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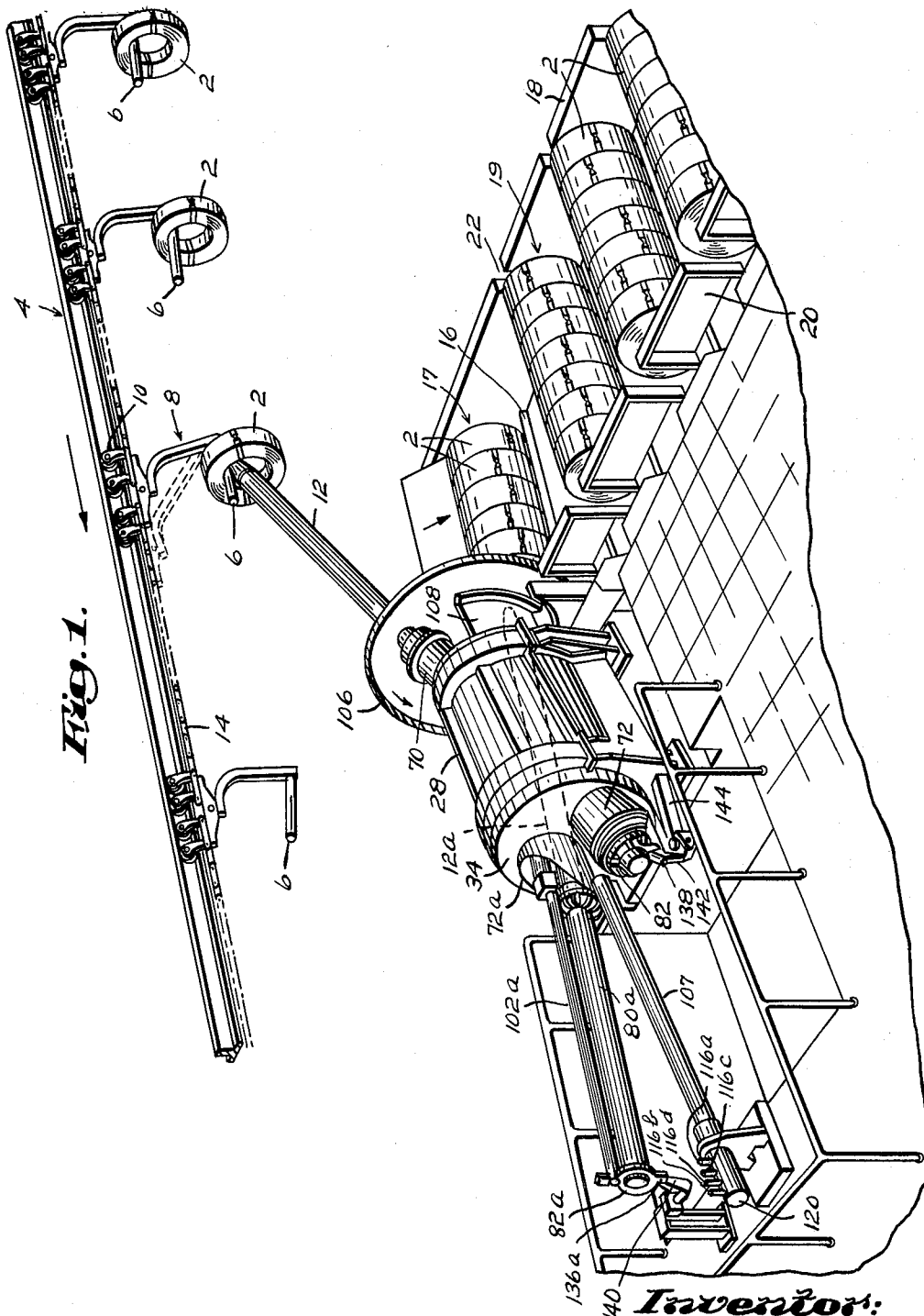
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3,240,356

