Feb. 16, 1937. H. N. NEIDT 2,071,137

UNIVERSAL COILING MACHINE

Filed Sept. 27, 1935 3 Sheets-Sheet 1

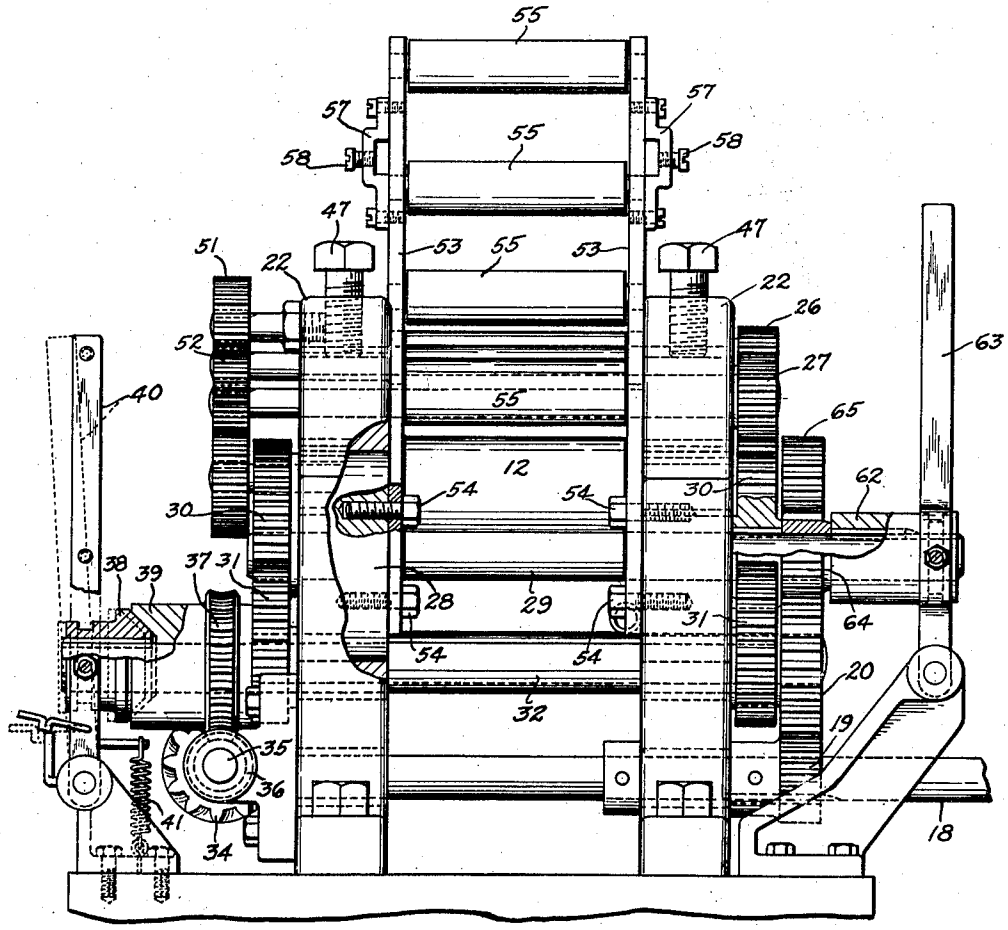


