

July 4, 1967

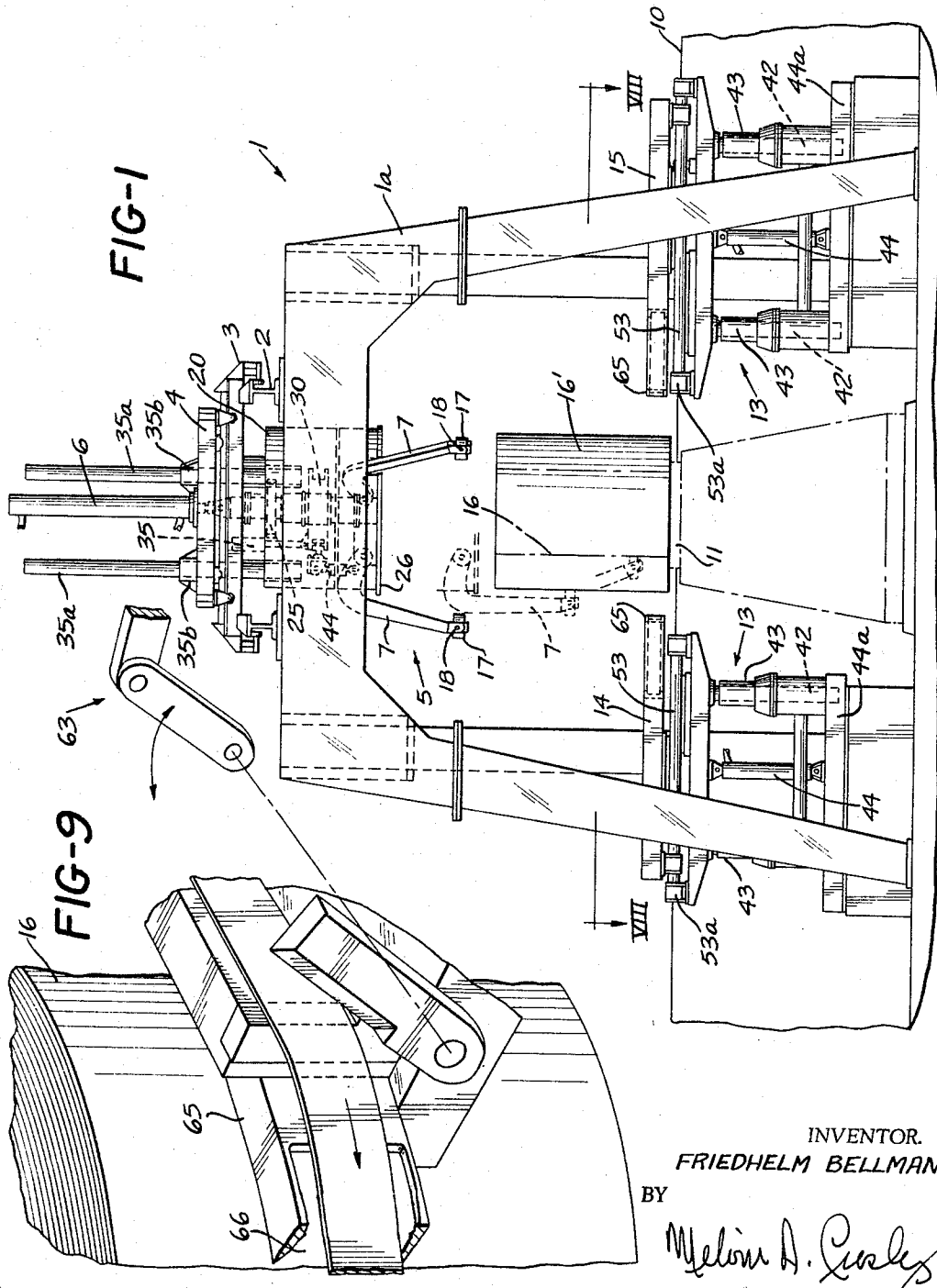
F. BELLMANN

3,329,083

METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

Filed Sept. 13, 1965

7 Sheets-Sheet 1



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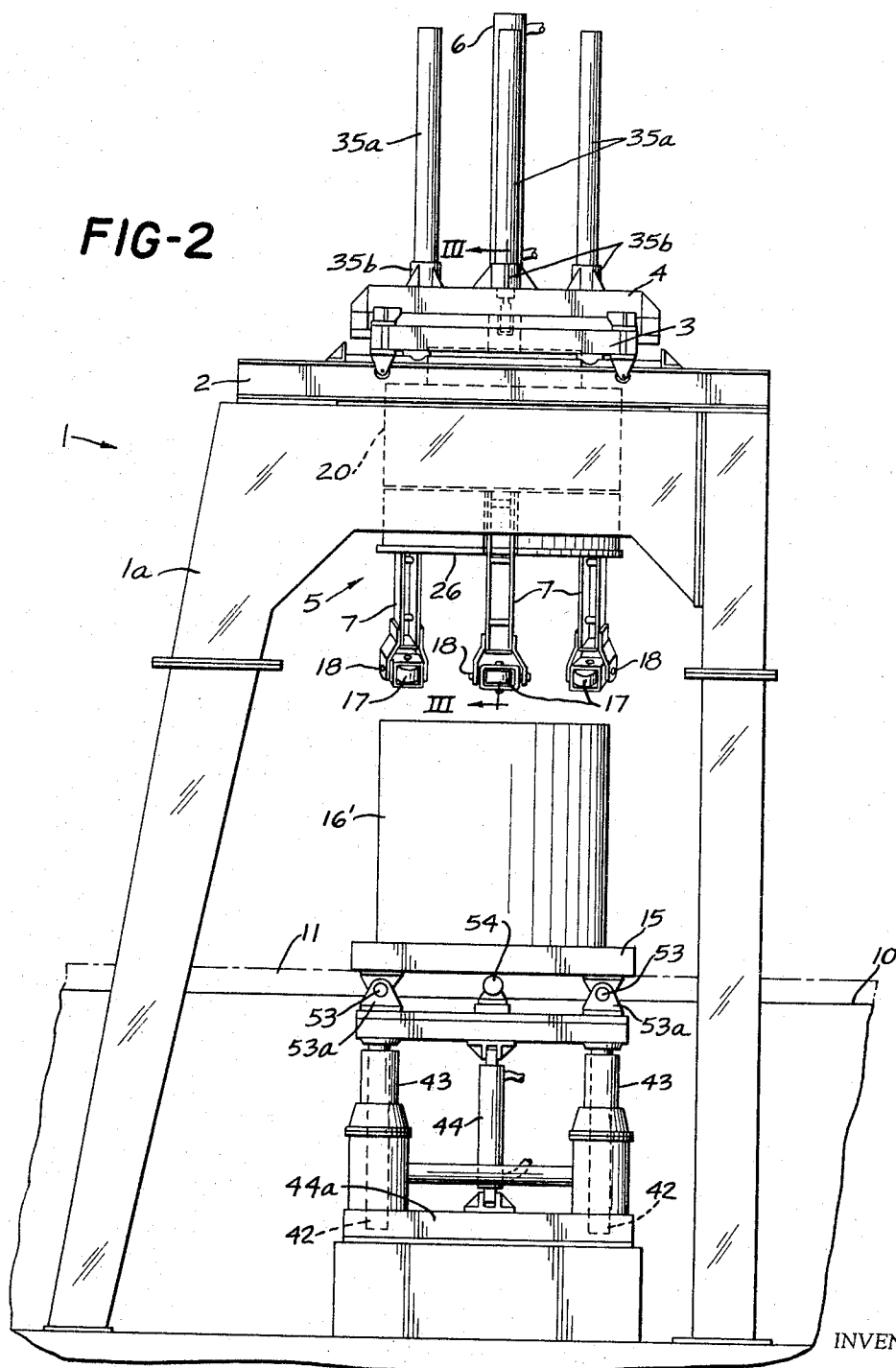
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METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

