

April 29, 1952

N. J. RANNEY

2,594,800

APPARATUS FOR THE MULTIPLE COILING OF SLIT METAL STRIPS

Filed June 22, 1951

4 Sheets-Sheet 1

Fig. 1.

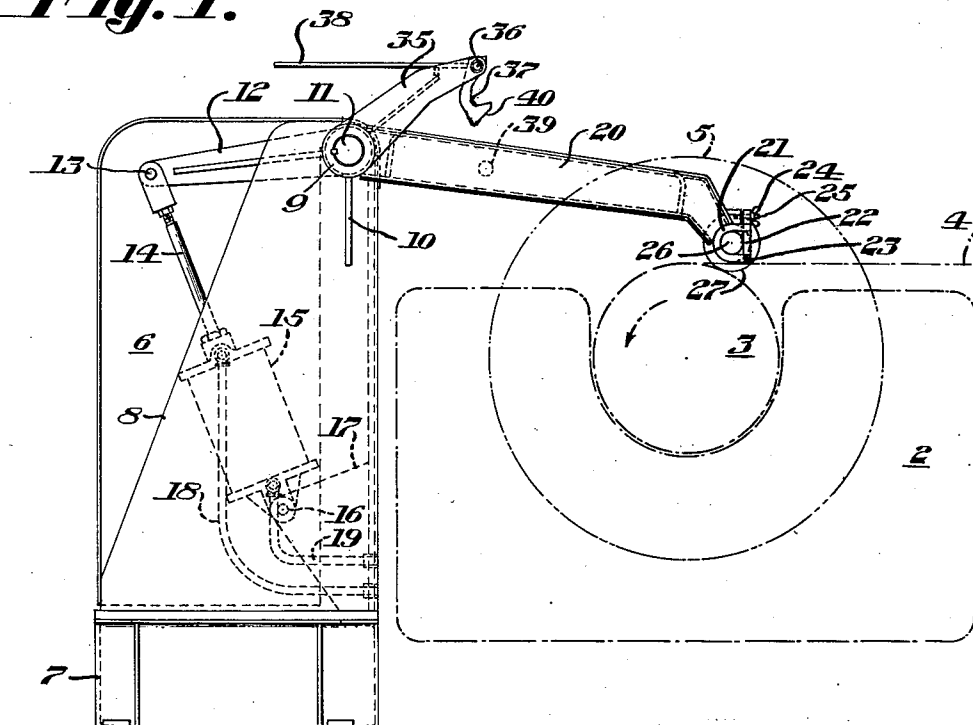


Fig. 2.

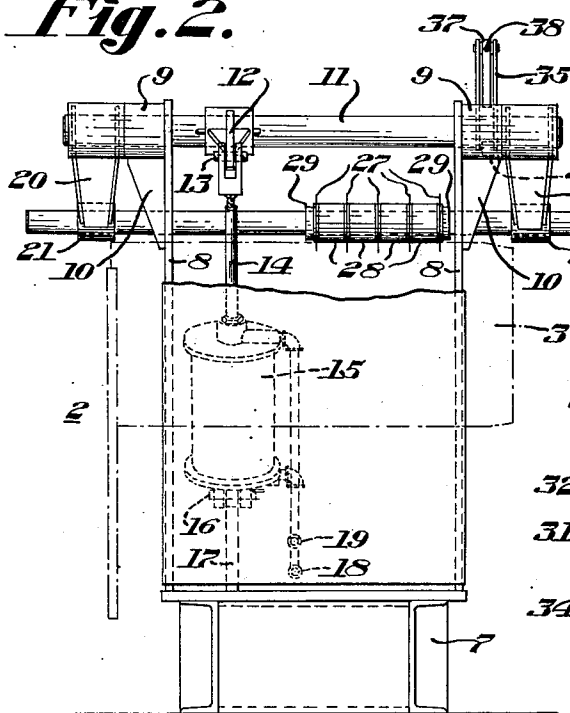


Fig. 3.

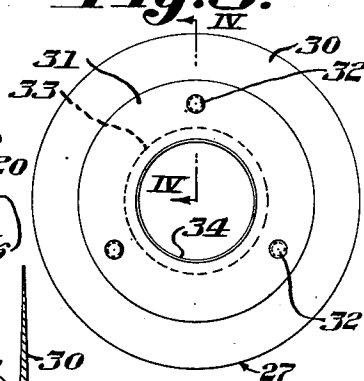
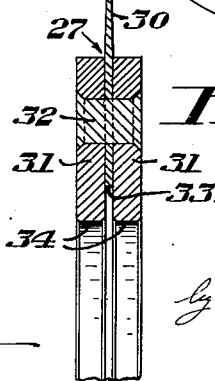


Fig. 4.