Fig. 1

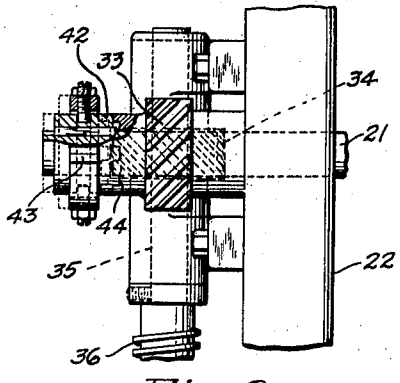


Fig. 2

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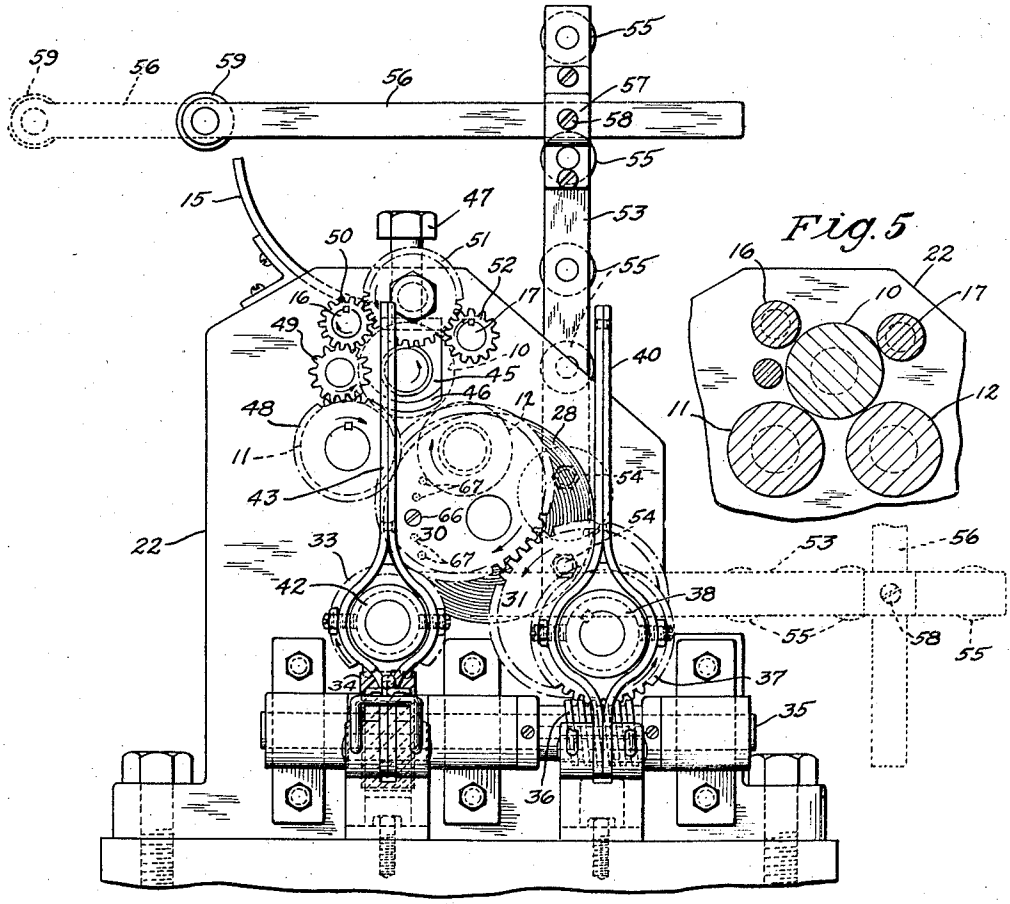