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7 Sheets-Sheet 2



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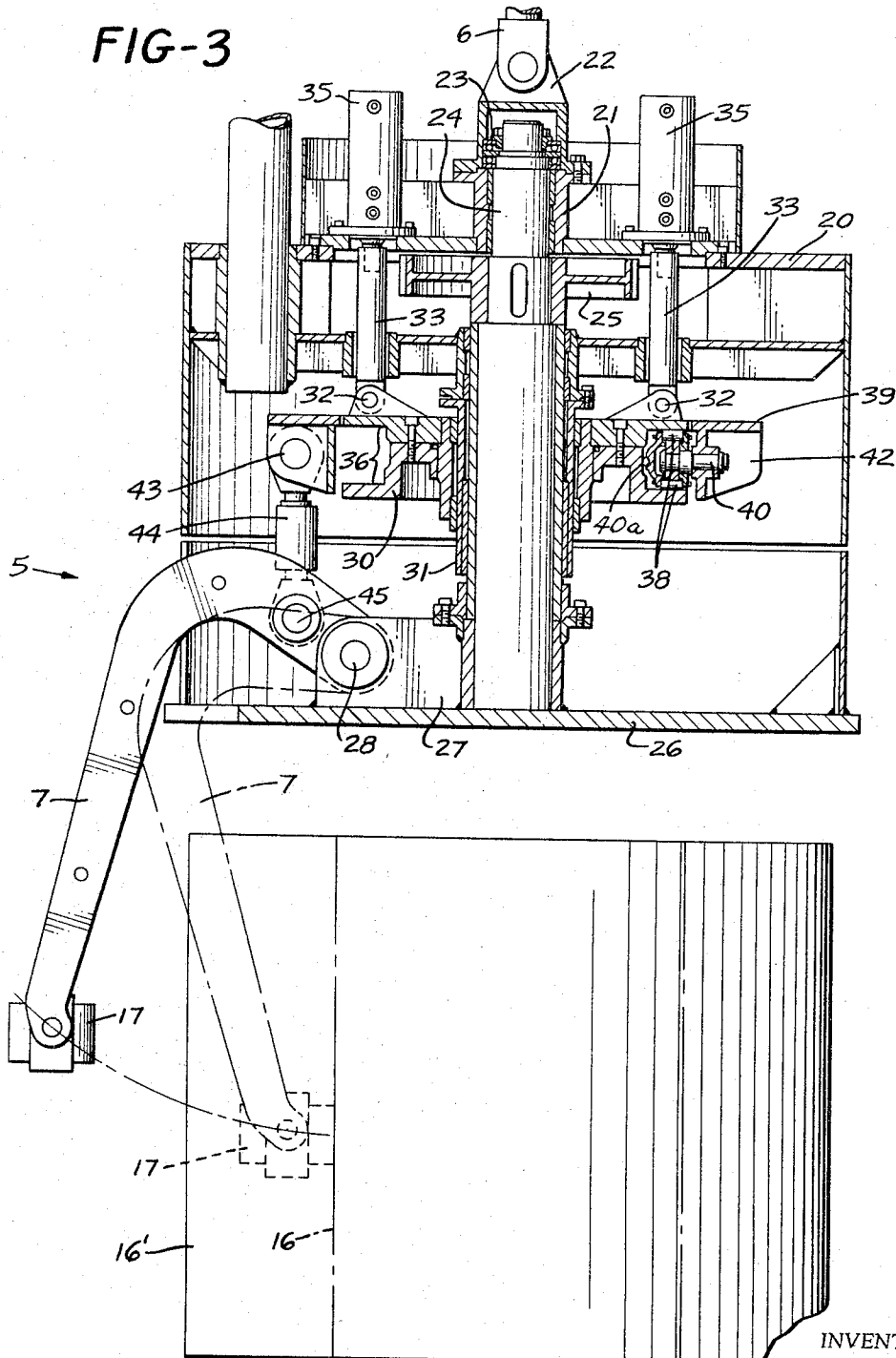
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METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

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FIG-3



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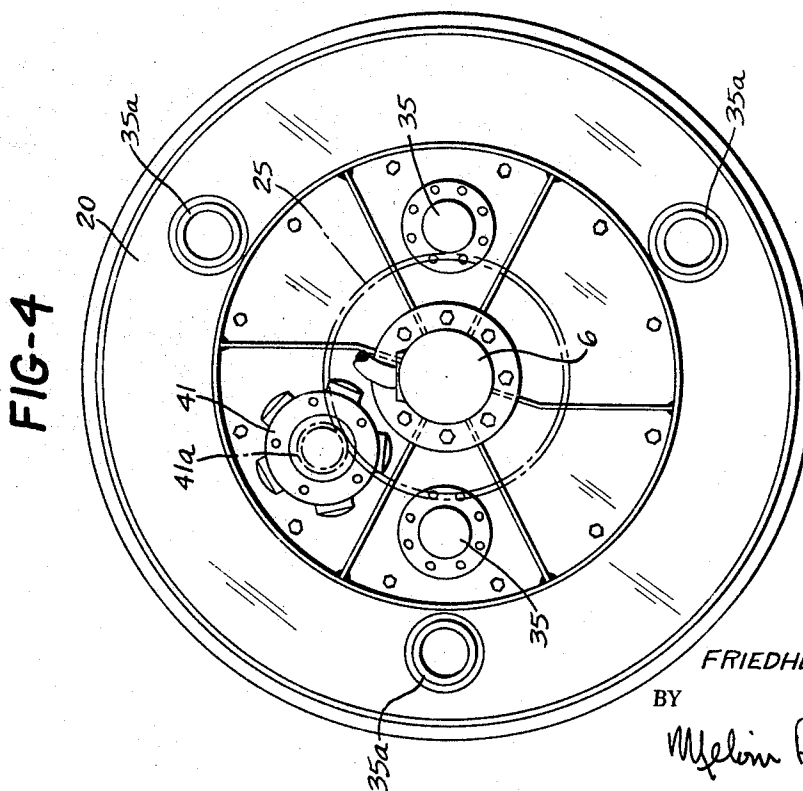
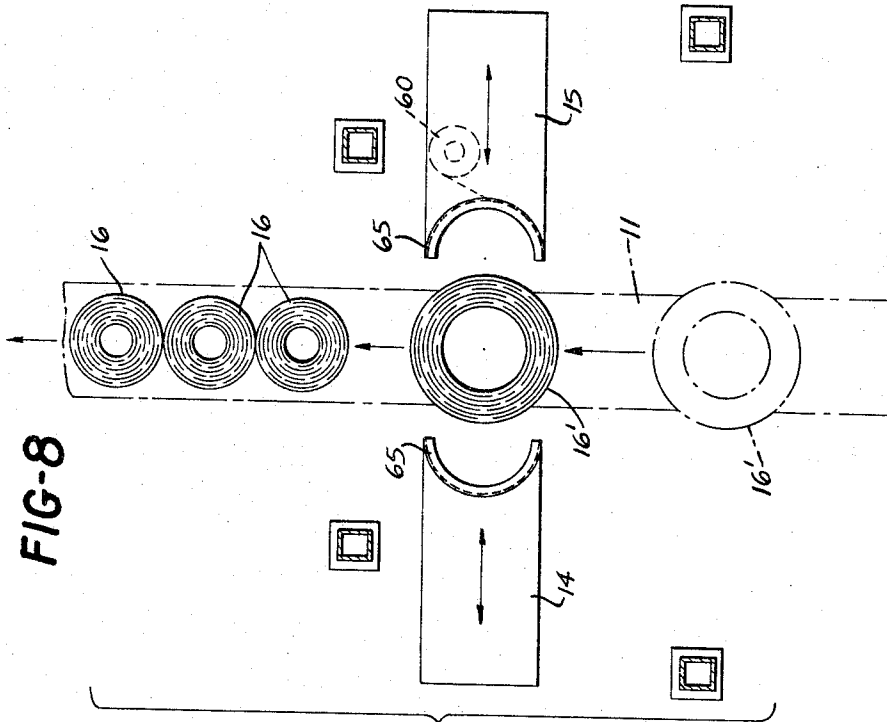
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METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