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April 29, 1952

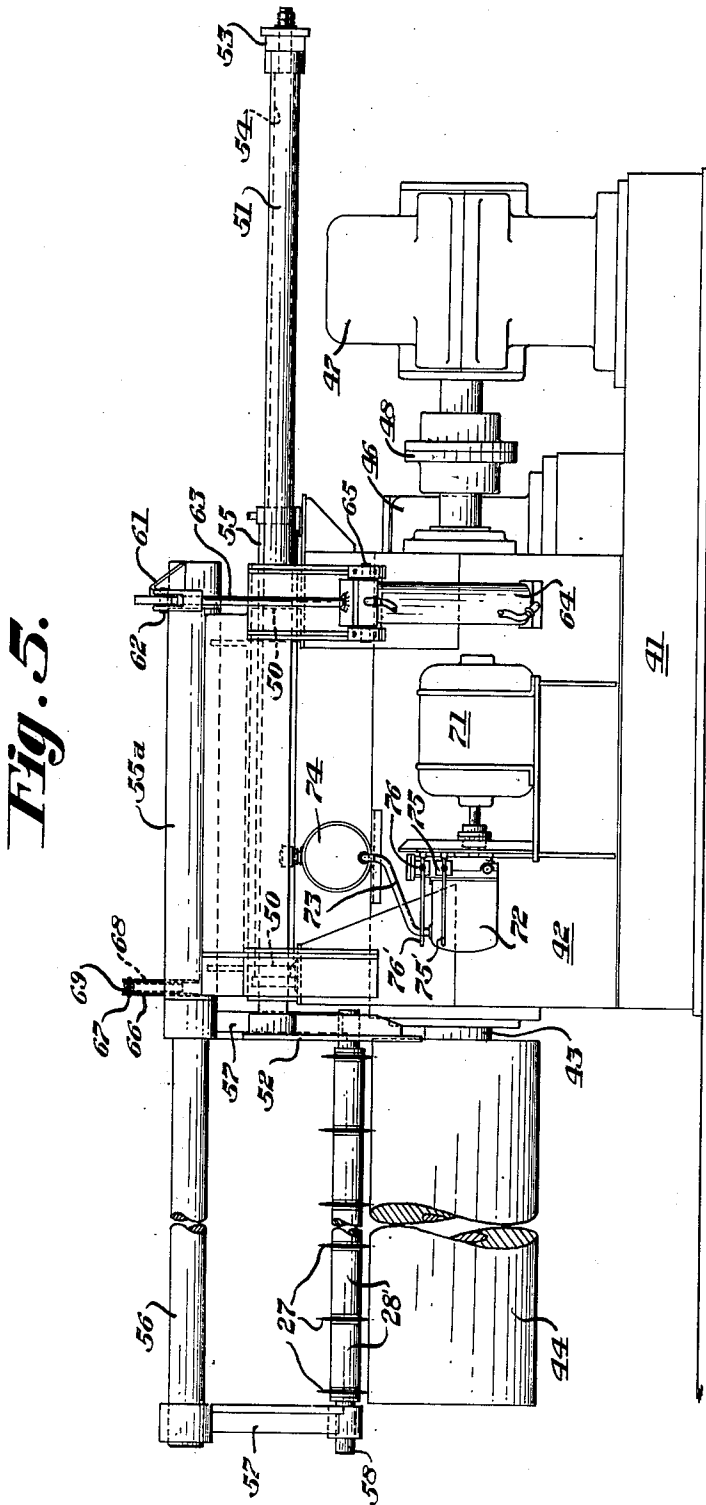
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APPARATUS FOR THE MULTIPLE COILING OF SLIT METAL STRIPS