Fig. 3

Fig. 5

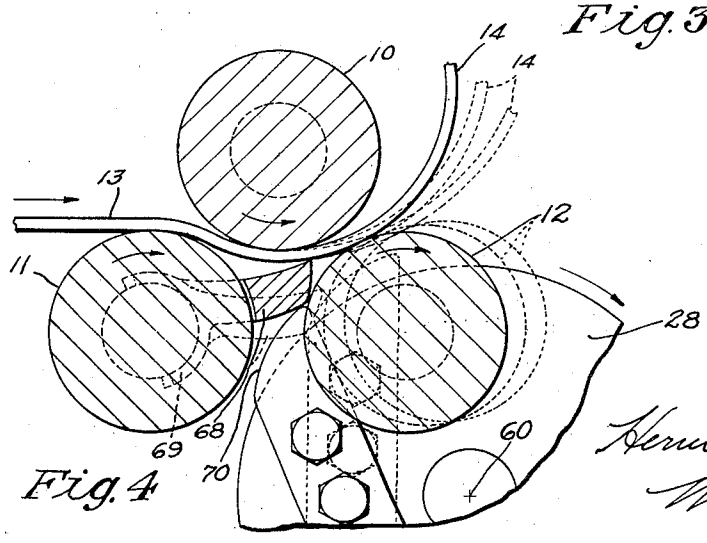


Fig. 4

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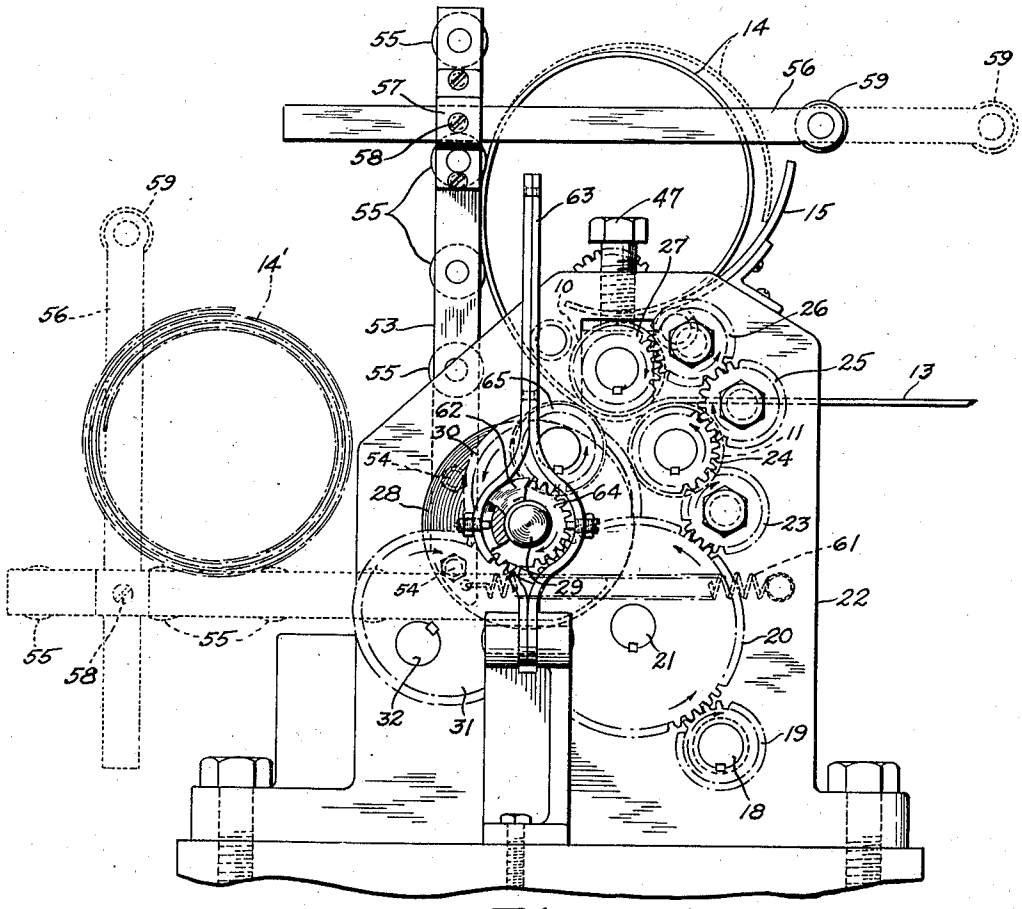


Fig. 6

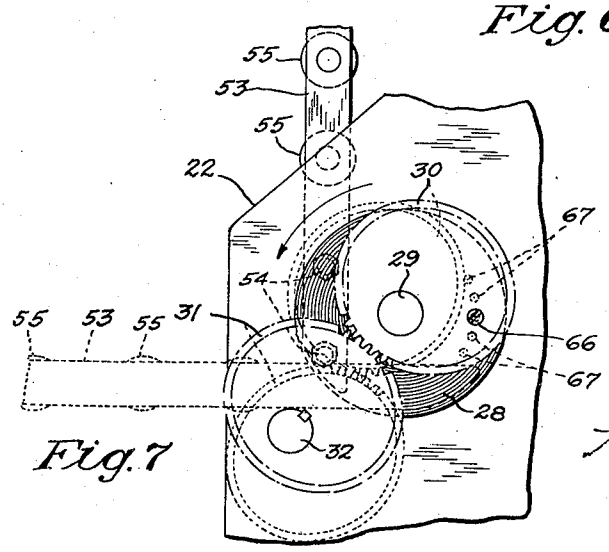


Fig. 7

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2,071,137

UNIVERSAL COILING MACHINE

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Application September 27, 1935, Serial No. 42,367

14 Claims. (Cl. 242—78)

This invention relates to a coiling machine, and more particularly to a machine for coiling flat strips or sheets of metal although it is not limited thereto. It may be used for coiling tubes or rods and may also be used for straightening the coiled strips, tubes or rods.

It is an object of the invention to provide an improved coiler which will coil the sheet or strip in a so-called open coil, that is with the adjacent convolutions of the coil spaced from each other so that in such operations as pickling or annealing and the like the entire coil will be uniformly treated.

It is also an object of the invention to provide a coiler which will be practically universal, that is it may be used for coiling open or closed coils, straightening metal, etc.

Another object is to provide a construction to facilitate removal of the coil from the machine and which after the coil is formed will lower it to the level of a truck or table and thus reduce necessary handling by the operator.

Still another object is to provide a coiler which may be used for coiling closed or open coils and on which the tail end may be left straight.

Other objects and advantages will become apparent as the description proceeds, and I wish it to be understood that I am not limited to the specific construction disclosed but may use various modifications and arrangements of the device.