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7 Sheets-Sheet 4



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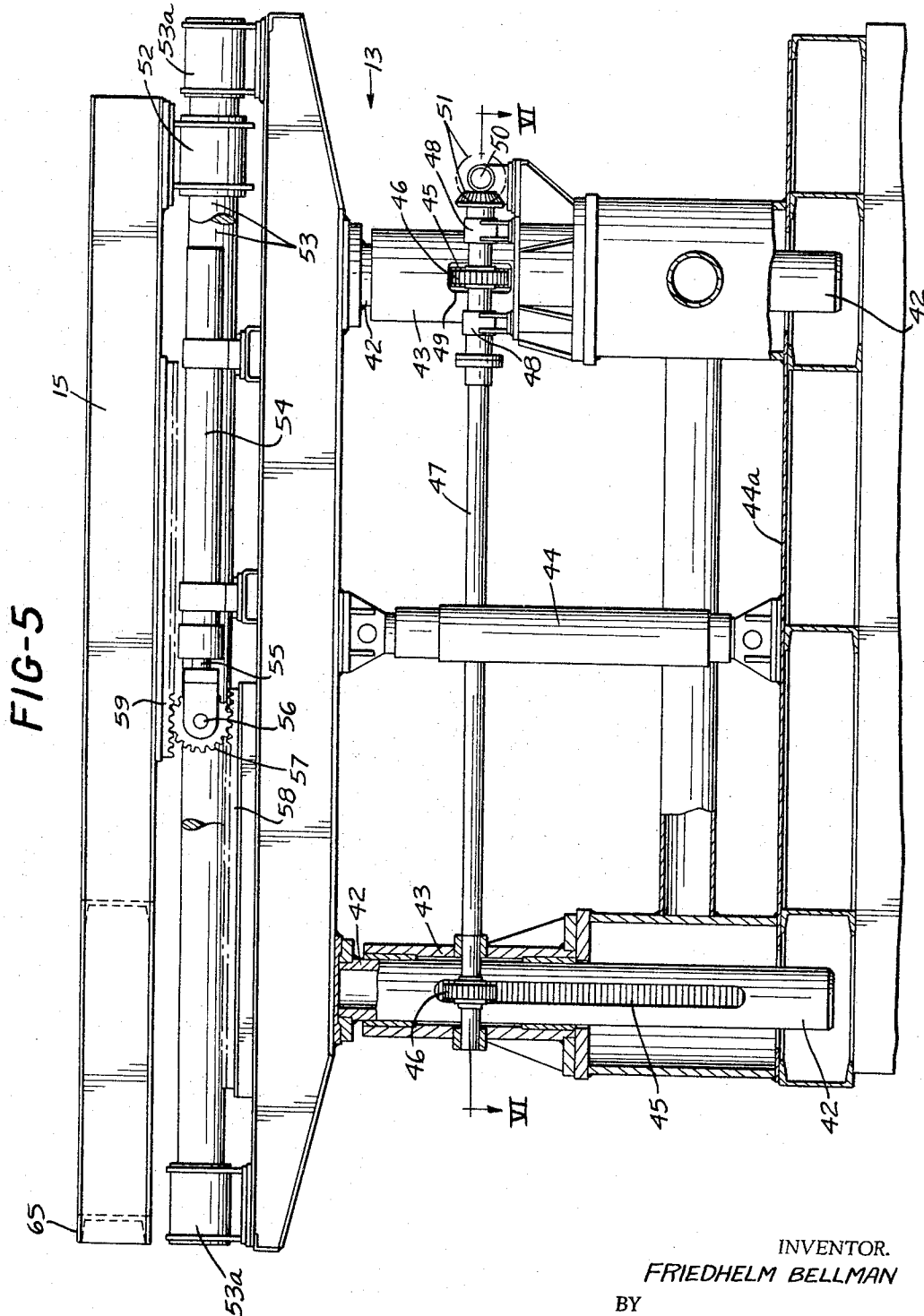
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METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

