplying metal sheets, a lifting device 45 for feeding sheets to

pinch rolls 46 for transfer to an endless conveyor 47, the latter supplying the sheets successively to the mill 1. On the other side of the mill, a second endless conveyor 48 conveys the rolled sheets from the mill to pinch rolls 49 to be piled on an inclined piling device 50.

The piling device 44 comprises a supporting base or platform 52 that is raised or lowered by a mechanism comprising a motor 53 that is suitably geared to vertically movable posts 54. Metal sheets 55 that are supported upon the platform 52 are removed therefrom by means of lifting mechanism 45 which is of the vacuum type and that is operated by motor 56 to transfer the sheets successively to pinch rolls 46 for transferring them to the conveyor 47.

The pinch rolls 46 are mounted in a housing 57 that is mounted on a base 58 which also supports the outer end of the conveyor 47. The inner end of the conveyor 47 is supported upon the coil box 3. The conveyor 47 is driven by a motor 59 connected thereto by reduction gearing 60.

The conveyor 48 which is driven by a motor 62 through reduction gearing 63, is supported at its inner end by the coil box 2 and at its outer end by the projecting base 64 of a housing 65 for the pinch rolls 49. The housing 65 is mounted upon a lifting mechanism comprising screw-threaded shafts or posts 66 that are raised or lowered by suitable motor operated gearing 67.

As the sheets 55 are removed from the piling device 44, the motor 53 is operated to raise the platform 52 to maintain the level of the sheets 55 substantially in horizontal alignment with the pinch rolls 46 whereby the sheets may be easily and conveniently removed from the pile and supplied to the pinch rolls 46 for delivery to the conveyor 47.

When the sheets pass through the mill 1, they are received by the conveyor 48 and are supplied to pinch rolls 49 which transfer them to the second piling device 50, the inclined base 68 of which is illustrated as stationary, although, if desired, the base may be raised and lowered in the same manner as that of the piling device 44. In the arrangement shown by way of example, however, the outer end of the conveyor 48 and the housing 65 for the pinch rolls 49, which housing supports the outer end of the conveyor 48, are adjustable vertically to maintain the outer end of the conveyor 48 and the pinch rolls 49 above the top of the pile of sheets on the piling device 50. The bearing supports for the roller 40 on the coil box 2 may provide bearing supports for the adjustable conveyor 48.

In the sheet-handling mechanism shown and described above, if it is desired that the metal have a plurality of passes, it is necessary to transfer the sheets 55 from the receiving piling device 50 to the supplying piling device 44. It will be possible, however, to provide apparatus for reversibly handling metal sheets for a plurality of passes without transfer directly between piling devices if an adjustable piling device such as the supplying device 44 is substituted for piling device 50 in order that each piling device may either supply sheets to the cooperating conveyor or receive sheets therefrom.

In case it is desired to adapt the mill 1 of Figs. 5 and 6 for rolling coils of sheet metal strip, or in other words, to restore the apparatus shown in Figs. 1 to 4, it will only be necessary to remove the conveyors 47 and 48 and the pinch roll housings 57 and 65, replace the upper coil supports 5 and 7 upon the posts 20 and replace the lifting mechanisms 8 and rollers 40. It will be noted that the posts 20 are sufficiently spaced from the coil supports 4 and 6 that when the beams 19 and the structure supported thereby are removed the conveyors 47 and 48 may be easily and conveniently placed in position or removed therefrom. It is not necessary to remove the piling devices 44 or 50 since they are sufficiently remote from the mill that they do not in any way interfere with the operation of the coil-handling apparatus.

The relative positions of the sheet metal handling apparatus and the coil-handling apparatus on one side of the mill are clearly shown in Fig. 7, in which the mill is illustrated as adapted for rolling metal sheets, the apparatus for handling the sheets being illustrated in full lines. The apparatus for handling coils that has been removed is indicated in dotted lines. By inspection of this view, it will be apparent that the adaptation of the mill for operation either for rolling metal sheets or coils of metal strip may be easily and conveniently accomplished with minimum time and labor.

The coil box and the lower coil support, together with the posts for supporting the upper coil support on each side of the mill, remain in position when the metal sheet apparatus is in position. The piling devices remain in position without in any way interfering with the operation of the coil-handling apparatus.

It will be noted that we have provided 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 both forms may be employed in connection with the same rolling mill with comparatively small expenditure of time and labor. The adapting of the mill for either form is a comparatively simple matter since the material-handling apparatus for each form of metal is adapted for cooperation with the apparatus for handling the other form. In view of the fact that certain of the apparatus is common to that for handling both forms of metal, it is only necessary to remove certain portions of the apparatus for adapting the mill to operate upon the other form of metal.

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

We claim:

1. Sheet metal apparatus comprising a mill for rolling sheet metal, a coil box in alignment with said mill for receiving coils of metal in strips, superposed coil-supporting members adjacent said coil box, the lower of said supporting members being adapted to supply coils to said coil box, and means for transferring coils from said coil box to the upper of said supporting members.

2. Sheet metal apparatus comprising a mill for rolling sheet metal, a coil box in alignment with said mill for receiving coils of metal in strips, superposed coil-supporting members adjacent said coil box, the lower of said supporting members being approximately in horizontal alignment with said coil box and adapted to supply coils thereto, and means for lifting coils from said coil box and transferring them to the upper of said supporting members.

3. Sheet metal apparatus comprising a mill for rolling sheet metal, a coil box in alignment with said mill for receiving coils of metal in strips, superposed coil-supporting members adjacent said coil box, the lower of said supporting members

being adapted to supply coils to said coil box, and hoisting means for transferring coils from said coil box to the upper of said supporting members, said hoisting means comprising a pair of arms rotatable about a pivotal support above said box and having portions for engaging the trunnions of drums for said coils.