In the accompanying drawings:

Fig. 1 is a front elevation or a view looking toward the outlet side of the machine;

Fig. 2 is a detail plan view of a portion of the drive mechanism;

Fig. 3 is a side elevation looking from the left of Fig. 1;

Fig. 4 is a detailed sectional view through the rolls;

Fig. 5 is a section through the coiling rolls and the coil supporting rollers;

Fig. 6 is a side elevation looking from the right of Fig. 1; and

Fig. 7 is a detailed side elevation of a portion of the drive for shifting the lower exit roll.

It is common practice in coiling strips or sheets of metal to employ three rolls arranged in pyramidal relation with the intermediate roll forming the upper or apex roll and two lower or base rolls arranged below the apex roll and one on either side thereof, so that metal fed over the forward or base roll and then under the apex and over the outlet base roll is given a bend in opposite directions so that as it leaves the rolls it is curved, and as it continues to come from the rolls is formed into a coil. It will be evident that if the relative positions of the three rolls are maintained the same the entire strip of metal will be given the same curvature so that it is formed into a coil with the adjacent convolutions in contact producing what is known as a tight or closed coil. For certain treatments of the metal it is desirable to have the metal coiled in a loose or open coil as it will be evident that with a tight or closed coil, in such treatments as pickling for instance, the outer convolutions will come readily in contact with the liquid while the surfaces of the inner convolutions may not be treated at all. Also, in annealing the outer convolutions will heat up quickly while the inner convolutions will heat more slowly with danger of non-uniform annealing throughout the coil. However, if the coil is wound loosely or with adjacent convolutions spaced from each other the coils would be uniformly heated throughout. It has therefore been old to vary the spacing between the top or apex roll and the two lower or base rolls of the coiler as the strip being coiled progresses through them in order to progressively vary the curvature of the metal so that the coil is wound with convolutions of progressively increasing diameter to produce a loose or open coil with adjacent convolutions spaced a short distance from each other. This was done by shifting the upper or apex roll gradually upwardly away from the lower or base roll during the coiling operation. This worked quite satisfactorily if the strip being coiled was of relatively hard metal with considerable resiliency so as to maintain the bite between the apex and base rolls. This, however, was not satisfactory for coiling relatively soft metal as this metal would not have sufficient resiliency to maintain the required grip or bite between the rolls throughout the coiling operation as the upper roll was moved away from the lower rolls.

I overcome these objections, and can coil either relatively hard or relatively soft metal with equal facility into a loose or open coil by gradually shifting the outlet base or lower roll away from the upper roll, but leaving the lower inlet roll and the upper or apex roll in the same relative positions, so that the grip or bite between these rolls on the strip being coiled is maintained the same or kept uniform throughout the entire coiling operation. These rolls therefore act as feed and pinch rolls. The shifting of the outlet or rear base roll has the effect of varying the curvature imparted to the strip so that the convolutions grow progressively larger as the coil is formed with the result that the convolutions are

spaced as desired. My improved machine includes improved means for so shifting the outlet lower or base roller with a drive which may be disconnected so as to form a tight coil, if desired, together with improved means for supporting the coil and for facilitating the removal of the coil from the machine.

The three coiling rolls are indicated at 10, 11, and 12 arranged in pyramidal relation as shown in Fig. 4, the roll 10 being the upper or apex roll, the roll 11 being the inlet lower or base roll, and the roll 12 being the rear or outlet base or lower roll. The metal strip 13 is fed between the rolls as indicated, passing over the top of the roll 11, under roll 10 and out over the top of the roll 12. It will be noted that it is first bent in one direction by the rolls 10 and 11 and then in the opposite direction by rolls 10 and 12 giving it a permanent set to a certain curvature so that as it continues to pass through the rolls it is formed into a coil 14. A curved guide 15 assists the free end in coming round in the circle and helps to retain the coil as it is formed on the supporting rollers 16 and 17, these rollers being driven so as to turn the coil during the coiling operation.