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7 Sheets-Sheet 5



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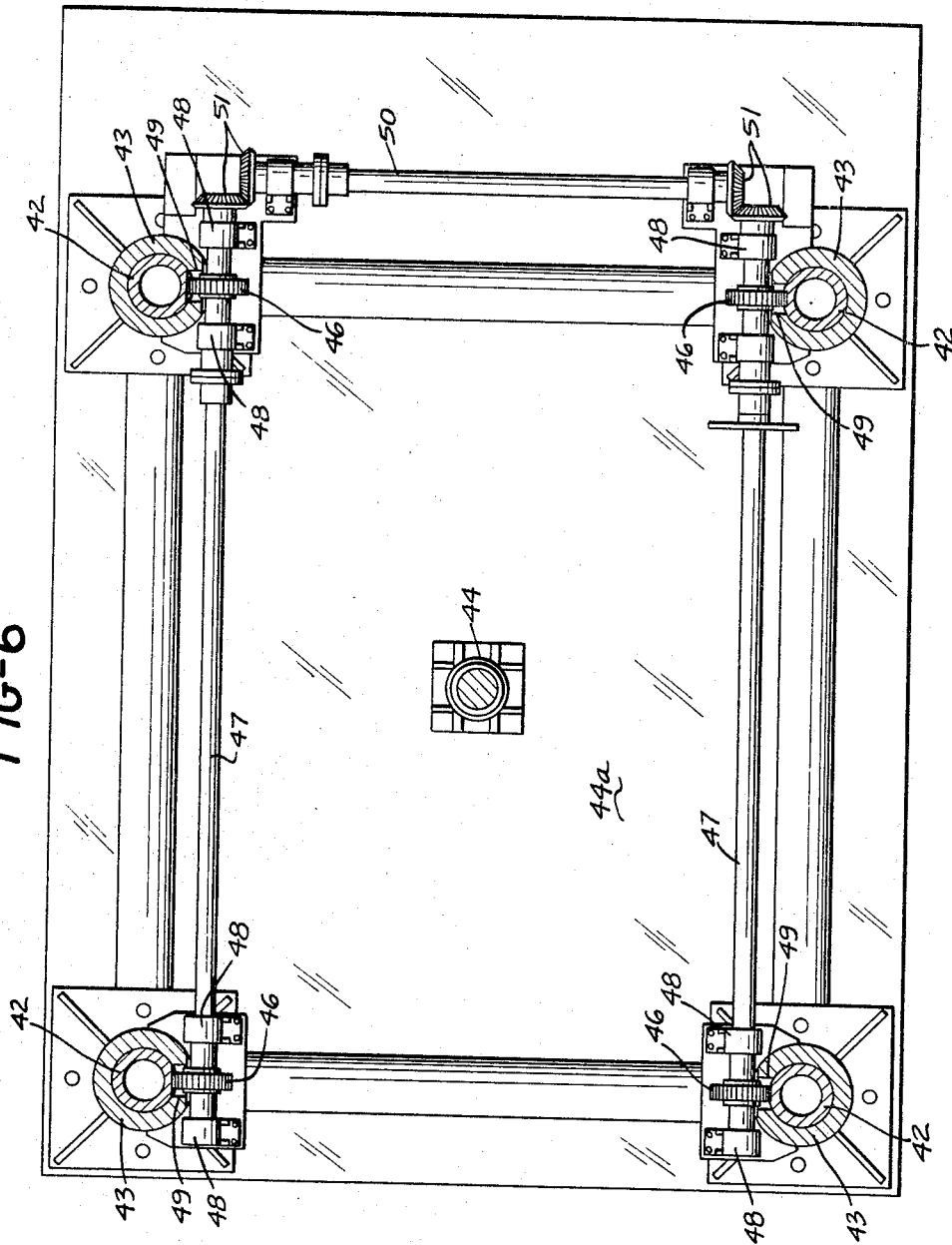
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METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

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FIG-6



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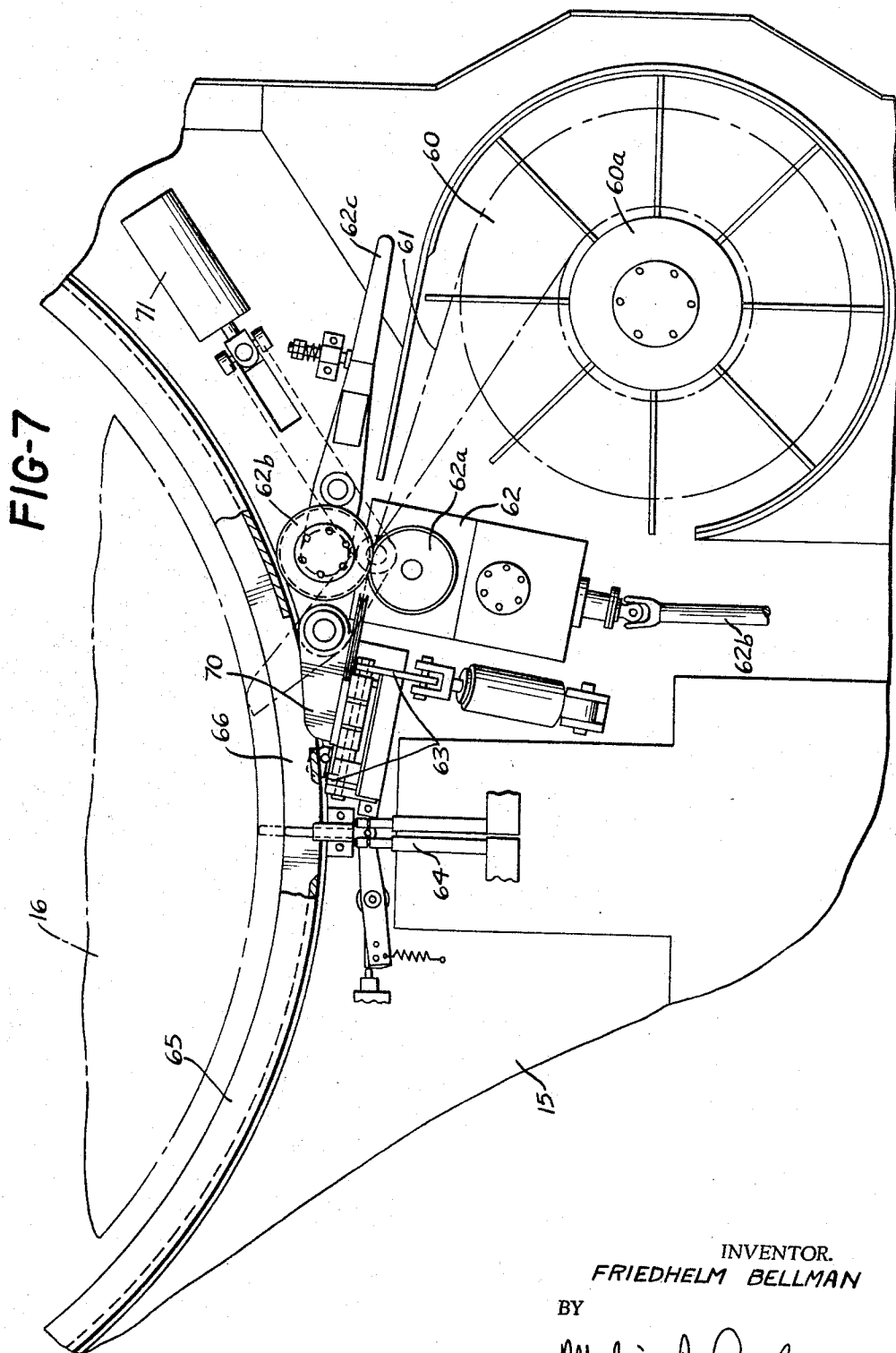
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METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

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7 Sheets-Sheet 7



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METHOD AND APPARATUS FOR TIGHTENING AND BANDING METAL COILS

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20 Claims. (Cl. 100—3)

This invention relates to a method and apparatus for placing retaining straps or bands around coils of metal sheet or strip and tightening the coils prior to the said banding thereof.

Rolling mill operations and the like, metal sheets or strips are made up into coils so that they are easier to handle and transport. For reeling up of the coils, known coiling devices were used, by the aid of which the coils are placed in vertical position on an intermittently advancing conveyor device.

In order to prevent the coils from loosening or from coming open, banding straps are employed which may be placed, for example, in the center of the height of the coil around the periphery of the coil, or several such straps in various axial positions along the coil can also be used. Such bands or straps will keep the coil in its coiled up condition and will permit easier handling and shipping of the coils. It is important however, that such bands or straps hold the coil tight or else the individual convolutions of the coil will shift on one another making the handling of the coil extremely difficult and introducing the possibility that the coil will slip open.

Heretofore, it has been customary to place straps or bands of this nature about the coils manually, the ends of the straps or bands thereafter being connected to each other by clamping or welding operations and preferably including a tensioning or tightening of the band or strap before the connecting of the ends thereof.

The manual work required for such banding of coils requires great skill and the use of considerable force and, furthermore, many times the coils are banded while still hot. In this latter case it is particularly difficult to effect proper banding of the coils. The need for adequate tight banding or strapping of the coils will thus be evident.