Filed June 22, 1951

4 Sheets-Sheet 2



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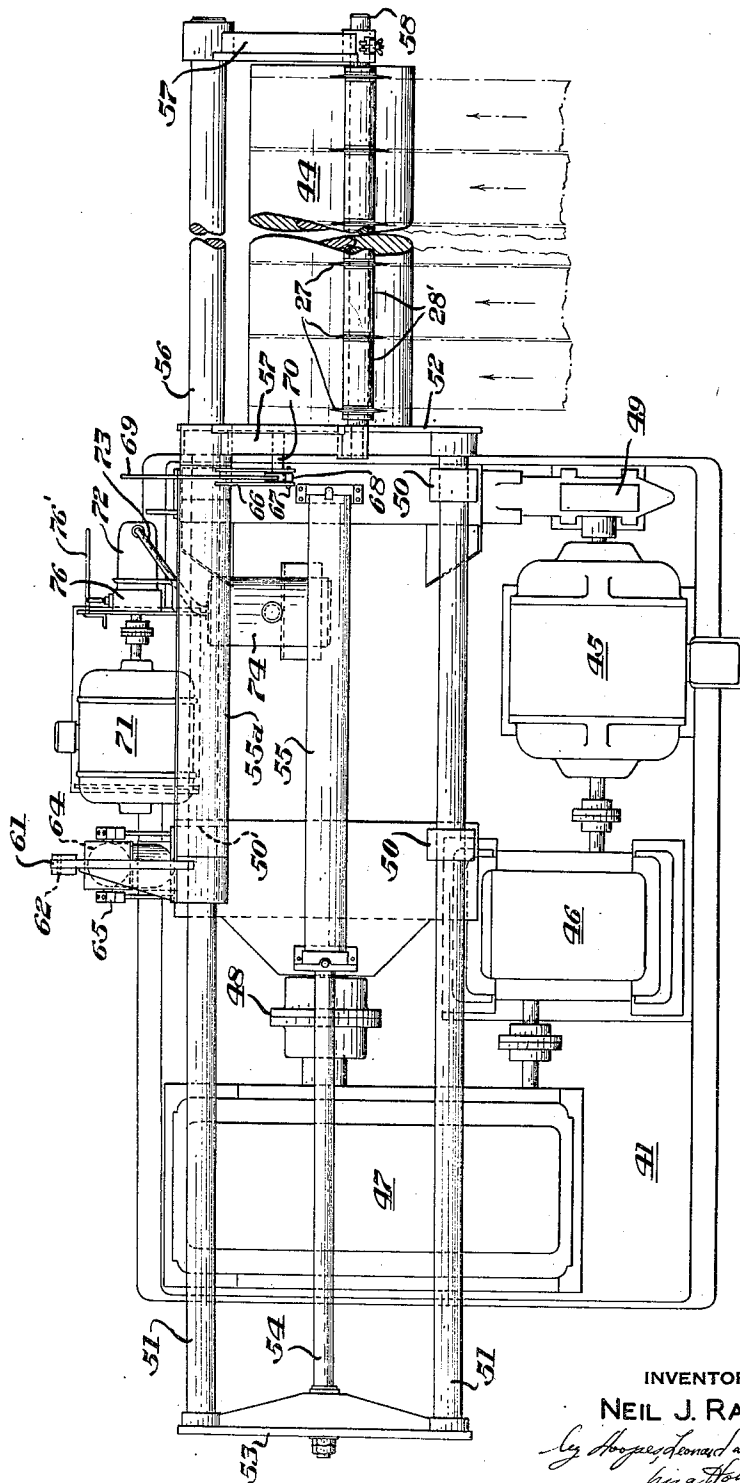
2,594,800

APPARATUS FOR THE MULTIPLE COILING OF SLIT METAL STRIPS

Filed June 22, 1951

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Fig. 6.



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2,594,800

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Filed June 22, 1951

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Fig. 7.