The rolls may be driven by any suitable means. Ordinarily these coilers are placed at the outlet side of a rolling mill to receive the strip or sheet of metal as it leaves the rolling mill and coils it as fast as it leaves the rolls. The coiler may be driven by any suitable drive such as a motor, but is generally driven from the drive mechanism for the rolling mill so that the surface speed of the rolls of the coiler has a certain relation to the surface speed of the rolls of the rolling mill, and therefore the speed of the strip as it leaves the mill, the speed of the coiling rolls being generally such as to place a tension on the strip as it leaves the rolling mill so as to keep it taut and straight. In the drawings I have not shown the rolling mill or the rolling mill drive, but as indicated above the main drive shaft 18 may be driven from the rolling mill drive by any suitable means. In the arrangement of the drawings I have shown an arrangement of drive by way of example, but various modifications may be employed as desirable. In the present showing the pinion 19 on the shaft 18 meshes with the gear 20 on a shaft 21 extending between the housings 22. The gear 20 meshes with a smaller idler pinion 23 which in turn meshes with a gear 24 driving the lower or base inlet roll 11. The top or apex roll 10 is driven from the gear 24 by the two idlers 25 and 26, 25 meshing with the gear 24 and gear 26 meshing with the gear 27 keyed to the neck of the roll 10. This drives the roll 10 in the opposite direction from the roll 11.

The outlet or base roller 12 is mounted to be gradually shifted away from the top roller 10 during the coiling operation so that as the strip progresses through the rolls it is given less and less bend, or that is, is wound in convolutions gradually increasing in diameter, so that the coil instead of being wound close or tight is wound loose or in an open condition with the adjacent convolutions spaced a short distance from each other. To accomplish this effect the outlet roll 12 is mounted on a support which turns about an axis eccentric to the axis of the roll 12. In other words, as the roll 12 is mounted on the support eccentric to the axis of rotation of this support the roll will be shifted bodily about the axis of rotation of the support. In the present instance this support comprises a pair of discs or cylinders 28 mounted to turn in bearings in the housings 22, and these two discs or cylinders are connected by a shaft 29 to which they are fastened so as to rotate together. They are driven by means of a pair of elliptical gears 30 and 31. One pair of these gears is sufficient to turn the support, but preferably there is a pair for each end of the support so that both cylinders 28 will be driven uniformly and the roll 12 kept in better alignment. The elliptical gears 30 are connected to the cylinders 28 and mounted on the shaft 29 while the elliptical gears 31 meshing therewith are secured to a shaft 32 extending transversely between the housings. This shaft is driven from the main drive by means of a spiral gear 33 on the shaft 21 meshing with a similar spiral gear 34 on a shaft 35 extending at right angles thereto. This shaft 35 carries a worm 36 meshing with a worm gear 37 on the shaft 32. This worm gear is loose on the shaft 32 but may be connected to it and released by means of a friction clutch, in the present instance indicated by a cone 38 splined to the shaft 32 so that it is keyed to this shaft but is slidable longitudinally thereon to and from the cone 39 connected with the worm gear 37. The clutch 38 may be released by means of a hand lever 40, but is normally held in engagement with the cone 39 during the coiling operation by a spring 41. The spiral gear 33 is also loose on the shaft 21 but has driving connection therewith through a clutch 42 operated by a hand lever 43, the member 42 being splined to the shaft 21 and having lugs 44 moving to and from engagement with corresponding recesses in the collar of the gear 33. This may be a friction clutch if preferred. Thus by releasing the clutch 42 or the clutch 38 the drive to the support 28 for the roll 12 may be disconnected.

The upper or apex roll 10 may be adjusted vertically to maintain the "pinch" or "bite" for different gauges of metal. For this purpose the roll 10 is mounted at its opposite ends in bearings 45 slidable vertically in slots 46 in the housings 22, and the position of the roll may be determined by adjusting screws 47. The supporting rollers 16 and 17 for carrying the coil as it is being formed are also driven by any suitable means. In the present instance the neck of the roll 11 is extended and carries a gear 48 meshing with an idler 49 which meshes with a gear 50 keyed to the neck of the roller 16. This gear 50 meshes with an idler 51 meshing with another gear 52 keyed to the neck of the roller 17 so that these two rollers are driven in the same direction and with the same surface speeds. To facilitate the removal of the coil from these rollers the rear roller 17 on the outlet side is placed somewhat lower than the roller 16 so that the coil may be more readily rolled off when it is completed.

Connected to the discs or cylinders 28 so as to turn therewith are arms 53. These may be secured to the disc by any suitable means such as the screws 54. In the normal coiling position these arms extend upwardly as shown in full lines on the opposite side of the rolls 10, 11 and 12 from the guide 15, and they carry suitable guides or guards such as idler rolls 55 to engage and guide the coils 15 during the coiling operation. These arms 53 also carry laterally extending arms 56 which preferably extend at substantially right angles thereto and across the opposite ends of the coil 14. In the present instance they are mounted to slide in brackets 57 carried by the arms 53 for adjustment and may be se-

cured in adjusted positions by the set screws 58. They carry a guide or roll 59 extending between them on the opposite side of the coil 14 from the arms 53 to assist in removing the coil 14 from the rollers 16 and 17 as will be further described.