COIL HANDLING APPARATUS

Filed May 17, 1962

7 Sheets-Sheet 1



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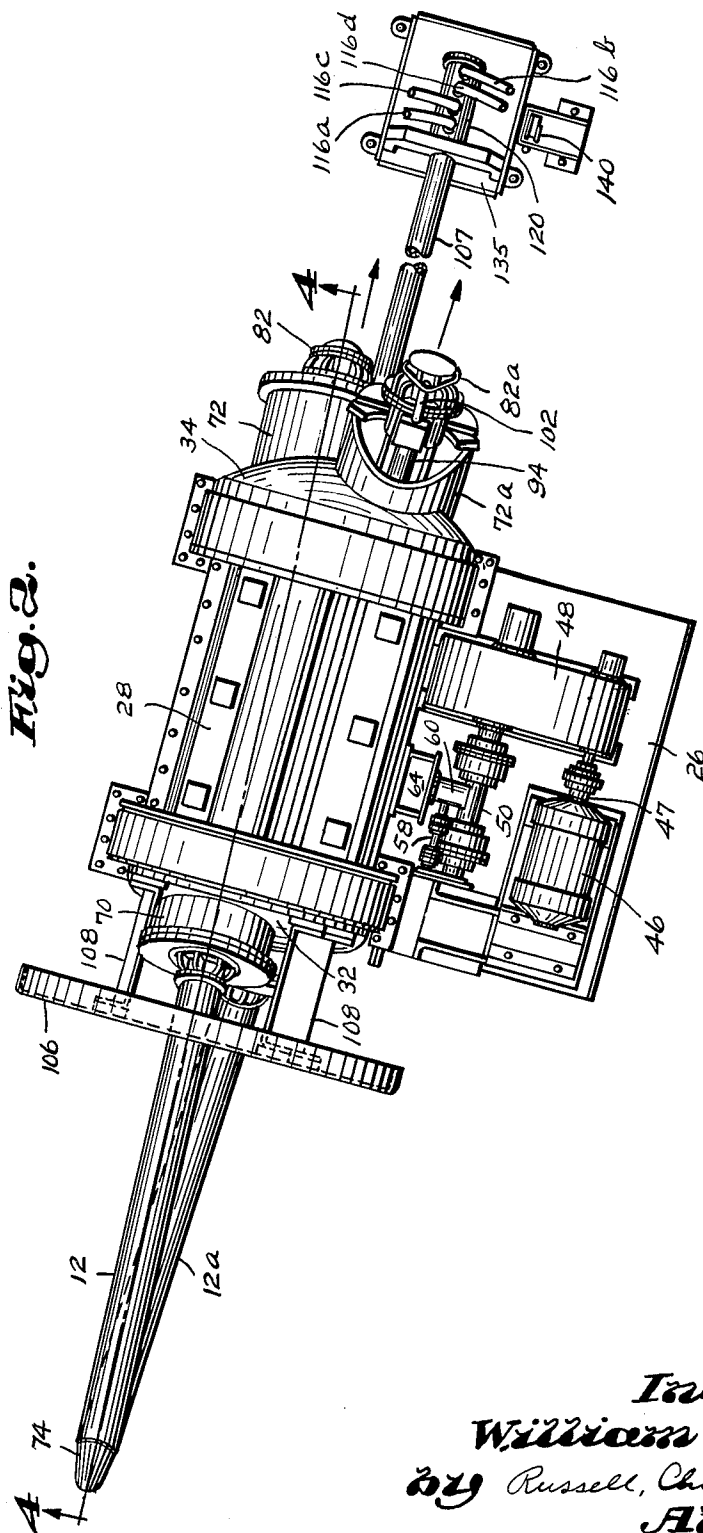
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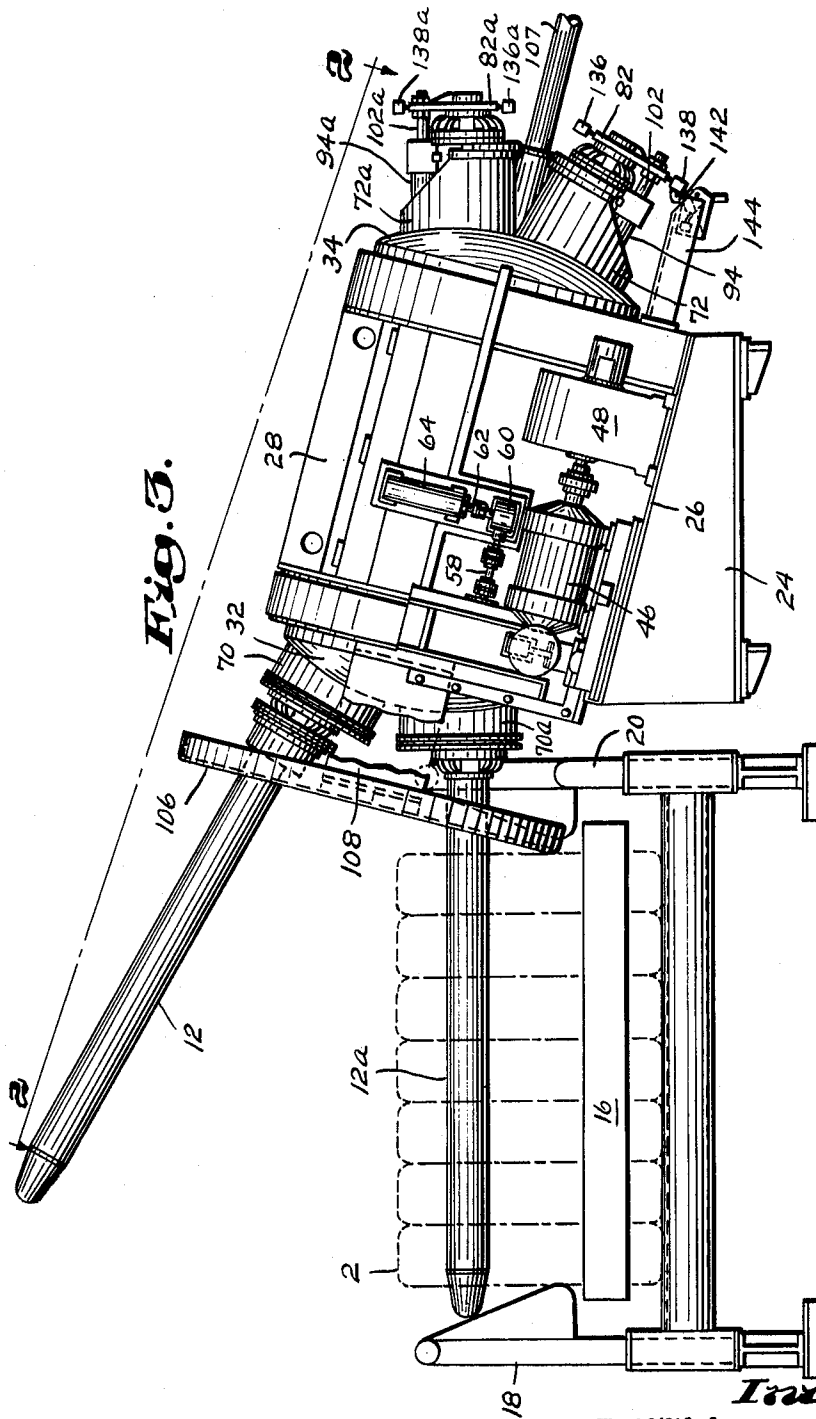
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