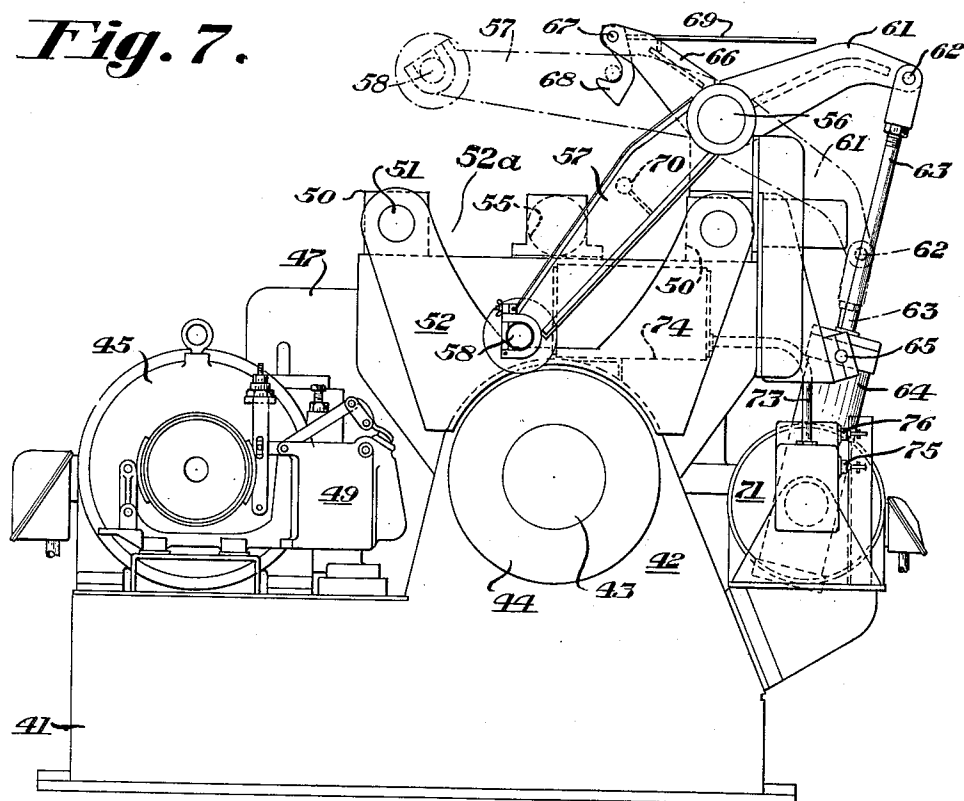
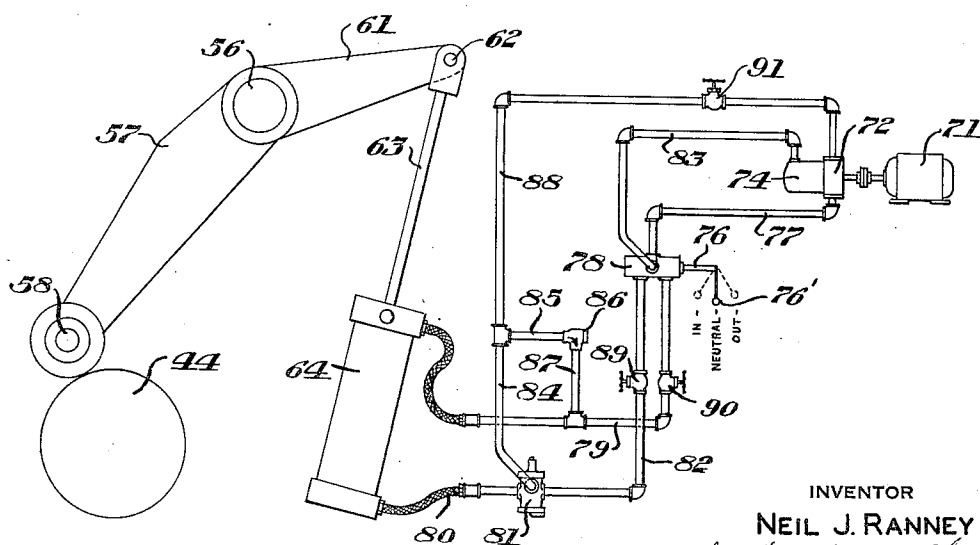


Fig. 8.



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UNITED STATES PATENT OFFICE

2,594,800

APPARATUS FOR THE MULTIPLE COILING
OF SLIT METAL STRIPS

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Application June 22, 1951, Serial No. 233,027

8 Claims. (Cl. 242-78)

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This invention relates to apparatus for the multiple coiling of slit metal strips. The apparatus comprises a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously and means for rotating the mandrel to coil the strips thereon together with a device controlling the coils as they are being formed. The controlling device maintains the coils separated and may otherwise control them.

An operation commonly performed in metal strip mills is to pass a wide strip through a rotary slitter, thereby continuously slitting the wide strip into a plurality of narrow strips. The wide strip may pass to the slitter from a coil. The narrow strips may be coiled on separate mandrels but ordinarily it is desirable to coil them side-by-side simultaneously on the same mandrel. When the narrow strips are coiled side-by-side simultaneously on the same mandrel it is necessary to maintain the strips separated. It is also necessary or desirable, particularly when the slit strips are quite narrow, to guide the slit strips to their respective coils.

I provide a device controlling coils as they are being formed side-by-side simultaneously on the mandrel, the device comprising coil controlling means mounted separately from the mandrel. The coil controlling means is movable generally toward and away from the mandrel. It comprises separating means adapted to be disposed between the strips as they are being coiled to separate the coils. The separating means are preferably positioned to engage the surface of the mandrel between the strips at the beginning of the coiling operation and to remain partially between the coils as they are being formed throughout the coiling operation.

The coil controlling device preferably includes in addition to the separating means above referred to means engaging the peripheries of the coils to keep the coils tight. Desirably means are provided for pressing the last mentioned means against the coils during formation thereof. I preferably provide adjustable control means automatically controlling the pressure of the device against the peripheries of the coils. Desirably the device is mounted so that as the diameters of the coils increase during formation thereof the means which engage the peripheries of the coils and which are pressed against the coils are gradually forced outwardly. At the same time the separating means are continuously disposed between the peripheral edges of the coils as they are being formed to separate the coils and properly guide the strips thereto so that each coil is properly formed and maintained tight.

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The separating means and the means engaging the peripheries of the coils are desirably mounted so as to be rotatable through frictional engagement with the coils. I prefer to mount a shaft with its axis generally parallel to the axis of the mandrel and to dispose the separating means and the means engaging the peripheries of the coils on the shaft. The shaft itself may be mounted so as to be rotatable if desired, in which case the separating means and the means engaging the peripheries of the coils may be keyed to the shaft, although I find it preferable to non-rotatably mount the shaft and make the separating means and the means engaging the peripheries of the coils rotatable on the shaft and relatively thereto.