In operation, if it is desired to coil the strip or sheet in an open or loose coil with the adjacent convolutions spaced from each other the two clutches 42 and 38 are left in engagement so that as the rolls 10, 11 and 12 are driven the drive 33, 36, 37 gradually turns the support discs 28 to shift the outlet roll 12 to the right as viewed in Figs. 3 and 4. This gradually carries the roll 12 away from the roll 10 as shown in dotted lines Fig. 4 so that the convolutions of the coil 14 are gradually made larger and larger in diameter as the strip progresses through the coiler, and therefore the coil is formed with the adjacent convolutions spaced a short distance from each other producing a so-called open coil as shown by the broken lines at 14' in Fig. 6. It will be seen however that as the roll 12 only is shifted the other rolls 10 and 11 remain constantly in the same relative position throughout the entire coiling operation. Therefore the bite or grip between the rolls 10 and 11 remains constant and is maintained throughout the entire coiling operation so that there is no variation of the feed of the strip through the coiler as would be the case if the top roll 10 were shifted. Because of this fact I can coil in an open or loose coil not only strips of relatively harder metal having considerable resiliency but also I can coil with equal facility strips of relatively soft metal or metal with very little resiliency.

It is to be noted from Fig. 4 that the center of rotation of the support 28 indicated at 60 is below and rearwardly of the center of the roll 12 when in its normal position at the beginning of the coiling operation. Therefore the roll 12 instead of being dropped vertically downward away from the roll 10 is shifted backwardly and upwardly and therefore this roll 12 supports the strip 13 and helps support the coil 14. Then after the center of the coil 12 passes over the center 60 the roll 12 is carried rearwardly and downwardly which is at the end of the coiling operation to remove the coil from the machine and permit the coil to be carried downwardly and rearwardly by the frame formed by the arms 53 and 56 together with their guide rolls. That is, as the coiling operation is completed the operator releases the clutch 38 which permits the springs 61 which are connected to the lower ends of the arms 53 to swing these arms downwardly and rearwardly by rotation of the supporting discs 28 to the dotted line position of Figs. 3 and 6. This movement carries with it the completed coil 14 which, if it does not fall of its own weight, is carried off the rollers 16 and 17 by the roller 59, and thus by merely releasing the clutch 38 the completed coil is automatically carried downwardly and rearwardly out of the coiling position to the broken line position 14' of Fig. 6 where it may be easily rolled onto a truck or table.

If it is desired to have a straight or uncoiled tail end on the coil to facilitate sticking in another rolling mill all that is necessary is for the operator to release the clutch 38 a short time before the free tail end of the coil is fed into the coiler. As indicated above this release of the clutch 38 permits the spring 61 to throw the frame 53 downwardly, and as this action also rotates the supporting discs 28 it at the same time carries the outlet roll 12 down and backwardly away from the roll 10 so that the last end portion of the strip 13 comes through the coiler straight and is not coiled.

The roll 12 is also driven in a direction opposite to the direction of rotation of the apex roll 10, and this roll 12 is driven during its shifting movements. This is accomplished by an idler gear 64 meshing with the gear 20 and in turn the idler gear 64 meshes with a gear 65 keyed to the neck of the roll 12. The idler 64 is coaxial with the axis of rotation of the supporting discs 28 about which the roll 12 and gear 65 swing so that there is a proper drive from the gear 20 to the gear 65 and the roll 12 in all of its positions.

For the next coiling operation the frame 53 and the roll 12 must be brought back to the normal full line position by rotating the supporting discs 28 backwardly. This may be readily accomplished by means of a friction clutch 62 operated by the lever 63 adapted to engage the idler 64. It will be evident that this idler 64 is rotated to the right or clockwise as viewed in Fig. 6, which is also the direction in which the supporting discs 28 for the roll 12 must be rotated to bring the support and the roll back to the coiling position. Therefore as the gear 64 is concentric with the axis of rotation of these supporting discs, or that is, is loose on the shaft 29, by merely clutching this idler to this shaft through the friction clutch 62 the whole support comprising the discs 28 and the elements carried by them are quickly brought back to the full line or coiling position by rotation of gear 64, and when they reach this position the clutch 62 is released. If it is not released at just the right moment it will slip so that nothing will be broken. It will of course be understood from this operation that the clutch 62 is splined to the shaft 29 so that it is keyed to the shaft but is slidable longitudinally thereon.