With the foregoing in mind, it is a primary object of the present invention to provide method and apparatus for placing bands or straps around the metal coils which avoids the difficulties referred to above.

Another object of this invention is to provide a method and apparatus which, in one continuous operation, will tighten metal coils and apply straps or bands thereto which will maintain the coil tightly coiled to permit handling and shipping thereof.

Another object of this invention is the provision of a method and apparatus of the nature referred to in which the apparatus can readily adapt itself to coils of different sizes and to coils in different positions relative to the apparatus.

A still further object of this invention is the provision of method and apparatus of the nature referred to which will operate extremely rapidly whereby the minimum of time is required to effect the strapping or banding operation on a coil.

A still further object of this invention is the provision of an apparatus for strapping or banding metal coils in which the apparatus itself can readily be adjusted to accommodate coils of different sizes.

It is also an object of this invention to provide an apparatus for effecting the banding of coils in which compressing means are employed for compressing the coils to a small size and in which the compression forces exerted on the coil are substantially entirely contained within a small portion of the apparatus.

Still another object of this invention is the provision of

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an apparatus of the nature referred to which is so constructed and arranged that it will have long life and can perform heavy service.

Still another object of this invention is the provision of an apparatus of the nature referred to which includes vertically movable table elements and wherein a single lift motor is provided for each table element while the table elements themselves are prevented from tilting during lifting and lowering movements thereof.

It is also an object of this invention is provide an improved band or strap applying mechanism in which a length of band or strap material is automatically fed about a coil, is then tightened about the coil, and is then welded and cut off thereby eliminating all manual operations in connection with the application of the band or strap to the coil.

A still further object of this invention is the provision of a method and apparatus of the nature referred to which can readily be automated and which, at the most, will require only simple control means, which may be located remote from the working station, to control the apparatus.

The exact nature of the present invention will become more clearly apparent upon reference to the following specification taken in connection with the accompanying drawings in which:

FIGURE 1 is an elevational view of an apparatus constructed according to the present invention looking in at the apparatus in direction of movement of the conveyor device on which the coils are transported;

FIGURE 2 is a side view of the device illustrated in FIGURE 1 but is drawn at somewhat enlarged scale;

FIGURE 3 is a vertical sectional view indicated substantially by line III—III on FIGURE 2 and drawn at enlarged scale and showing the portion of the device by means of which the coils are tightened up;

FIGURE 4 is a plan view looking down on top of the portion of the device illustrated in FIGURE 3;

FIGURE 5 is a side view, partly in section, of one of the vertically movable table structures that are disposed on opposite sides of the coil conveyor;

FIGURE 6 is a sectional view indicated substantially by line VI—VI of FIGURE 5 and showing the synchronizing or antitilting mechanism pertaining to the table of FIGURE 5;

FIGURE 7 is a plan view looking down on a portion of one of the aforementioned tables and showing the band material feeding, clamping, and welding device according to the present invention;

FIGURE 8 is a somewhat schematic plan section indicated by line VIII—VIII on FIGURE 1 and showing the table structures and the strip guides thereon; and

FIGURE 9 is a fragmentary perspective view showing the cut-off shear.

Referring to the drawings somewhat more in detail and, particularly, to FIGURES 1 and 2, there is shown a framework 1 forming a supporting structure for the device according to the present invention. The framework consists of spaced apart leg members which, at the upper ends, support an interconnecting head structure 1a. The spaced apart legs of the structure permit the conveyor for the coils to be banded to pass therethrough.

On top of the structure 1a there are provided rails 2 on which there is rollingly mounted a bridge or carriage 3. Bridge or carriage 3, in turn, slidably or rollingly supports a second carriage or platform 4 for movement on carriage 3 in a direction at right angles to the motion taken by carriage 3 on rails 2. The movements of carriages 3 and 4 are such that carriage 4 has substantially universal movement relative to frame 1 of the device.

Carriage 4 is availed of for carrying the coil tightening device generally indicated by reference number 5. The

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tightening device 5 is suspended from carriage 4 by means of piston and cylinder means 6 which permit the tightening device to be raised and lowered within the frame 1. During the raising and lowering of the tightening device within the frame 1 guide rods 35a connected thereto slide in suitable bushings 35b provided therefor in carriage 4 and thereby prevent the tightening device from rotating relative to the carriage 4.

The tightening device includes a plurality of arms 7 which are movable in vertical planes. At their lower ends arms 7 carry rollers 17 which are preferably flexibly connected to the end of the arms, as by pivot means 18, so that when the arms are brought toward a coil to be tightened, the rollers 17 will conform to the periphery of the coil and make proper contact with the outer convolution of the coil.

As will be noted in FIGURES 1 and 2, a coil to be tightened and banded may be brought to the device of the present invention in a rather loose condition as indicated by reference numeral 16' whereas, after tightening of the coil by the apparatus of the present invention, it may be reduced to the size indicated by reference numeral 16.

Turning now to FIGURE 3 the tightening device 5 is shown somewhat more in detail in section. It will be seen that the device comprises a housing 20 and fixed to housing 20 in about center of the top wall thereof is an upwardly extending extension 21 that terminates in a portion 22 which is adapted for connection to the ram of the piston cylinder means 6 previously referred to. Rotatable on the vertical central axis of housing 20 is a shaft 24 having its upper end supported in anti-friction bearing means 23. A gear 25 is fixed to shaft 24 and forms the means for rotating the said shaft. The lower end of shaft 24 has fixed thereto a disc 26 and on the upper side of the disc are radially extending ribs 27. The ribs 27 stiffen the disc and are also availed of for supporting the previously mentioned arms 7, which are connected to ribs 27 by means of pivots 28. There may be as many or as few of the arms 7 as desired but it has been found that three arms, distributed at intervals of 120° are satisfactory for the purpose of the present invention.

Slidably mounted on sleeve 31 surrounding shaft 24 is an inner ring structure 30. The ring structure however does not rotate but remains stationary in this respect as does housing 20. Ring 30 on its outer periphery has an annular groove that forms a race-way for receiving guiding rollers. The ring is adapted for being moved in the vertical direction by means of the connections 32 of ring 30 with rods 33 that project from fluid motors 35 carried on top of housing 20. By means of fluid motors 35, ring 30 can be moved upwardly and downwardly within the housing 20.

In surrounding relation to ring 30 is another ring 39 which carries shaft means at 40 extending into the annular groove surrounding ring 30. On these shafts are rollers 38 which engage the axially spaced side faces 36 of the groove. The shafts also support carriers for balls 40a which roll around the axially extending radially inner or bottom portion 37 of the groove.

On the bottom side of ring 39, ribs 42 are distributed and these ribs are availed of for receiving pivot means 43 which pivotally support the upper ends of links 44, the lower ends of which are pivoted at 45 to the respective arms 7. At this point it will become apparent that upward and downward movement of ring 30 by fluid motors 35 will bring about pivoting of arms 7 in their respective vertical planes thereby to move the lower ends thereof, on which the pressure rollers 17 are mounted, toward and away from the periphery of a coil beneath the tightening device. In FIGURE 3 the arms, prior to the engagement thereof with the loose coil 16', are shown in full lines, whereas the arms, after the coil has been tightened up to the size indicated by reference numeral 16, are positioned as shown in dotted outline in FIGURE 3.