The separating means are preferably in the form of discs and the means engaging the peripheries of the coils are preferably spacers which serve both to space the discs apart the proper distance and also to press against the peripheries of the coils to maintain the coils tight as they are being formed. The spacers are preferably rotatable collars or rollers on the shaft. The discs and spacers may have bushings engaging the shaft to rotatably mount the discs and spacers on the shaft.

In a preferred form of structure I provide a carrier in which is mounted the shaft upon which the discs and spacers are mounted, the carrier being movable to move the shaft toward and away from the coils being formed on the mandrel. The carrier may move either rectilinearly or angularly. I preferably employ a swingable carrier mounted for swinging movement about an axis generally parallel to the axis of the mandrel. I provide means acting on the carrier tending to turn it about the first mentioned axis to press the shaft toward the coils. Such means may, for example, comprise fluid pressure operated means such as a piston and cylinder.

I provide means maintaining the coil controlling device in inoperative position remote from the mandrel when the formed coils are to be stripped off of the mandrel.

The coil controlling device may be mounted either integrally with the reel or separately therefrom, examples of both forms of structure being shown in the drawings.

Other details, objects and advantages of the invention will become apparent as the following description of certain present preferred embodiments thereof proceeds.

In the accompanying drawings I have shown certain present preferred embodiments of the invention in which

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Figure 1 is an elevational view partly diagrammatic and partly in vertical cross section of apparatus for the multiple coiling of strips;

Figure 2 is an elevational view of the apparatus shown in Figure 1 as viewed from the left-hand side of Figure 1;

Figure 3 is a plan view of one of the separating discs;

Figure 4 is an enlarged fragmentary cross-sectional view taken on the line IV—IV of Figure 3;

Figure 5 is an elevational view, with a portion cut away, of a modified form of apparatus for the multiple coiling of strips;

Figure 6 is a top plan view, with a portion cut away, of the apparatus shown in Figure 5;

Figure 7 is an end elevational view to enlarged scale of the apparatus shown in Figure 5 as viewed from the left-hand end of that figure; and

Figure 8 is a diagram showing the fluid pressure system for operating the coil controlling device shown in Figs. 5, 6 and 7.

Referring now more particularly to the form of structure shown in Figures 1 and 2, there is indicated purely diagrammatically at 2 a strip coiler for coiling up strip and which is adapted for coiling either a single strip or a plurality of strips simultaneously in side-by-side relationship. The coiler per se may be conventional and since no novelty is claimed in it it is shown only diagrammatically. It comprises a mandrel or reel or block 3 which in the form shown is of the cantilever type, being mounted only at its left-hand end viewing Figure 2 so that its opposite end is always free for the stripping off of coils. The mandrel 3 may be of the expanding and contracting type so that after coils have been formed thereon it may be contracted to facilitate stripping off of the coils. The mandrel is rotated by any suitable driving mechanism as well known in the art. The strips moving to the mandrel approach generally horizontally from the right viewing Figure 1 as indicated at 4. They may be coiled up on the mandrel to form coils of any feasible diameter, as, for example, coils whose circumference is indicated at 5.

The coil controlling device is designated generally by reference numeral 6. In the form shown in Figures 1 and 2 that device is mounted separately from the coiler 2. It comprises a base 7 upon which is mounted a structural support including uprights 8. The respective uprights 8 carry at their upper portions bearings 9, plates 10 carried by the uprights 8 underlying the bearings 9 to form a strong reinforced structure. Rotatably mounted in the bearings 9 is a shaft 11. Keyed to the shaft 11 is an arm 12 to the outer extremity of which is pivoted at 13 a piston rod 14 connected with a piston in a cylinder 15 pivoted at 16 to a bracket 17 forming part of the supporting structure. Fluid connections 18 and 19 for fluid under pressure extend to the respective ends of the cylinder 15. When fluid is admitted below the piston in the cylinder 15 the piston moves upwardly and turns the shaft 11 in the clockwise direction viewing Figure 1. When fluid is admitted above the piston in the cylinder 15 the piston moves downwardly and turns the shaft 11 in the counterclockwise direction viewing Figure 1.

Keyed to the shaft 11 are like arms 20 which project from the shaft generally horizontally to positions in which their ends are disposed generally above the mandrel 3. Each of the arms 20 has at its outer extremity a yoke bearing 21 adapted to be closed by a plate 22 pivoted at 23 and maintained in closed position by a nut 24

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screwed onto a bolt 25. Mounted in the yoke bearings 21 is a shaft 26. The shaft 26 may, if desired, be made rotatable in the bearings 21 but in my preferred structure it is immaterial whether or not the shaft is made rotatable in the bearings and for present purposes it may be considered as being non-rotatively mounted therein.