In order to prevent the free forward end of the strip 13 from passing down between the rolls 11 and 12 a guide 68 is provided between these rolls and preferably has a curved top surface so as to guide the free end of strip upwardly between rolls 10 and 12. However, if this guide were stationary it would still bend the strip upwardly after roll 12 is moved rearwardly. Therefore the guide 68 is pivoted, in the present case by bearings 69 on the necks of roll 11, and it is held in its upper position by a cam or cams 70 secured to one or both of discs 28. With this arrangement as the discs 28 are rotated the cams 70 are shifted away from the guide 68 allowing it to gradually drop down away from roll 10 as shown in dotted lines Fig. 4 so as not to interefere with the coiling operation. When the discs 28 are turned back to bring the roll 12 back to the coiling position the cam or cams 70 engage the guide 68 and raise it to the normal or full line position of Fig. 4.

It will be seen from Fig. 4 that if the supporting discs 28 for the roll 12 were turned at a uniform speed during the coiling operation there would be a variation in the shifting speed of the roll 12. In other words during the first part of the coiling operation the movement of the roll 12 away from the roll 10 would be relatively slow but would become more rapid as the roll 12 moves away from the roll 10. This is because the center of the roll 12 is moving progressively farther away from the line joining center 60 and the center of the roll 10. This action would tend to give non-uniform coiling and therefore to obviate this I employ means to vary the speed of movement of roll 12 so as to get uniform coiling. In the pres-

ent instance I use the elliptical gears 30 and 31 for rotating these supporting discs 28. By means of these gears the speed of rotation of the discs 28 is gradually reduced as the roll 12 moves farther and farther away from the roll 10 and therefore the movement of the roll 12 away from the roll 10 may be made substantially constant giving a more uniform coiling operation. The elliptical gears 30 can also be mounted so as to be adjustable around the axis 60 of the discs 28 so that the variation in the speed of rotation of the discs 28 and the shifting of the roll 12 may be varied as desired. For this purpose I have shown a screw or pin 66 in the gear 30 which may be seated in any one of a series of openings 67 in the supporting disc 28 to thereby secure the gear 30 in different angular positions on the discs 28. The gears 30 can therefore be located to give the greatest speed of rotation of the disc 28 at any desired location in their movement.

As indicated above this machine may also be used to make a tight or closed coil. In order to do this all that is necessary is to release the clutch 42 and maintain it released. This will cut out the drive 33, 34, 36 to the support 28 for the roll 12 and therefore the roll will not be shifted away from the roll 10 and the strip will be coiled in the usual manner. Under these conditions the roll 12 and the frame 53 are held in the coiling position by the clutch 38. At the end of the coiling operation, by merely releasing the clutch 38 the frame 53 is thrown downwardly and rearwardly by springs 61 to discharge the coil from the machine as above described, and if the clutch 38 is released just before the last end portion of the strip is coiled the coil will be carried down and left with a straight tail end. In other words this is a universal coiling machine in that it will take care of all of the ordinary coiling operations. That is, it will coil closed coils, open coils, coils with or without a straight tail, can be used for straightening out a coiled strip, rod or tube, and can be used for coiling tubes or rods. In short it can be used for all the ordinary coiling operations. It can also carry the finished coil down to the level of a truck, and it will do this either with or without a straight tail end, and it is practically automatic requiring only simple and easy operations on the part of the operator.

Having thus set forth the nature of my said invention, what I claim is:

1. In a coiling machine, an upper roll, a pair of rolls positioned below and one on either side of the upper roll arranged to impart a downward and then an upward curvature to a strip of metal fed between the upper and lower rolls, means for driving the upper roll in one direction and the lower rolls in the opposite direction, and means connected with and operated by the drive for gradually moving the rear lower roll away from the upper roll throughout the coiling operation to progressively increase the diameter of the coil and coil the convolutions in spaced relation.

2. In a coiling machine, three rolls arranged in nesting spaced apart pyramidal relation, means for rotating the apex roll in one direction and the base rolls in the opposite direction to curve a strip of metal fed between the apex and base rolls, and means operable to gradually move the rear base roll backwardly and upwardly away from the apex roll as the strip is advanced between the rolls to progressively increase the diameter of the coil and coil the convolutions in spaced relation.

3. In a coiling machine, three rolls mounted in pyramidal relation, means to drive the apex roll in one direction and the base rolls in the opposite direction to coil a strip of metal fed between them, and means for gradually shifting the rear base roll bodily rearwardly about a center placed to the rear of the original axis of the roll as the strip is advanced through the rolls to progressively increase the diameter of the coil and coil the convolutions in spaced relation.