FIGURE 4 shows the plan view of the device just de-

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scribed and it will be seen therein that mounted on top of housing 20 is a motor 41 which has a pinion 41a meshing with the aforementioned drive gear 25 on shaft 24.

FIGURE 4 will also show that there are three of the guide rods 35a and that there are two of the fluid motors 35.

Returning for the moment to FIGURES 1 and 2, reference numeral 10 indicates the floor line, it will be seen that the apparatus according to the present invention is mounted in a pit in the floor. Also disposed below the floor line is an intermittently movable conveyor mechanism 11 which may consist, for example, of interconnected plates so that the coils can be brought to the tightening and banding device of the present invention and conveyed therefrom.

These tables have upper platform portions 14 and 15 mounted thereon which are movable horizontally in a direction transverse to conveyor 11 and, thus, toward and away from a coil resting on conveyor 11 between the table structures.

FIGURES 5 and 6 show somewhat more in detail the construction of the said tables. Both tables are substantially identical so that FIGURES 5 and 6 illustrate the table structure 13. As it will be seen, table structure 13 has downwardly extending guide rods 42 thereon which extend into the stationary guiding members 43. About the center of table 13 there is provided piston cylinder means 44 by means of which the table is moved vertically. Both the piston cylinder means 44 and the guide means 43 for the guide rods 42 receive their support from a base 44a.

In order to permit a single actuating motor to provide for the raising and lowering of table 13, each of the guide rods 43 is provided with teeth 45. The teeth 45 engage pinions 46 mounted on shaft 47 which is journaled in respective bearings 48 fixed to each of the stationary guide members 43. Four of the guide members 42 are provided and, accordingly, there are two of the shafts 47 and pinions 46 thereon at each side of the table structure. An additional shaft 50 is provided for interconnecting shafts 47 and 48 and this shaft is connected with respective shafts 47 by means of the bevel gears 51. In this manner all of the guide rods 42 are caused to move upwardly and downwardly at exactly the same speed and the table thus remains level at all times and can be moved in parallelism with itself by the use of a single actuating motor.

It will be evident that the movement of the table could also be affected by driving one of the shafts 47, 50 if so desired. For maintaining the stationary guide members 43 as solid and strong as possible, openings 49 are preferably provided therein through which the pinions 46 extend into meshing engagement with teeth 45 on the guide rods 42.

The movable platform 15 on top of table 13 is guided thereon by bushing means 52 connected with platform and embracing guide rods 53 which are fixed to table 13 as by means of the brackets 53a.

A reciprocable fluid motor 54 is fixedly mounted on table 13 and has a ram 55. A gear 57 is connected to the end of ram 55 by shaft 56. A gear 57 meshes, on the one hand, with the teeth of a rack 58 fixed to table 13 and, on the other hand, with the teeth of a rack 59 fixed to the bottom of platform 15. It will be evident, at this point, that reciprocation of ram 55 of motor 54 will bring about reciprocating movement of platform 15 in the same direction as the said ram is moving but at twice the speed and displacement as the said ram. By this relatively simple mechanism, the individual platforms at opposite sides of conveyor 11 can be raised and lowered and the platforms 14 and 15 thereon can be caused to advance toward a coil resting on the conveyor or to be retracted therefrom. Each of the platforms and table structures referred to is a substantial mirror image of the other except that on one of the platforms, for example,

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platform 15, there is provided means for supplying banding strap material for banding the coils.

FIGURE 7 will show that there is mounted on platform 15 a reel 60a carrying a supply 60 of banding material. This banding material as it is pulled off from the supply, is represented in FIGURE 7 by reference numeral 61. The banding material passes through the feed device 62 which may consist, for example, of a driven roll 62a and a backup idler roll 62b. Idler 62b is supported on the end of a spring biased lever 62c so that the banding material is tightly gripped between the two rollers. Roller 62a is adapted for being driven by way of a drive connection 62b which is actuated by a reversible motor; an electric or hydraulic motor, for example.

The strip 61 of the banding material, upon leaving the driving device, passes through a guiding arrangement which includes a shear mechanism 63. The strip banding material thereafter passes in front of a welding station 64. Each of the tables is provided with a substantially semi-circular member 65 which has therein a groove 66 opening toward the coil.

The members 65 are substantially semi-circular and when the platforms are advanced into engagement with the coil, the said semi-circular grooves 66 in the members form a continuous angular groove extending completely about the coil and which groove will serve to guide the banding strap material about the coil and in a plane at right angles to the coil axis when the said material is fed into the groove by means of the feeding device.

When the banding material is fed about the coil, the leading end thereof is caused to go completely around the coil and pass by the welding station 64. When the leading end of the band has passed welding station 64, a clamp lever 70 is actuated by its actuating motor 71 and clamps the strap material against the coil. Thereafter, the feed device 62 is reversed and this will draw the band tightly about the coil. Thereafter the band in the region thereof between the feeding device 62 and the coil will be clamped against the coil, as by a clamp member (not shown) similar to lever 7, and the shears 63 are then operated to cut off the band material. This cut off will take place between the last mentioned clamping point and the feed device. With the strip of band material now passing completely around the coil and clamped thereto, and cut off, the welding device 64 is operated to weld the ends of the band together and the coil is thus provided with a band. Alternatively, the welding electrode could be moved in prior to operation of the shears and thus effect the said clamping. If this is done, the welding current can be supplied to the electrode either before or after operation of the shears.

As mentioned before, the coil could be provided with more than one band if so desired. Ordinarily, the band is applied closely beneath the point of engagement of the pressure rollers 17 with the coil and in this manner the coil is banded as tightly as possible.

In operation, a coil is mounted on conveyor 11 with the axis of the coil vertically and the conveyor then advances the coil into the range of the apparatus according to the present invention. With arms 7 swung outwardly, fluid motor 6 is then availed of for moving tightening device 5 downwardly. When tightening device 5 has reached the proper position, the fluid motors 35 are availed for moving rings 30 and 39 downwardly which will bring about inward swinging of arms 7 to cause pressure rollers 17 to engage the periphery of the coil with radially inwardly directed pressure.

Motor 41 is then energized and this will cause the shaft 24, disc 26, arms 7, and ring 39 to rotate relative to housing 20 and to apply tightening pressure to the coil. The direction of rotation of the device is, of course, in the same direction as the coil is wound so that the convolutions of the coil are caused to tighten up on each other. It will be understood that rotation of the tightening

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device can be commenced prior to engagement of the pressure rolls with the coil if so desired.

Furthermore, it will be understood that any adjustments necessary to adapt the device to the particular size coil to be treated will have been made before the operation is commenced.

During the tightening operation on the coil, it will be evident that the carriages 3 and 4 previously referred will adjust themselves relative to each other and on head 1a of the frame so that all of the tightening forces on the coil will be contained within housing 20 and will not be transmitted to frame 1 of the device. This is important because the coils are large and heavy and equal pressure around the entire circumference of the coil could not be exerted without permitting the tightening device to float in the frame of the machine in the prescribed manner or exactly aligning the coil with the device.

After the coil has been tightened up to the desired degree, the rotation of the tightening device can be interrupted and this is done, preferably, in such a manner that one of the pressure members halts at about the terminal end of the outer convolution of the coil so that the coil is held as tightly closed as possible.