Mounted on the shaft 26 is a series of alternately arranged coil separating discs 27 and spacers 28. The discs and spacers may be of various constructions. The discs 27 are adapted to be disposed between the coils being formed on the mandrel 3 and to guide the strips properly into the coils whereby to separate the coils from one another and insure proper formation thereof on the mandrel. The spacers 28 space apart the discs 27 and are also adapted to engage peripherally the coils being formed. I prefer to have the discs and spacers mounted so that they are rotatable through frictional engagement with the coils. This may be accomplished by making the shaft 26 rotatable, or, whether it is rotatable or not, making the discs and spacers rotatable on the shaft. The discs and spacers are maintained in proper position on the shaft by stop collars 29.

The discs and spacers may have bushings engaging the shaft 26, especially if they are to be mounted for rotation relatively to the shaft. One form of disc which may be employed is shown in Figures 3 and 4. The disc proper is designated 30 and comprises a hollow steel disc somewhat tapered to minimum thickness at its peripheral edge. Riveted to opposite sides of the disc 30 by rivets 32 are bushing hubs 31. The periphery of the bore in the disc 30 is indicated at 33 while the periphery of the bore in each of the bushing hubs 31 is indicated at 34. The bores of the bushing hubs 34 are such that they have a rotating fit on the shaft 26. Similarly the spacers 28 may be in the form of sleeves having liner bushings having a rotating fit on the shaft 26. Consequently, the respective separating discs and spacers are freely rotatable and in practice turn through frictional engagement with the strips as the strips are being coiled up on the mandrel 3.

Connected with the bearing 9 is an upwardly and outwardly extending arm 35 to which is pivoted at 36 a suspended hook 37. Integral with the hook 37 is a rod 38. The arm 20 adjacent the arm 35 has a pin 39 projecting laterally therefrom into the vertical plane of the hook 37. When the shaft 11 is turned far enough in the counterclockwise direction viewing Figure 1 the pin 39 strikes the lower inclined face 40 of the hook 37, turning the hook somewhat in the clockwise direction about its pivot 36 viewing Figure 1 until the pin 39 rises to the level of the throat of the hook, at which time the mass of the rod 38 causes the hook to turn back in the counterclockwise direction until the pin 39 is seated in the throat of the hook. Thus the hook will maintain the control device including the arms 20, the shaft 26 and the separating discs and spacers thereon in inoperative position remote from the mandrel 3 to permit stripping of coils off of the mandrel. When it is desired to release the control device the rod 38 is pushed manually upwardly whereby to turn the hook 37 in the clockwise direction and release the pin 39 from the throat of the hook.

When coils are to be wound upon the mandrel 3 simultaneously in side-by-side relationship the shaft 26 is lowered until the peripheries of the discs 27 rest upon the bare mandrel. The strips are then started around the mandrel, being

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guided into their proper respective positions on the mandrel by the discs 27. In the starting position the strips are approximately tangent to the spacers 28 or possibly spaced slightly away therefrom. As the mandrel 3 rotates in the counterclockwise direction viewing Figure 1 the strips are wound or coiled thereabout to form coils which are spaced apart by the discs 27. As the coils begin to increase in diameter they are engaged at their peripheries by the spacers 28 which, being free to rotate, turn through frictional engagement with the incipient coils. Also, the discs 27, being free to rotate, turn through frictional engagement with the strips as they pass to the coils and with the edges of the coils themselves. As the coils increase in diameter they raise the shaft 26, the discs 27 and spacers 28 continuing to engage the coils and perform their functions.

During formation of the coils some pressure is maintained against the bottom of the piston in the cylinder 15 to press the spacers 28 down against the peripheries of the coils. This not only assists in insuring proper guiding of the strips into the coils but maintains the coils tight.

When the coils have been completed they are banded and the piston is moved downwardly in the cylinder 15 until the arms 20 are raised so that they are latched in inoperative position by the hook 37. The coils are then stripped from the mandrel after which the hook 37 may be released as above explained whereupon the apparatus is ready for immediate initiation of another cycle. There are no separating discs mounted on the mandrel which have to be removed from the mandrel with the coils, separated from the coils and then put back in their proper places on the mandrel.

Referring now more particularly to the form of apparatus shown in Figures 5, 6 and 7, there is shown a base 41 on which is mounted a reel designated generally by reference numeral 42 and which may per se be conventional. The reel includes an overhung shaft designated generally by reference numeral 43 on the projecting portion of which is mounted a mandrel or block 44. An electric motor 45 drives the shaft 43 through reduction gearing 46 and 47 and a coupling 48. A brake 49 operates on the motor shaft in conventional manner. The structure of Figures 5, 6 and 7 thus far described may be conventional and hence I have not gone into detail with respect thereto.