4. In a coiling machine, three rolls mounted in pyramidal relation, means to drive the apex roll in one direction and the base rolls in the opposite direction to coil a strip of metal fed between them, a support for the rear base roli rotatable about a center eccentric to the axis of the roll, and means connected with the drive to rotate the support to gradually shift the rear base roll away from the apex roll as the strip is advanced through the rolls.

5. In a coiling machine, three rolls mounted in pyramidal relation, means to drive the apex roll in one direction and the base rolls in the opposite direction to coil a strip of metal fed between them, a support for the rear base roll rotatable about a center eccentric to the axis of the roll, and means connected with the drive to rotate the support to gradually shift the rear base roll away from the apex roll as the strip is advanced through the rolls, said drive connection including means to gradually vary the speed of rotation of the support as the turning movement progresses.

6. In a coiling machine, three rolls mounted in pyramidal relation, means to drive the apex roll in one direction and the base rolls in the opposite direction to coil a strip of metal fed between them, a support for the rear base roll rotatable about an axis eccentric to the axis of the roll to shift this roll away from the apex roll, and a driving connection between the roll drive and the rotatable support including intermeshing elliptical gears to vary the speed of rotation of the support as the strip advances between the rolls.

7. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the apex roll in one direction, a rotatable support for the outlet base roll, means for mounting said roll on the support eccentric to the center of rotation of the support, a driving gear, a driven gear for driving the outlet roll in a direction opposite to the apex roll, an idler gear between the driving and driven gears meshing therewith and mounted on a shaft concentric to the axis of rotation of the support, and a clutch for connecting said idler to its shaft to shift the support.

8. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the rolls, a support for the outlet base roll mounted to turn about an axis eccentric to the axis of the roll, a feed drive for turning the support to gradually shift the latter roll rearwardly away from the apex roll as a strip progresses between the rolls, and a manually controlled drive from the roll drive for reversing movement of the support to return the outlet base roll to coiling position.

9. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the rolls, a support for the outlet base roll mounted to turn about an axis eccentric to the axis of the roll, a feed drive for turning the support to gradually shift the latter roll rearwardly away from the apex roll as a strip progresses between the rolls, coil supporting rollers above the said rolls, a guide frame carried by the outlet base roll

support and movable therewith, means to turn the support at the end of a coiling operation to carry the frame downwardly and rearwardly, and means on said frame to carry a coil downwardly and rearwardly out of the machine away from the rollers.

10. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the rolls, a support for the outlet base roll mounted to turn about an axis eccentric to the axis of the roll, a feed drive from the roll drive for turning the support to gradually shift the outlet base roll away from the apex roll as a strip progresses between the rolls, a frame on the support and movable therewith, means tending to shift said support downwardly and rearwardly, means for at will disconnecting the feed drive to permit said support shifting means to act, and means on said frame to carry a coil downwardly and rearwardly from the machine.

11. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the rolls, a support for the outlet base roll mounted to turn about an axis eccentric to the axis of the roll, a feed drive from the roll drive for turning the support to gradually shift the outlet base roll away from the apex roll as a strip progresses between the rolls, a frame on the support and movable therewith, means tending to shift said support downwardly and rearwardly, means for at will disconnecting the feed drive to permit said support shifting means to function, means on said frame to carry a coil downwardly and rearwardly from the machine, and a manually controlled drive from the roll drive for reversing movement of the support to return the outlet base roll and the frame to coiling position.

12. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the rolls, a pivoted guide between the base rolls to guide the free end of a strip between the apex and base rolls, a support for the outlet base roll, means for shifting said support to move the latter roll gradually away from the apex roll as a strip progresses between the rolls, and means controlled by movement of said support to permit the guide to gradually drop away from the apex roll as the outlet roll is shifted.

13. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the rolls, a pivoted guide between the base rolls to guide the free end of a strip between the apex and base rolls, a support for the outlet base roll mounted to turn about an axis eccentric to said roll, a driving means for rotating the support to gradually shift the outlet base roll away from the apex roll as a strip progresses through the rolls, and a cam on said support to retain the guide in its upper position at the beginning of the coiling operation and arranged to permit the guide to drop away from the apex roll as the outlet base roll is shifted.

14. In a coiling machine, three rolls mounted in pyramidal relation, means for driving the rolls, a movable support for the outlet base roll, a feed drive from the roll drive to said support for shifting the support to gradually move the outlet base roll away from the apex roll as a strip progresses between the rolls, a manually controlled clutch for connecting and disconnecting said feed drive, and means for shifting the outlet base roll downwardly and rearwardly when said drive is disconnected.

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