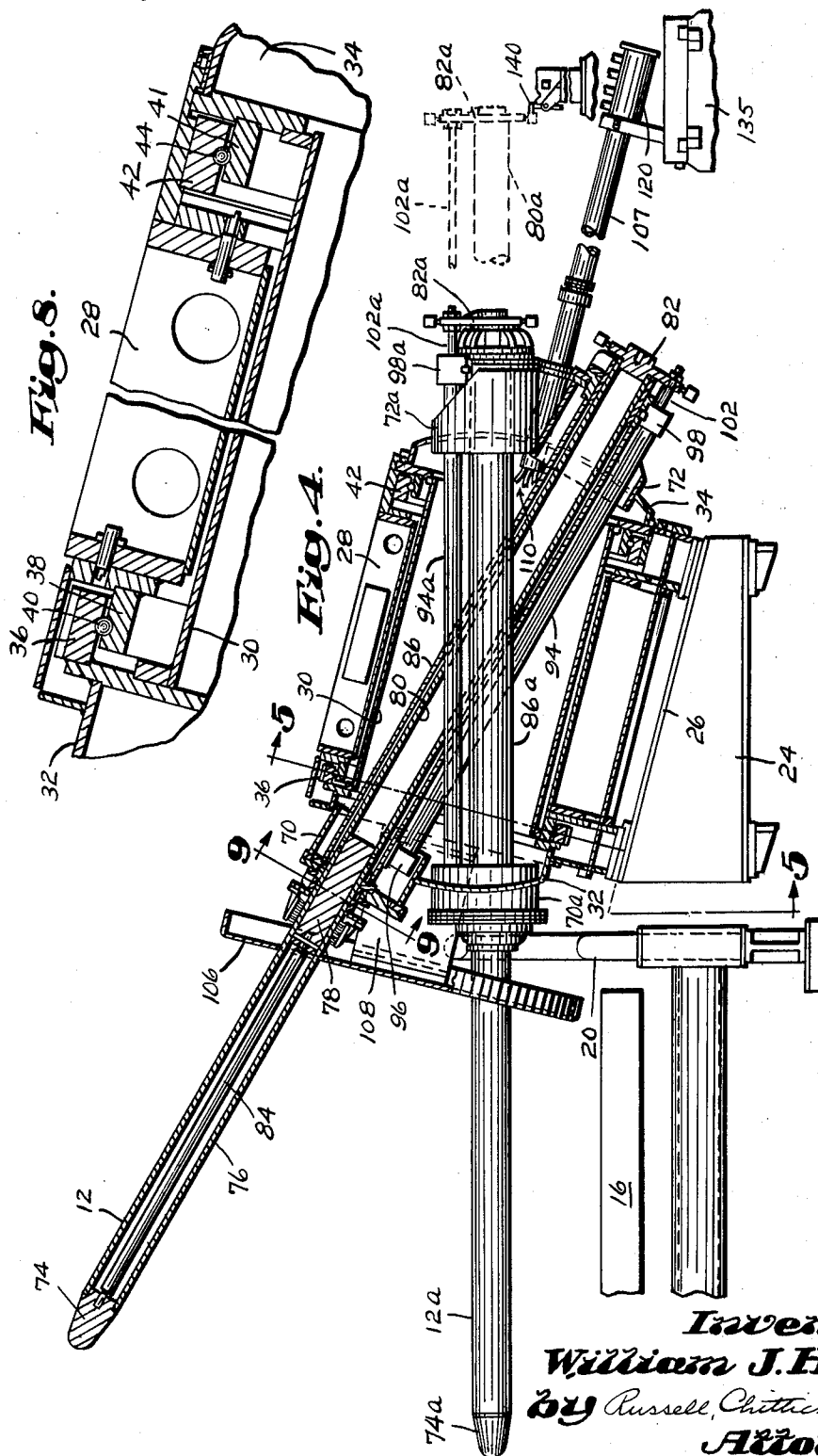
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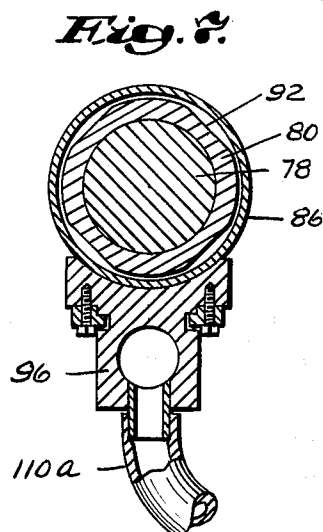
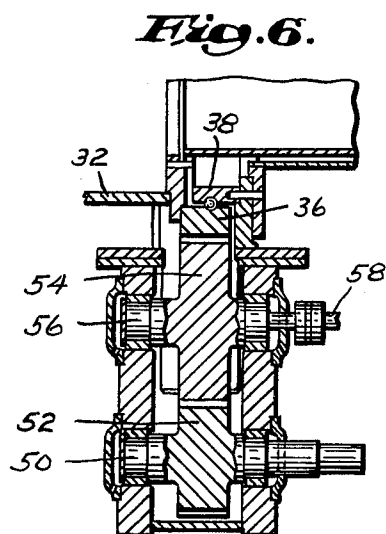
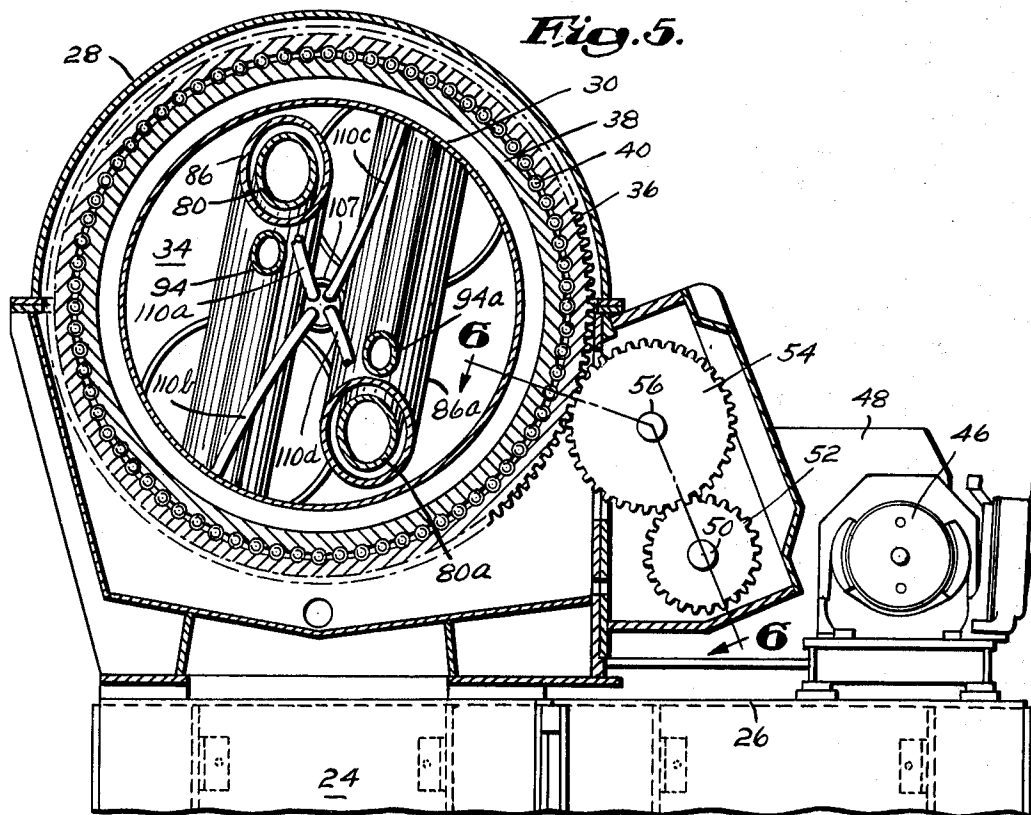
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COIL HANDLING APPARATUS