Mounted in bearings 50 in the supporting structure are two horizontal rods 51 carrying at one end a stripper plate 52 and at the other end a crosshead 53. The crosshead 53 is connected through a rod 54 with a piston in a cylinder 55. The piston in the cylinder 55 is operated by fluid pressure. When fluid under pressure is admitted to the left of the piston in the cylinder 55 viewing Figure 4 the rods 51 and the stripper plate 52 move toward the right to push coils off of the mandrel 44. When fluid is admitted to the right of the piston in the cylinder 55 viewing Figure 4 the stripper plate 52 is returned to its inoperative position as shown in Figure 4.

Mounted in a tubular bearing 55a in the supporting structure is a shaft 56 whose axis is parallel to the axis of the shaft 43. Fixed to the shaft 56 are arms 57 which carry at their outer extremities a shaft 58. The shaft 58 carries alternate separating discs 27 and spacers 28'. The shaft 58 may be mounted in the arms 57 in the same way as the shaft 26 of Figures 1 and 2 is mounted in the arms 20 and the discs 27

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and spacers 28' may be of the same general structural characteristics as the discs 27 and spacers 28 of Figures 1 and 2 and similarly mounted, although the spacers 28' are shown as being of somewhat greater length than the spacers 28.

Fastened to the shaft 56 is an arm 61 to which is pivoted at 62 a rod 63 carried by a piston in a cylinder 64 trunnioned to the supporting structure at 65. The piston in the cylinder 64 is effective for moving the arms 57 between the full-line and chain-line positions of Figure 7 in the same manner as the piston in the cylinder 15 operates the arms 20 in Figures 1 and 2. Similarly the supporting structure in Figure 7 carries an arm 66 to which is pivoted at 67 a hook 68 having connected therewith a rod 69, this structure being exactly analogous to the corresponding structure of Figures 1 and 2. A pin 70 is carried by one of the arms 57 to cooperate with the hook 68 in exactly the same manner as above described with respect to the pin 39 and its cooperation with the hook 37. The stripper plate 52 is, as shown in Figure 7, disposed in the same direction from the mandrel as the shaft 58. The stripper plate has a recess 52a in which the shaft is positioned along a portion of the length thereof. This clearly appears in Figures 5, 6 and 7. The purpose of providing the stripper plate with the recess 52a is to shorten the overhang of the mandrel or block 44 needed for a given effective length thereof. As will be clear from Figure 5, if the stripper plate 52 were to be positioned to the right of the right-hand end of the shaft 58 viewing that figure it would be necessary to move the mandrel 44 and the shaft 58 and the supporting means for the shaft to the left a distance of several inches, thus increasing the overhang of the mandrel. By positioning the shaft along a portion of the length thereof in the recess 52a of the stripper plate the entire apparatus may be foreshortened and consequently certain of the parts may be made of lighter construction than would otherwise be necessary.

The structure above described permits the stripper plate 52 when in inoperative position to have its general plane intersecting the shaft 58 which would not be possible if the recess 52a were not provided in the stripper plate. Actually in the structure shown in Figures 5, 6 and 7 not only is the shaft positioned in the recess 52a along a portion of the length of the shaft but also a portion of one of the arms 57 is disposed in the recess when the stripper plate is in its innermost position and the shaft 58 is in its lowermost position as shown in full lines in Figure 7.

The structure of Figures 5, 6 and 7 is shown simply to make clear that the coil control device may be mounted unitarily with the reel as well as separately therefrom. The exact form of structure may vary widely while accomplishing the same result.

An electric motor 71 drives a fluid pump 72 connected through a pipe 73 with a fluid reservoir 74. Valves 75 and 76 operated by operating members 75' and 76', respectively, determine the direction of outflow of fluid under pressure from the pump 72. The valve 75 controls the flow of fluid under pressure to the stripper, that fluid moving the stripper in one direction or the other depending upon the position of the valve.

The hydraulic system for the cylinder 54 is shown in Figure 8. The valve 76 and its operating member 76' have three positions, an "In"

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position, a "Neutral" position and an "Out" position as indicated by the legends in Figure 8. When the valve is in the "In" position fluid under pressure passes from the pump 72 through a pipe 77, through the valve, whose casing is designated 78 in Figure 8, and through a pipe 79 to the upper end of the cylinder 64 while fluid passes out of the lower end of the cylinder 64 through a pipe 80, a pressure relief valve 81 and a pipe 82 and through the valve and through a pipe 83 back to the tank 74. This causes downward movement of the piston in the cylinder 64 and upward movement of the shaft 58. When the valve is in the "Out" position fluid under pressure passes from the pump 73 through the pipe 77, through the valve, and through the pipe 82, the pressure relief valve 81 and the pipe 80 to the lower end of the cylinder 64 while fluid passes out of the upper end of the cylinder 64 through the pipe 79 and through the valve and through the pipe 83 back to the tank 74. This causes upward movement of the piston in the cylinder 64 and downward movement of the shaft 58.