4. Sheet metal apparatus comprising a mill for rolling sheet metal, a coil box in alignment with said mill for receiving coils of metal in strips, superposed coil-supporting members adjacent said coil box, the lower of said supporting members being adapted to supply coils to said coil box, and hoisting means for transferring coils from said coil box to the upper of said supporting members, said hoisting means comprising a pair of arms rotatable about a pivotal support above said coil box and a second pair of arms rotatable forwardly with the first pair of arms and having portions upon which said coils may travel to the upper of said supporting members from the position to which they are lifted by the first pair of arms.

5. Sheet metal apparatus comprising a mill for rolling sheet metal, a coil box in alignment with said mill for receiving coils of metal in strips, means for supplying coils to said coil box, members at an elevation above the coil box and the coil-supplying means for receiving coils from the coil box, latching mechanism on said members, means for hoisting coils from said coil box to a level from which they may be transferred to the supporting members, and means movable forwardly with said hoisting means and cooperating with said latching mechanism for supporting said coils during their transfer from the hoisting means to the receiving members.

6. Sheet metal apparatus comprising a mill for rolling sheet metal, a coil box in alignment with said mill for receiving coils of metal in strips, means for supplying coils to said coil box, members at an elevation above the coil box and the coil-supplying means for receiving coils from the coil box, latching mechanism on said members, means for hoisting coils from said coil box to a level from which they may be transferred to the supporting members, and means movable in one direction with said hoisting means and having portions adapted to be supported by said latching mechanism to provide inclined supports for causing said coils to move by gravity from the hoisting means to the receiving members.

7. Sheet metal apparatus comprising a rolling mill, two superposed coil-supporting devices, a coil box in approximately horizontal alignment with the lower supporting device, a conveyor for metal sheets that is interchangeable with the upper coil-supporting device to adapt the apparatus for handling coils of sheet metal strip or metal sheets as the case may be.

8. Sheet metal apparatus comprising a rolling mill, two superposed coil-supporting devices on each side of said mill, a piling device for sheet metal adjacent the outer ends of said coil-supporting devices, and a conveyor for sheet metal that is adapted to replace each upper supporting device when sheet metal is rolled in the mill and transferred from one piling device to the other, and said conveyor being replaced by the upper supporting device when coils of sheet metal strip are passed through the mill.

9. Sheet metal apparatus comprising a rolling mill, a coil box on each side thereof, a lower coil-supporting device in alignment with each coil box, means for supplying and receiving metal sheets beyond the outer ends of said coil-supporting devices, a removable conveyor for each side of the mill that is adapted to rest upon the coil box at one end and to be supported at its outer end when the mill is rolling metal sheets, and a removable upper coil-supporting device that replaces each conveyor when the mill is rolling sheet metal strip.

10. Sheet metal apparatus comprising a coil box, two pairs of rotatable arms that are interlocked for simultaneous movement in one direction, one pair of arms being adapted for engaging coils of strip metal for lifting them above said coil box, apparatus for receiving said coils, the other pair of arms being adapted to transfer the coils from the position to which they are elevated by the lifting arms to the receiving apparatus when the lifting arms are reversed to release the coils, and means for actuating both pairs of arms to complete their rotation into position for lifting and transferring a succeeding coil.

11. Sheet metal apparatus comprising a coil box, a pair of coil-supporting members at a level above said coil box, a pair of rotatable members for lifting coils from said coil box above the level of the coil-supporting members, a pair of rotatable arms movable forwardly with said rotatable members, latch members on said supporting members for supporting the ends of said arms when the latter have rotated through a predetermined angle, said arms having end portions for forming inclined supports for said coils when supported by said latch members and which conduct said coils to said coil-supporting members when the coils are released by the lifting members.

12. Sheet metal apparatus comprising means for supporting a coil at two different levels, a pair of rotatable members for engaging a coil and lifting it from the lower to the upper level, means for rotating said members, means for stopping said members when the coil is above the upper level, and a pair of members rotatable with the lifting members in the forward direction for engaging the upper supporting means to transfer the coil thereto by gravity when released by the lifting members, all of said rotatable members thereupon continuing their rotation in the original direction to their initial positions.

13. Sheet metal apparatus comprising means for supporting a coil at two different levels, a pair of rotatable members for engaging a coil and lifting it from the lower to the upper level, a pair of members rotatable with the lifting members and adapted to make a latching engagement with the upper supporting means, means for rotating said members, and means for stopping said members when they are in position to transfer said coil to the upper supporting means and for causing said members to continue their rotation in the original direction when the coil has been transferred from the lifting members to the upper supporting means.

14. The combination with a rolling mill of duplicate sheet metal handling apparatus on opposite sides thereof comprising superposed means for storing a plurality of coil drums for delivering strip metal to and from the mill, a coil holder arranged between the mill and said storing means to receive a coil drum from one of said storing means, and means for moving a coil drum from said holder to the other of said storing means.

15. The combination with a rolling mill of a convertible apparatus for delivering to and receiving from the mill metal strips in both coil and

sheet form, said apparatus comprising means for supporting the coils which is adapted to receive and also support a demountable conveyor for handling sheets, and a removable sheet conveyor adapted to be mounted on a part of said coil supporting means.

16. Sheet metal apparatus comprising a mill for rolling sheet metal, superposed coil supporting members at one side of the said mill for supporting a plurality of coils at different elevations, a coil box disposed between the mill ends of said supports and the mill for supporting a coil while the material thereon is being worked upon by the mill, and means operable between the level of said supports for transferring coils from one to the other.

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