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COIL HANDLING APPARATUS

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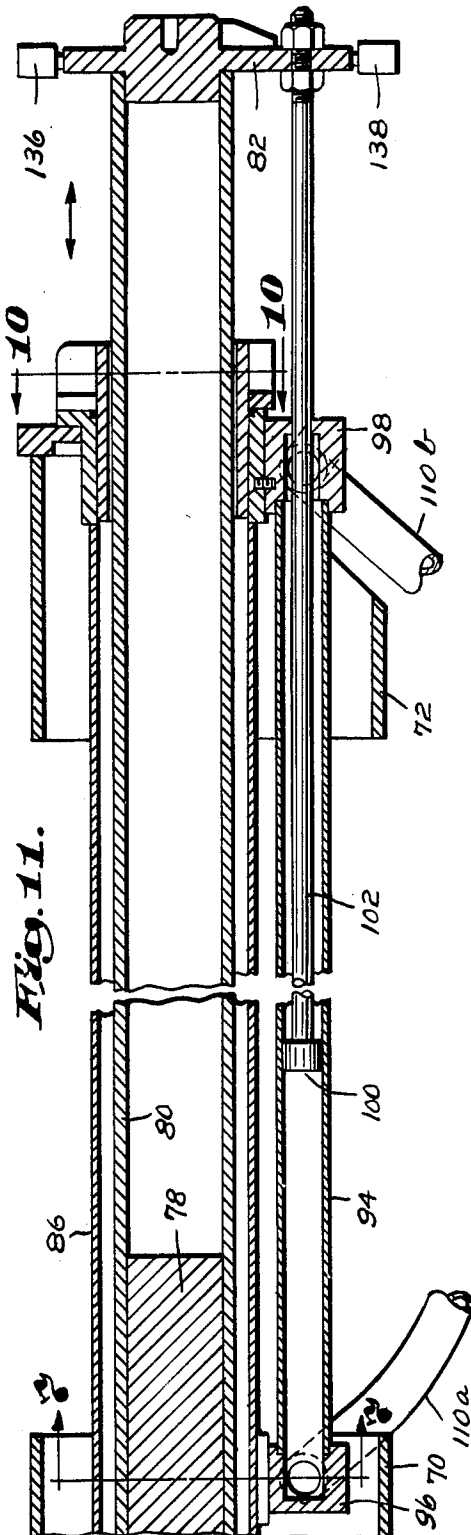


Fig. 10.

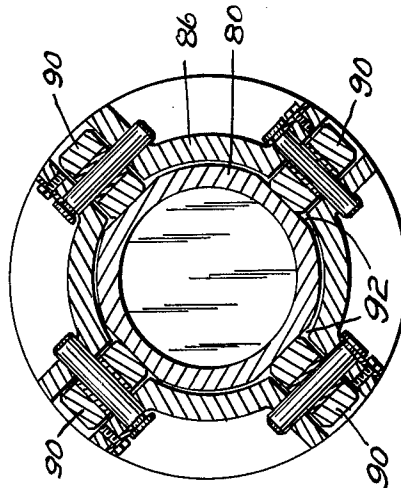
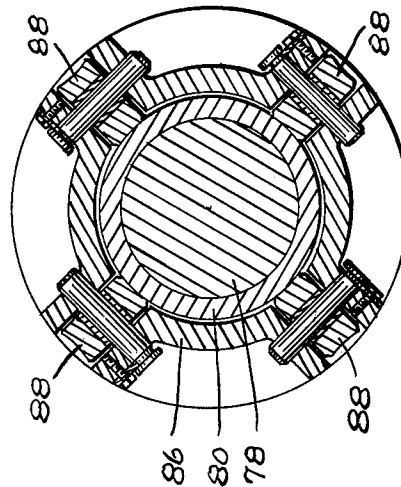


Fig. 9.