When the apparatus is in operation with a series of strips being coiled up on the mandrel or block 44 and the shaft 58 carrying alternate separating discs and spacers as above described has been lowered into position with the separating discs engaging the mandrel or block 44 the valve is shifted to its "Neutral" position at which time both of the pipes 79 and 82 are closed at the valve. As the diameters of the coils being formed on the mandrel or block 44 increase the shaft 58 is gradually forced upwardly which in turn forces the piston downwardly in the cylinder 64. The downward movement of the piston in the cylinder 64 forces fluid out of the pipe 80 to the pressure relief valve 81. From the pressure relief valve 81, which may be adjustably set to determine the resistance which the shaft 58 offers to upward movement, the fluid passes through a pipe 84 whence part of it passes through a pipe 85 and through a check valve 86 and a pipe 87 to the pipe 79 while the remainder of the fluid passes through a pipe 88 back to the pump 72. Three flow control valves 89, 90 and 91 are provided as shown in Figure 8.

While I have shown and described certain present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a shaft mounted with its axis generally parallel to the axis of the mandrel, substantially circular coil confining and separating discs on the shaft positioned to be disposed against the sides of the coils as they are being formed to confine and separate the coils and means on the shaft engaging the discs at opposite sides thereof to predeterminedly position the discs axially of the shaft, the discs being mounted for continuous rotation through frictional engagement with the coils.

2. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a device controlling the coils as they are being formed, the

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device comprising a shaft mounted with its axis generally parallel to the axis of the mandrel with substantially circular coil confining and separating discs and spacers therebetween mounted on the shaft, and means for pressing the device toward the coils being formed so that the spacers engage the peripheries of the coils to keep the coils tight, the separating discs and spacers being mounted for continuous rotation through frictional engagement with the coils.

3. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a device controlling the coils as they are being formed, the device comprising a shaft mounted with its axis generally parallel to the axis of the mandrel with substantially circular coil confining and separating discs and spacers on the shaft engaging the discs at opposite sides thereof to predeterminedly position the discs axially of the shaft mounted for continuous rotation on the shaft in the same direction as the direction of linear movement of the strips and means for pressing the device toward the coils being formed so that the spacers engage the peripheries of the coils to keep the coils tight.

4. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a device controlling the coils as they are being formed, the device comprising a swingable carrier mounted for swinging movement about an axis generally parallel to the axis of the mandrel and having mounted therein a shaft also having its axis generally parallel to the axis of the mandrel with coil confining and separating discs and coil periphery engaging spacers therebetween mounted on the shaft, the carrier being swingable about the first mentioned axis whereby it is movable between operative position in engagement with the strips being coiled and inoperative position out of engagement with but adjacent the strips being coiled, a fluid pressure cylinder mounted adjacent the carrier, a piston within the cylinder and a connection between the piston and the carrier so that by fluid under pressure within the cylinder the carrier may be moved between operative and inoperative positions and the pressure of the device against the strips may be controlled.

5. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips moving to the mandrel generally in a plane are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a shaft whose axis is parallel to the axis of the mandrel, spaced apart supports for the shaft and separating means mounted on the shaft between the supports disposed between the strips as they are being coiled to separate the coils, the separating means being positioned to intersect said plane without causing the strips to deviate therefrom so as to lie between the edges of the strips as they pass to the coils and before the strips are coiled to guide the strips into the coils.

6. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a shaft whose

axis is parallel to the axis of the mandrel, spaced apart supports for the shaft, generally circular rotatable separating means mounted on the shaft between the supports disposed between the strips as they are being coiled to separate the coils and means on the shaft engaging the separating means at opposite sides thereof to predeterminedly position the separating means axially of the shaft, the generally circular separating means being positioned to intersect the plane along which the strips pass to the coils so as to lie between the edges of the strips as they pass to the coils and before the strips are coiled to guide the strips into the coils and being mounted for rotation through contact with the strips.

7. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a shaft whose axis is parallel to the axis of the mandrel, spaced apart supports for the shaft and separating discs mounted on the shaft between the supports disposed between the strips as they are being coiled to separate the coils, the thickness of the separating discs increasing inwardly from their peripheries, the discs having hubs secured thereto, the hubs being rotatable.

8. Apparatus for the multiple coiling of slit metal strips comprising a mandrel on which a plurality of strips are adapted to be coiled side-by-side simultaneously, means for rotating the mandrel to coil the strips thereon, a shaft whose

axis is parallel to the axis of the mandrel, spaced apart supports for the shaft, separating means mounted on the shaft between the supports disposed between the strips as they are being coiled to separate the coils and means disposed in the same direction from the mandrel as the shaft for stripping lengthwise off of the mandrel coils formed thereon, the stripping means having a recess in which the shaft is positioned along a portion of the length thereof.

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