The vertical movable tables at opposite sides of the conveyor are now brought to the proper level and the platforms thereon are advanced inwardly toward the coil at a point therealong just below the level of the pressure members 17. Preferably, one of the platforms is advanced inwardly toward the coil, is then slowed down, and brought to a stop, and thereafter the other platform is brought inwardly against the coil; the first mentioned platform thus dictating the final positions of both platforms.

The coil is now tight and held and the banding mechanism is in position for applying a band to the coil. At this point the feed mechanism 62 is actuated and this causes a length of banding material to be passed about the coil and to be guided thereabout by the grooves 66 in the semi-circular members 65 on the ends of the platforms. The strip of material is advanced about the coil until the leading end thereof passes by the welding station 64. The length of material required to do this can be determined by controlling the feeding device 62 so that it feeds a predetermined length of the material or, the device can be provided with a detecting mechanism which will detect when the end of the banding material reaches the proper position. When the proper length of banding material is fed about the coil, the clamp 70 is actuated and thereby clamps the leading end of the band against the tightened coil. The feeding device 62 is then reversed to draw the band tight about the coil. The band, in the region thereof leading from the feeding device 62 to the coil is then clamped to the coil, the shear 63 is operated to cut off the material between the feeding device and the last clamped point, and then welding station 64 is operated to weld the overlapping ends of the band material together. After the welding is completed, the welding unit retracts, and the other parts of the mechanism can also be retracted. If only a single band is to be applied to the coil, the platforms are retracted and the tables may, at this time, be lowered, if so desired, the arms 7 swung outwardly, and the tightening device 5 elevated. The conveyor is then actuated to convey the tightened banded coil away from the apparatus and a new coil to be tightened and banded is brought into position.

If, on the other hand, the coil is of such a nature that it is desired for more than one band to be placed thereon, the additional bands can be put in place in the same manner as above described by moving the platforms 12 and 13 to the respective heights along the coil at which the bands are to be applied to the coil. Preferably, in order to have as tightly banded a coil as possible, the tightening device 5 is also adjusted to different axial positions along the coil while the arms 7 hold their respective pressure members 17 in pressure engagement with the coil just above the region to be banded and in this manner a plu-

rality of bands can be applied to a coil one after the other.

It will be appreciated that the tightening and banding coils according to the present invention not only results in coils as tightly coiled as reasonably possible and banded as tightly as is reasonably possible, but the operation of the machine can be quite rapid and it makes no difference whether the coils are hot or cold.

No high degree of skill is required on the part of the operators and the operator is not required to work in the immediate vicinity of hot coils. Coils tightened and banded according to the present invention can be handled and shipped freely without the coils coming loose or opening up.

It will also be evident that the apparatus according to the present invention adapts itself readily to remove control because all of the various parts of the apparatus are capable of being operated by electric control circuits from remote positions. Furthermore, automation of the mechanism is readily possible because the minimum amount of exact positioning of any of the components is required and, thus, the apparatus will operate with the minimum amount of critical attention at all times.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions; and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. An apparatus for tightening and banding metal coils comprising; pressure bodies adapted to engage spaced points about the periphery of a metal coil, means for moving the pressure bodies around the coil while in engagement therewith to tighten the coil, means for feeding a length of band material about the tightened coil, and means for joining the ends of said length of band material together to form a retaining band about the coil.

2. An apparatus for tightening and banding metal coils comprising; pressure bodies adapted to engage spaced points about the periphery of a metal coil, means for moving the pressure bodies around the coil while in engagement therewith to tighten the coil, means for feeding a length of band material about the tightened coil, means for tightening said length of band material about the coil, and means for joining the ends of said length of band material together to form a retaining band about the coil.

3. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a vertically movable head in the frame above the coil, pressure bodies carried by the head therebeneath adapted for engaging spaced points of the periphery of said coil under pressure, means for rotating said pressure bodies about the coil while maintaining the pressure thereof on the coil to tighten the coil, means in the frame supporting said head for movement in two transverse directions so the head will center relative to the coil; and means in the frame beneath the head for supplying band material about the coil, for tightening the band material about the coil, and for cutting off the band material and welding the ends of the band material together to form a band about the coil.

4. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a vertically movable head in the frame above the coil, pressure bodies carried by the head therebeneath adapted for engaging spaced points of the periphery of said coil under pressure, means for rotating said pressure bodies about the coil while maintaining the pressure thereof on the coil to tighten the coil, a first carriage supported on the frame above the head and movable on the frame in one lateral direction, a second frame supported on said first carriage for movement thereon in a lateral direction at an angle to said one lateral direction, means supporting said head on

said second carriage, and means in the frame beneath the head for supplying band material about the coil, for tightening the band material about the coil, and for cutting off the band material and welding the ends of the band material together to form a band about the coil.

5. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a vertically movable head in the frame above the coil, pressure bodies carried by the head therebeneath adapted for engaging spaced points of the periphery of said coil under pressure, means for rotating said pressure bodies about the coil while maintaining the pressure thereof on the coil to tighten the coil, a first carriage supported on the frame above the head and movable on the frame in one later direction, a second frame supported on said first carriage for movement thereon in a lateral direction at an angle to said one lateral direction, means guiding said head in vertical non-rotative movement on said second carriage, motor means connected between said head and said second carriage for adjusting the head vertically on said second carriage, and means in the frame beneath the head for supplying band material about the coil, for tightening the band material about the coil, and for cutting off the band material together to form a band about the coil.

6. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a first carriage in the frame above the coil movable in the frame in one lateral direction, a second carriage movable on the first carriage in another lateral direction, a housing suspended from said second carriage and guided thereon for non-rotative vertical movement, motor means in said second carriage connected to said housing for moving said housing to adjusted vertical positions relative to said second carriage, a vertical shaft in the head and means for rotating the shaft, a plurality of circumferentially spaced arms having their upper ends pivotally connected to said shaft and tiltable about said connections in respective vertical planes, pressure bodies on the lower ends of said arms for engagement with the periphery of a coil in said frame, means carried by the head for tilting said arms in unison to cause said pressure bodies to embrace a coil therebetween or to release a coil, and means in the frame beneath the head for supplying band material about the coil, for tightening the band material about the coil, and for cutting off the band material and welding the ends of the band material together to form a band about the coil.

7. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a first carriage in the frame above the coil movable in the frame in one lateral direction, a second carriage movable on the first carriage in another lateral direction, a housing suspended from said second carriage and guided thereon for non-rotative vertical movement, motor means in said second carriage connected to said housing for moving said housing to adjusted vertical positions relative to said second carriage, a vertical shaft in the head and means for rotating the shaft, a disc fixed to the lower end of the shaft, a plurality of arms spaced circumferentially of said disc and having their upper ends pivoted to said disc and tiltable on the disc in respective vertical planes, pressure bodies on the lower ends of said arms to engage the outer periphery of a coil in said frame, a first ring in said housing coaxial with said shaft and reciprocable but non-rotatable in the housing, a second ring surrounding said first ring, means guiding said second ring on the first ring for rotation thereon while holding the second ring against axial movement on the first ring, link means connecting said second ring with said arms so that axial movement of the second ring will tilt the arms, motor means carried by the housing and connected with said first

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ring for moving the first ring axially in the housing thereby also to move said second ring axially to tilt said arms, and means in the frame beneath the head for supplying band material about the coil, for tightening the band material about the coil, and for cutting off the band material and welding the ends of the band material together to form a band about the coil.