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Fig. 12.

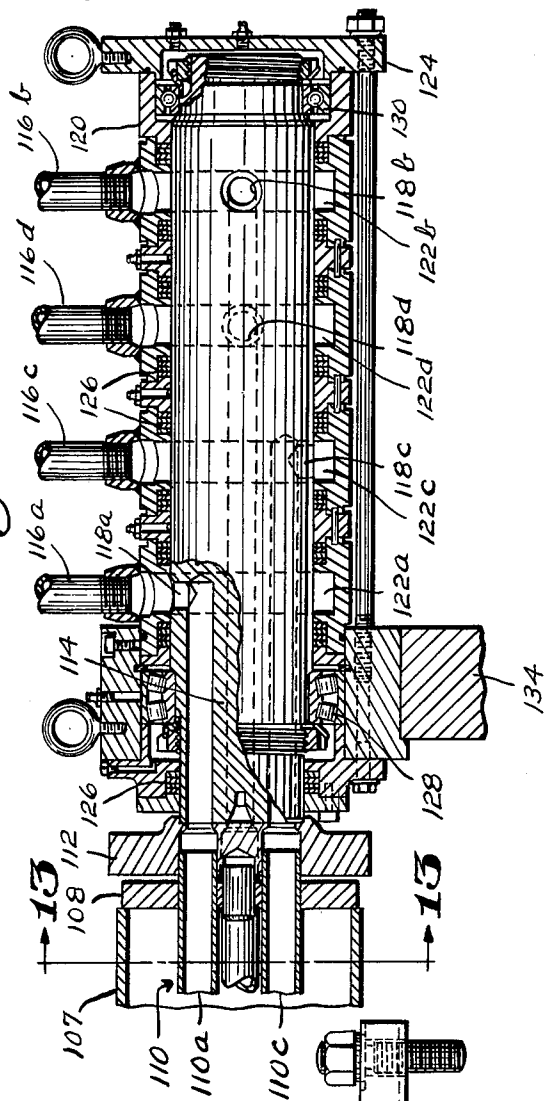
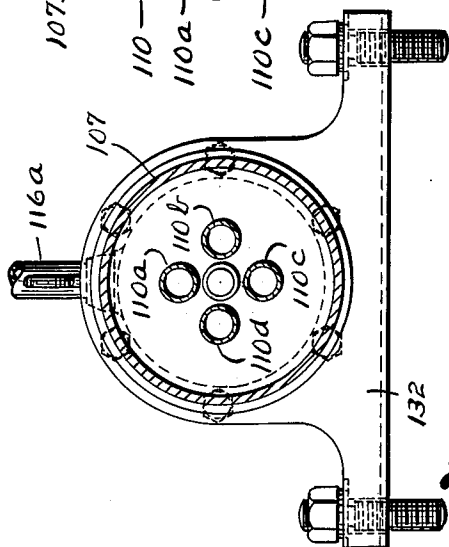


Fig. 13.



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COIL HANDLING APPARATUS

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10 Claims. (Cl. 214—1)

This invention relates to material handling and is particularly concerned with the handling of coils of rod or wire following the coiling operation in a laying or pouring reel in a rod mill.

The customary procedure as the coils leave the laying or pouring reels in succession on a conveyor is to up-end each coil so that it may be picked up by one of the hooks of an overhead conveyor which will then carry the coil to a storage position or other intermediate handling station.

In some cases, it is desirable to assemble a group of coils in standing side-by-side position, which group is then advanced to a compacting station where the coils are pressed together to reduce their volume and, when so compressed, are banded together for ease in subsequent handling.

The present invention has been designed to collect a plurality of successive coils on a collecting bar as they are brought along by the conveyor. Then, when the proper number of coils has been collected on the collecting bar, the bar is shifted to a lower position where the coils will be deposited side-by-side on a conveyor or other support. When the coils are in this new deposited position, the collecting bar is withdrawn from the coils so that they are free to be moved to a subsequent station, such as, for example, the compacting position. The bar is then returned to its original elevated position where it will pick up another group of coils and repeat the previous operation.

In order that all of the coils may be continuously successively removed from the hook conveyor, the machine of the present invention is provided with two collecting bars which act alternately to collect the coils from the conveyor. As soon as the upper bar has collected its quota of coils and is being moved downwardly to the discharge position, the other bar is ascending and moving to extended position to be ready to intercept the next coil coming along on the hook conveyor.

The machine constituting the present invention may be operated manually through the actuation of switches under the control of the operator, or it may function under automatic controls with an operator standing by to override the automatic controls should occasion arise.

These and other objects of the invention will be more fully understood as the description proceeds with the aid of the accompanying drawings in which:

FIG. 1 is a perspective view of the machine in operation. In this view a collected group of coils has just been deposited on a conveyor by the lower bar and the upper bar is in position to collect another group of coils as they come along one by one on the hook conveyor;

FIG. 2 is a plan view of the machine as seen along the line 2—2 of FIG. 3;

FIG. 3 is a side elevation of the machine and conveyor on which a group of coils has just been deposited;

FIG. 4 is a view generally in section taken on the line 4—4 of FIG. 2;

FIG. 5 is a section taken on the line 5—5 of FIG. 4;

FIG. 6 is a section taken on the line 6—6 of FIG. 5;

FIG. 7 is a section taken on the line 7—7 of FIG. 11;

FIG. 8 is an enlarged view of the upper part of FIG. 4;

FIG. 9 is an enlarged section taken on the line 9—9 of FIG. 4;

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FIG. 10 is a section taken on the line 10—10 of FIG. 11;

FIG. 11 is an enlarged sectional view corresponding generally to the righthand end of the upper bar shown in FIG. 4;

FIG. 12 is a sectional view of the rotary joint whereby hydraulic fluid is supplied to the hydraulic cylinders and pistons; and

FIG. 13 is a section on the line 13—13 of FIG. 12.