8. An apparatus according to claim 7 in which said means guiding the second ring on the first ring is a groove formed in one ring and opening toward the other and roller means on the other ring engaging the sides and bottom of the said groove.

9. An apparatus according to claim 7 in which said means guiding the second ring on the first ring is a groove formed about the periphery of the first ring opening radially outwardly and having axially spaced side walls and a bottom wall, shafts on the second ring extending into said groove, and rolling bodies on said shafts engaging the side walls and the bottom wall of said groove.

10. An apparatus according to claim 7 in which said housing has a sleeve-like extension on the top wall into which the upper end of said shaft extends, bearing means in the sleeve-like extension rotatably supporting said shaft, and means at the top of said extension for connection of said housing to the said motor means on said second carriage.

11. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a vertically movable head in the frame above the coil, pressure bodies carried by the head therebeneath adapted for engaging spaced points of the periphery of said coil under pressure, means for rotating said pressure bodies about the coil while maintaining the pressure thereof on the coil to tighten the coil, means in the frame supporting said head for movement in two transverse directions so the head will center relative to the coil, platforms in the frame on opposite sides of the coil movable toward and away from the coil, semi-circular channels on the coil ends of the platforms opening toward the coil and forming a continuous annular guide channel about the coil when the platforms are moved against opposite sides of the coil, means for feeding a length of banding material into said channel so the material will pass around the coil, and means for tightening the length of material around the coil and joining the ends of the length of material.

12. An apparatus according to claim 11 in which tables are provided supporting said platforms, means for moving said tables vertically to dispose said platforms at any desired level along a coil, and means on the tables for moving the platforms horizontally thereon.

13. An apparatus according to claim 11 in which tables are provided supporting said platforms, means for moving said tables vertically to dispose said platforms at any desired level along a coil, and means on the tables for moving the platforms horizontally thereon, said tables including guide means to guide the tables in the vertical direction, and a fluid motor connected to each table for actuating the respective table in its vertical movement.

14. An apparatus according to claim 11 in which tables are provided supporting said platforms, means for moving said tables vertically to dispose said platforms at any desired level along a coil, and means on the tables for moving the platforms horizontally thereon, said tables including guide rods at the corners extending downwardly therefrom, guide members beneath the tables receiving said rods, a fluid motor connected to each table for moving the same vertically, and means connecting said rods of each table to cause all thereof to take the same vertical movement and thereby hold the respective table in parallelism with itself.

15. An apparatus according to claim 11 in which tables are provided supporting said platforms, means for moving said tables vertically to dispose said platforms at any

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desired level along a coil, and means on the tables for moving the platforms horizontally thereon, said tables including guide rods at the corners extending downwardly therefrom, guide members beneath the tables receiving said rods, a fluid motor connected to each table for moving the same vertically, each rod having teeth, a pinion engaging the teeth of each rod, shaft means rotatable on the pertaining guide member and fixed to each pinion, said shaft means being in the form of one shaft for each pair of pinions of each table, and means connecting the shafts of each table for rotation in unison.

16. An apparatus according to claim 11 in which tables are provided supporting said platforms, means for moving said tables vertically to dispose said platforms at any desired level along a coil, and means on the tables for moving the platforms horizontally thereon, said tables including guide rods at the corners extending downwardly therefrom, guide members beneath the tables receiving said rods, a fluid motor connected to each table for moving the same vertically, each rod having teeth, a pinion engaging the teeth of each rod, shaft means rotatable on the pertaining guide member and fixed to each pinion, said shaft means being in the form of one shaft for each pair of pinions of each table, a third shaft for each table, and gears connecting said third shaft with the pinion shafts of the pertaining table to cause the pinion shafts of each table to rotate in unison.

17. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a vertically movable head in the frame above the coil, pressure bodies carried by the head therebeneath adapted for engaging spaced points of the periphery of said coil under pressure, means for rotating said pressure bodies about the coil while maintaining the pressure thereof on the coil to tighten the coil, means in the frame supporting said head for movement in two transverse directions so the head will center relative to the coil, platforms in the frame on opposite sides of the coil moveable toward and away from the coil, semi-circular channels on the coil ends of the platforms opening toward the coil and forming a continuous annular guide channel about the coil when the platforms are moved against opposite sides of the coil, means for supporting a supply of strip material on one of said platforms, feeding means on said one platform for feeding said strip material from said supply into said guide channel so the material will pass about the coil, means on said one platform for clamping the leading end of the material against the coil, shear means on said one platform for cutting of the material, and welding means on said one platform for welding the ends of said cut off strip together to form a band around the coil.

18. An apparatus for tightening and banding metal coils comprising; a support frame in which the coil to be tightened and banded is placed with the axis thereof vertical, a vertically movable head in the frame above the coil, pressure bodies carried by the head therebeneath adapted for engaging spaced points of the periphery of said coil under pressure, means for rotating said pressure bodies about the coil while maintaining the pressure thereof on the coil to tighten the coil, means in the frame supporting said head for movement in two transverse directions so the head will center relative to the coil, platforms in the frame on opposite sides of the coil moveable toward and away from the coil, semi-circular channels on the coil ends of the platforms opening toward the coil and forming a continuous annular guide channel about the coil when the platforms are moved against opposite sides of the coil, means for supporting a supply of strip material on one of said platforms, feeding means on said one platform for feeding said strip material from said supply into said guide channel so the material will pass about the coil, means on said one platform for clamping the leading end of the material against the coil, means for reversing said feeding means to tighten the material about the

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coil, means for clamping the material between the feeding means and the coil to the coil, shear means on said one platform for cutting of the material between the feeding means and the coil, and welding means on said one platform for welding the ends of said strip together to form a band around the coil.

19. The method of tightening and banding a metal coil which comprises; supporting the coil with the axis thereof vertical, engaging circumferentially spaced points of the outer periphery of the coil with radially inwardly directed pressure, moving the said points of engagement circumferentially of the coil while maintaining the said pressure to thereby compress and tighten the coil, feeding a strip of banding material in a plane perpendicular to the axis of the coil and circumferentially around the coil until the strip overlaps itself while still maintaining said pressure, clamping the leading end of the strip to the coil, exerting tension on the trailing region of the strip to tighten the strip about the coil, clamping the trailing region of the strip to the coil, cutting off the strip outwardly of the coil from the clamped region of the said trailing end, and securing the overlapping regions of said strip to each other.

20. The method of tightening and banding a metal coil which comprises: supporting the coil with the axis thereof vertical, engaging circumferentially spaced points of the outer periphery of the coil with radially inwardly di-

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rected pressure, moving the said points of engagement circumferentially of the coil while maintaining the said pressure to thereby compress and tighten the coil, feeding a strip of banding material in a plane perpendicular to the axis of the coil and circumferentially around the coil until the strip overlaps itself while still maintaining said pressure, clamping the leading region of the strip to the coil at a first point along the strip spaced from the leading end, exerting tension on the trailing region of the strip to tighten the strip around the coil, clamping the trailing region of the strip to the coil at a second point located between the said leading end of the strip and said first point, cutting off the strip outwardly of the coil from said second point, and interconnecting the ends of said strip in the overlapping region thereof, between the said leading end thereof and said second point.

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