Referring first to FIG. 1, the invention is designed to collect a succession of coils 2 as they come along an overhead conveyor 4. Each coil is carried by an individual hook 6 in conventional manner. When each hook 6 reaches the position 8, the hook, by conventional means, is swung to the rear as the carriage 10 continues to advance. The hook is tilted at a sufficiently steep angle so that the coil thereon slides off the hook and onto the bar 12 of the coil handling apparatus which constitutes the present invention. The steady forward movement of carriage 10 through operation of chain 14 and the tilting of each hook 6 at position 8 to cause the coil to slide off is all conventional in the art and need not be described in further detail. Suffice it to say that, when position 8 is reached by each advancing hook 6, the bar 12 will be positioned to receive the freed coil.

After bar 12 has received a proper number of coils, which in the illustration is shown as seven, the housing carrying bar 12 is rotated through 180 degrees which causes the bar 12 to swing down to a horizontal position to deposit the seven collected coils 2 in side-by-side position on a conveyor 16 at position 17.

While the bar 12 is descending, another bar 12a, which is shown in withdrawn position within the housing in FIG. 1, is advanced through the housing to be in fully extended position at the completion of 180-degree rotation. Bar 12a will then be in the same position as bar 12 in FIG. 1 and ready to receive the next group of oncoming coils 2 from the hooks 6.

As soon as the coils 2 are resting on conveyor 16 at position 17, the bar 12 is withdrawn by hydraulic means to assume the withdrawn position previously occupied by bar 12a in FIG. 1. This frees the withdrawn bar 12 from the coils so that the conveyor may advance the coils 2 deposited at position 17 to position 19, freeing the space at 17 to receive the next batch of descending coils 2. As soon as the now upper bar 12a is loaded and ready to descend, the housing can be rotated. The coils on upper bar 12a descend to receiving position 17 on the conveyor and the withdrawn lower bar 12 will, during rotation of the housing, be again extended to a position as in FIG. 1 to intercept the first coil of the next batch of coils.

The conveyor has side walls 18 and 20 with vertical openings 22 therein aligned with the coils so that, if desired, a lifting fork may be inserted to take them away to another station.

Referring now to FIGS. 2, 3 and 4, the invention may be seen in more detail. A supporting frame 24 having a sloping upper surface 26 carries a generally cylindrical housing 28 suitably braced to carry the loads involved. Within housing 28 is a rotatable support shown in the form of a cylinder 30. Cylinder 30 has affixed thereto a front header 32 and a rear header 34. Surrounding the front end of cylinder 30 and affixed thereto is a ring gear 36 (see FIGS. 4 and 8), the inner side of which forms a bearing surface cooperating with an inner race 38 and bearings 40. The inner race is appropriately secured to the housing 28.

The rear end of cylinder 30 has mounted thereon a cylindrical race 41 which cooperates with an outer race 42 carried by housing 28 and bearings 44 therebetween.

By these means in which the rotatable and fixed races form annular bearings, it will be apparent that cylinder 30 is rotatable within the housing.

Mechanical rotation of the housing is achieved in the following manner: Referring to FIGS. 2, 3, 5 and 6, a motor 46 drives through shaft 47 to reduction gear 48 to shaft 50 having thereon gear 52 which drives gear 54 carried by shaft 56. Gear 54 in turn drives the large ring gear 36 which is mounted on the cylinder 30.

As shown in FIGS. 2, 3 and 6, shaft 56 has an extension 58 which drives a pair of bevel gears (not shown) in housing 60 to drive shaft 62 of limit switch assembly 64. The switching can be arranged according to well known procedures so that, after motor 46 has been put in operation, manually or automatically, and cylinder 30 has rotated 180 degrees, the motor circuit will be broken and the cylinder will come to a halt at a constant position. Through other conventional means which need not be described, a timer may be utilized to put motor 46 into operation at set intervals which will agree with the advance of conveyor 4.

The headers 32 and 34 integral with cylinder 30 support a pair of coil collecting bars previously mentioned and referred to as bars 12 and 12a. These bars are identical and are actuated by identical means.

As can be seen in FIG. 4, two short cylindrical supports 70 and 70a spaced 180 degrees apart extend through and are affixed to header 32. At the rear end of cylinder 30 are two other short cylindrical supports 72 and 72a affixed to header 34 and spaced 180 degrees apart, but not in the same plane as elements 70 and 70a. Supports 70 and 72 act to carry bar 12 in longitudinal sliding engagement, while supports 70a and 72a act to carry bar 12a in similar sliding engagement. The supports are so positioned on the headers that the two bars 12 and 12a pass each other within cylinder 30 in the manner shown.

The bar 12 comprises a tip 74, tubular element 76, and a core 78 on which is positioned both the end of element 76 and a rear tube 80. Tube 80 is closed at its rear end by plate 82. An internal tie rod 84 holds the outer parts of bar 12 tightly together. The bar 12, running from the tip 74 to the plate 82, is a strong integral cylindrical member capable of carrying the loads imposed thereon. The construction of the other bar 12a is in every way the same as that of bar 12.

In order that bar 12 may be moved back and forth readily, the supports 70 and 72 carry a cylindrical housing 86 having at its forward end four bearings in the form of rollers 88 spaced 90 degrees (see FIG. 9) and at its rear end four rollers 90 spaced 90 degrees (see FIG. 10), all of which rollers engage the tube 80. It will be observed in FIG. 10 that the tube 80 is flattened over its length as at 92 at four positions 90 degrees apart and that the rollers 90 ride on these flattened areas. This is to prevent rotation of bar 12 within its supports.

Paralleling housing 86 is an hydraulic cylinder 94, the forward end of which is affixed to housing 86 at 96 and the rear end affixed to the housing at 98. Within hydraulic cylinder 94 (see FIG. 11) is a piston 100 and piston rod 102, the end of which is connected to an extension 104 of plate 82. Thus as piston rod 102 may be caused to move back and forth within cylinder 94 so will the bar 12 be caused to move back and forth within housing 86 and cylinder 30.

A similar hydraulic cylinder 94a is associated with cylindrical housing 86a and the piston rod 102a is connected to plate 82a in the same manner to move the bar 12a in the same manner as bar 12 is moved.

A cylindrical shield 106, normal to the axis of cylinder 30, is mounted on header 32 by two plates 108 spaced 180 degrees apart (see FIG. 2). This shield is for the purpose of limiting the movement of the coils 2 along bars 12 and 12a. The length of hydraulic cylinders 94 and 94a is such that when their related pistons have been moved a full stroke to the right, as viewed in FIG. 10,

the tip 74 of bar 12 and tip 74a of bar 12a will have been retracted to positions at or just beyond the outer surface of shield 106 and in this way be completely freed from the coils 2 after they have been deposited on the conveyor 16 at the position 17 shown in FIG. 1.

The actuation of the pistons in the hydraulic cylinders 94 and 94a is achieved in the following manner: A tube 107 in axial alignment with the axis of cylinder 30 is affixed to rear header 34. Thus as cylinder 30 rotates so does tube 107. Referring to FIGS. 12 and 13, it can be seen that tube 107 terminates in a header 108, which header supports four pipes, generally referred to as 110 and individually numbered 110a, 110b, 110c and 110d. These pipes extend the length of tube 107 and beyond rear header 34 and rotate with tube 107. The right-hand ends of pipes 110 extend through the header and make liquid-tight connection in corresponding holes in a circular plate 112 which is integral with a cylindrical member 114 which forms a rotating connection with four sources of hydraulic pressure 116a, 116b, 116c and 116d. There are four parallel passages through member 114 which are axially aligned with the pipes 110a, 110b, 110c and 110d, and these passages have been correspondingly numbered in FIG. 12. At the ends of each of the passages 110a, 110b, 110c and 110d in member 114 are readily extending passages 118a, 118b, 118c and 118d, each of which leads to a circumferential groove in a non-rotatable cylindrical housing 120. The grooves are numbered 122a, 122b, 122c and 122d.

By this construction, regardless of the angular position of the tube 107, hydraulic pressure can be supplied to the various pipes 110a, 110b, 110c and 110d through the related pipes 116a, 116b, 116c and 116d. The hydraulic fluid pressure is under control of conventional valving mechanisms (not shown) which may be actuated manually or automatically, as preferred.

Leakage of fluid between the housing 120 and member 114 is prevented by means of a plate 124 closing the end of housing 120 and a series of packing rings 126 spaced at numerous intervals along member 114. To facilitate rotation of the member 114 within the housing, bearing assemblies 128 and 130 are provided.

The housing 120 may be supported in any convenient manner, such as bracket 132 mounted on an intermediate member 134 which rests in turn on a supporting base 135.

At the other end of the tube 107 within cylinder 30 are four pipes which radiate outwardly from pipes 110a, 110b, 110c and 110d to connect with the ends of the two hydraulic cylinders 94 and 94a. The pipes 110a and 110b connect with opposite ends of cylinder 94 and the pipes 110c and 110d connect with opposite ends of cylinder 94a. Details of the cylinder 94 are shown in FIG. 11. By this arrangement, as hydraulic pressure is alternately supplied to the pipes 110a and 110b, the piston 100 and attached bar 12 will be caused to slide back and forth through the rotatable cylinder 30 and the associated housing 86. Similarly, as hydraulic fluid is alternately supplied to pipes 110c and 110d leading to hydraulic cylinder 94a, the bar 12a can be caused to move back and forth through its housing 86a in like manner.

The operation of the unloader is as follows: Assume that the starting position is the same as that shown in FIG. 1, in which the bar 12 is in up extended position ready to receive a group of coils 2 and bar 12a is in retracted position. Assume also that the unit is to be operated manually. The operator does nothing until the preselected number of coils 2 have been deposited on bar 12. In the present example, seven such coils will be placed thereon. The operator then closes a switch which starts motor 46 which, through the gearing, causes cylinder 30 to rotate counterclockwise, as viewed in FIG. 1, and clockwise, as viewed in FIG. 5. As rotation starts, the operator throws the valve connected with the source of hydraulic pressure which will admit fluid to pipe 110d.

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This will move piston rod 102a of cylinder 94a forwardly and thus commence to drive bar 12a to extended position. Thus, while cylinder 30 is rotating through 180 degrees, bar 12a will be progressively extended so that by the time 180-degree rotation is completed bar 12a will then be in the same position as bar 12 was originally. This 180-degree rotation and extension of bar 12a occurs in a time interval less than it takes the next coil 2 to advance to the discharge position 8.

With bar 12a now in the up position, a new group of seven coils will be deposited thereon. During this interval, the original seven coils 2 which have just been deposited on conveyor 16 at position 17 by the descending bar 12, are freed of bar 12 through operation of valve mechanism under control of the operator which causes hydraulic pressure to flow into the forward end of hydraulic cylinder 94 to drive piston rod 102 and bar 12 to the rear. As soon as bar 12 has been fully retracted, the operator then throws a switch which puts conveyor 16 into operation to advance the now-deposited group of seven coils at station 17 one position along the conveyor to station 19. Thus the position below the raised bar 12a is now open to receive the next group of seven coils.

It might be pointed out that rotation of the cylinder 30 and bars 12 and 12a is preferably automatically limited to 180 degrees through operation of limit switch 64 which is in timed relation with the ring gear 36.

It will be understood that the speed of rotation of cylinder 30 through 180 degrees is suitably timed with respect to the advancing speed of conveyor 4 so that the bar swinging upwardly and simultaneously being extended can reach loading position before the arrival of the next coil.

Actuation of the unloader may, of course, be accomplished automatically, if desired. To this end, the plates 82 and 82a on the rear ends of bars 12 and 12a may have oppositely extending switch engaging arms 136 and 138 and 136a and 138a. When the horizontally disposed bar reaches fully retracted position, the arm 136 or 136a, as the case may be, engages a lever 140 which, through conventional electrical means, will shut off the hydraulic pressure then being supplied to the related hydraulic cylinder and will, after a suitable time delay, start motor 46 to commence rotation of cylinder 30 to extend bar 12a as it is swinging around toward up position. When bar 12a has moved to extended position, the stop 138a will come into engagement with an arm 142 mounted on a fixed bracket 144 (see FIG. 1) at the rear of housing 28. This acts to shift the hydraulic valves again. Hydraulic fluid now operates on cylinder 94 of bar 12 which has just deposited coils 2 on the conveyor at position 17. This causes automatic retraction of the now horizontal bar 12 until it has assumed the position of bar 12a shown in FIG. 1 and its arm 136 has encountered the control actuating lever 140. Timing mechanism is included which delays closing of the motor circuits until seven coils have been deposited on the up bar. After the expiration of this time period, motor 46 starts and the unit is rotated again through 180 degrees to deposit the new collected group of coils at the empty position 17 of the conveyor and simultaneously the retracted down bar is again extended in upward position to receive the next group of oncoming coils.

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

I claim:

1. Coil handling apparatus comprising two bars whose axes cross but do not intersect each other, an annular bearing with fixed and rotatable races supporting both bars therewithin, means for rotating both bars about an intermediate axis that passes between but does not intersect either bar, and other means for moving each bar axially.

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2. Coil handling apparatus as set forth in claim 1, and means for stopping rotation of said supporting means when one bar is substantially horizontal and the other slopes upwardly.

3. Coil handling apparatus as set forth in claim 1, the means for moving each bar axially being operative while the bars are rotating.

4. Coil handling apparatus for collecting a succession of coils from a traveling hook conveyor comprising a rotatable annular support having a sloping axis, two bars carried by and extending through said support and radiating symmetrically away from said axis starting at a point within the longitudinal confines of said support, said bars being diametrically opposite each other at all points along said axis, the position of said bars with respect to said axis being such that when one bar is in upper position to collect coils the other bar will be substantially horizontal, means for retracting the lower bar after it has reached horizontal position to free the coils thereon, and means for causing said lower bar to move from retracted lower position to extended upper position while the support is rotating 180 degrees to move the upper bar with coils thereon to the lower horizontal position.

5. Coil handling apparatus comprising a rotatable support carried by spaced annular bearings, two non-parallel bars carried by said support and having portions located within said bearings, said bars having their axes diverging from both ends of said support, said bars passing each other within said support and between said bearings, means for selectively moving said bars axially with respect to said support whereby each bar in turn may be retracted while the support is stationary and then extended while the support is rotating through 180 degrees.

6. Coil handling apparatus comprising a rotatable tubular support having its axis of rotation sloping upwardly, means comprising spaced annular bearings for intermittently rotating said support 180 degrees in the same direction, two symmetrically disposed non-parallel bars extending into said support and within said bearings, means associated with said support for mounting said bars in axially movable relation thereto, fluid pressure actuator means connected to each bar and said support whereby each bar may be selectively moved in an axial direction with respect to said support.

7. Coil handling apparatus for collecting a succession of coils from a traveling hook conveyor comprising a rotatable support having a sloping axis and mounted on annular bearings carried by a fixed base, means for rotating said support in 180° steps about said axis, first and second bars each carried by said support and positioned within said annular bearings, said bars being on opposite sides of and radiating away from said axis and being diametrically opposite each other at all points along said axis, means for moving said bars axially back and fourth with respect to said support from an extended to retracted position in timed relation to the angular position of said support, a conveyor immediately adjacent said rotatable support, the positions of said first bar with respect to said axis, support and conveyor during each 360° rotation of said support being as follows: with the support stationary, the first bar will be extended in upper sloping position to collect coils from the traveling hook conveyor, then after 180° rotation of said support, said first bar will be horizontal immediately above said conveyor, then after said first bar has been retracted by said bar moving means said coils collected on said first bar will be deposited on said conveyor, then while said rotatable support is being rotated through the next 180° said first bar will be moved by said bar moving means from retracted horizontal position to original extended upper sloping position, said second bar duplicating the movements of said first bar with respect to the angular position of said support, and means for moving said conveyor and coils deposited thereon after retraction of the coil carrying bar to a position clear

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of the coils collected on the other bar as the other bar with coils thereon descends from upper sloping position to horizontal position over said conveyor.

8. Coil handling apparatus as set forth in claim 7, said annular bearings being spaced and comprising fixed and rotatable races, said support being carried by the rotatable races, and axially spaced bar bearings associated with said support for facilitating axial movement of said bars.

9. Coil handling apparatus as set forth in claim 7, said means for moving said bars axially comprising for each bar a fluid actuated cylinder and piston unit, one of which is fixed with respect to said support and the other is fixed to said bar, and means for selectively supplying fluid under pressure to said units to cause the required axial movement of said bars.

10. Coil handling apparatus as set forth in claim 7, said means for moving said bars axially comprising for each bar a fluid actuated cylinder and piston unit, said bearings being spaced and comprising fixed and rotatable races and having said bars and said cylinder and piston

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units extending through said races, and means for supplying fluid under pressure to said units comprising a plurality of pipes connected to the ends of said cylinders and rotatable therewith and fluid tight rotatable pipe joints aligned with the axis of said support whereby fluid under pressure can be supplied to each pipe selectively to move each said bar axially.

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