

[54] **METHOD OF AUTO-LOADING OF COILED MATERIAL IN BLANKING LINE**

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[58] Field of Search..... **242/79, 78.6, 78.7, 242/78.8, 58.6**

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[57] **ABSTRACT**

In a blanking line including a coil car, an uncoiler, a washing roll, a feed roll, a leveler and a blanking press, an auto-loading operation of a coiled steel material in the blanking line can be attained by carrying out automatically various kinds of operations which have been manually made heretofore, such as, for example, operation for loading the coiled steel material on the coil car, operation for supporting the coiled steel material by the uncoiler and the like operations.

4 Claims, 8 Drawing Figures

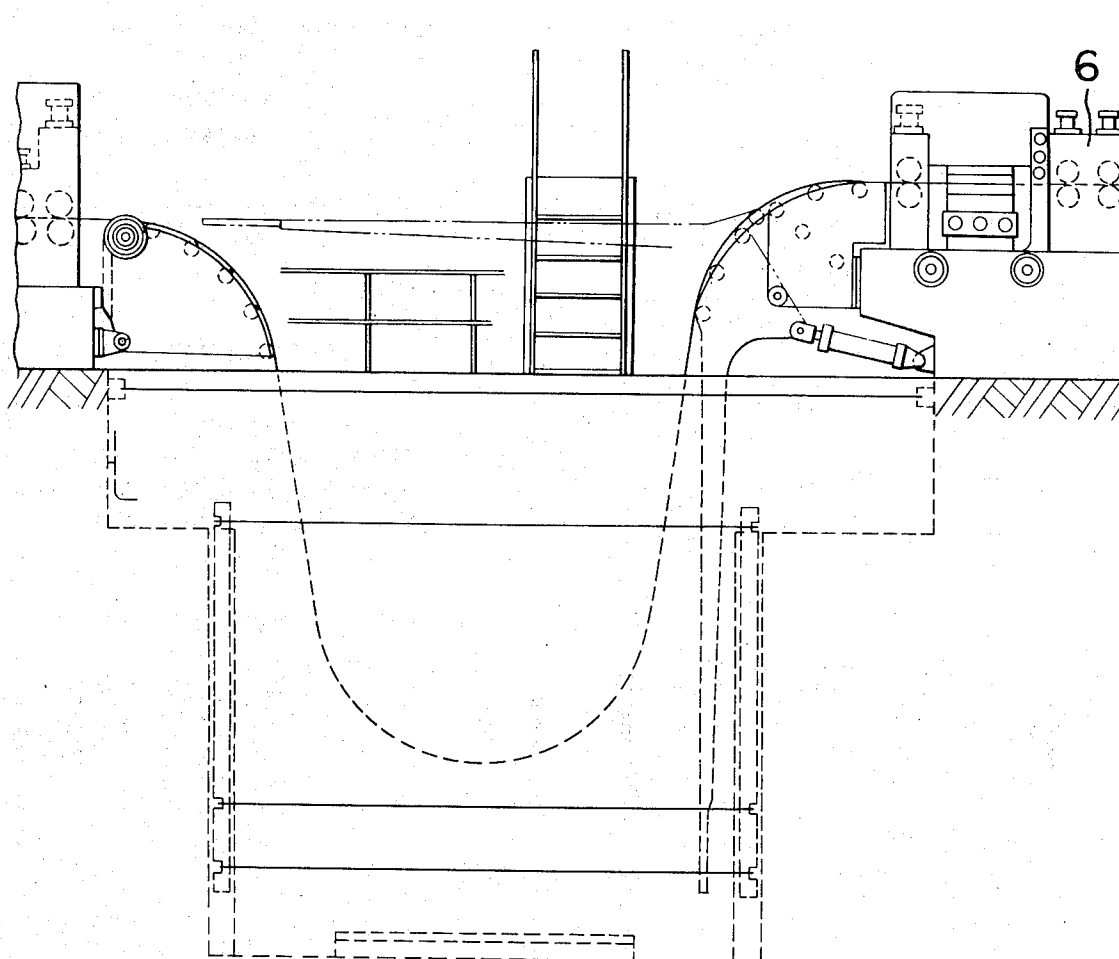
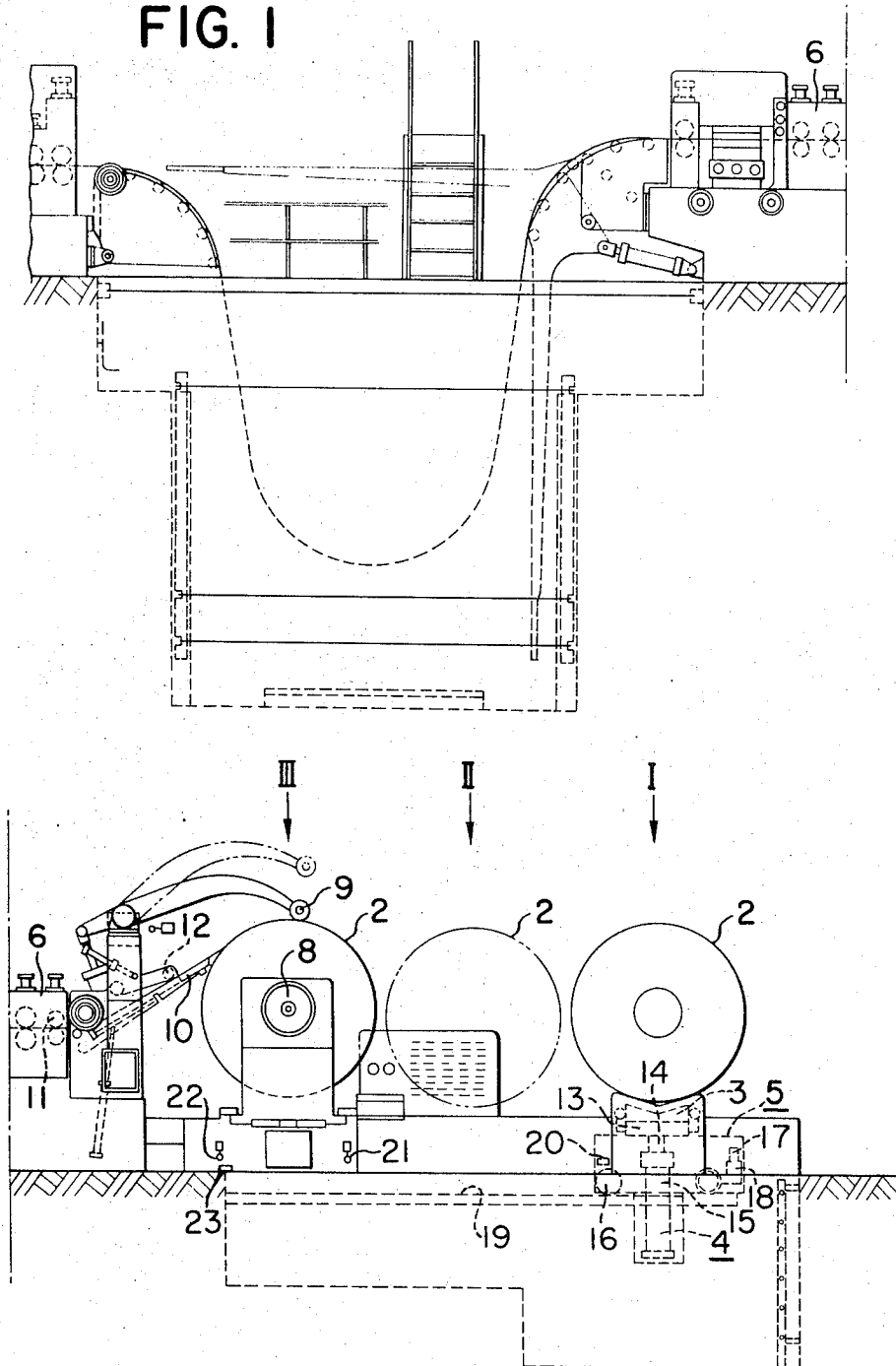


FIG. 1



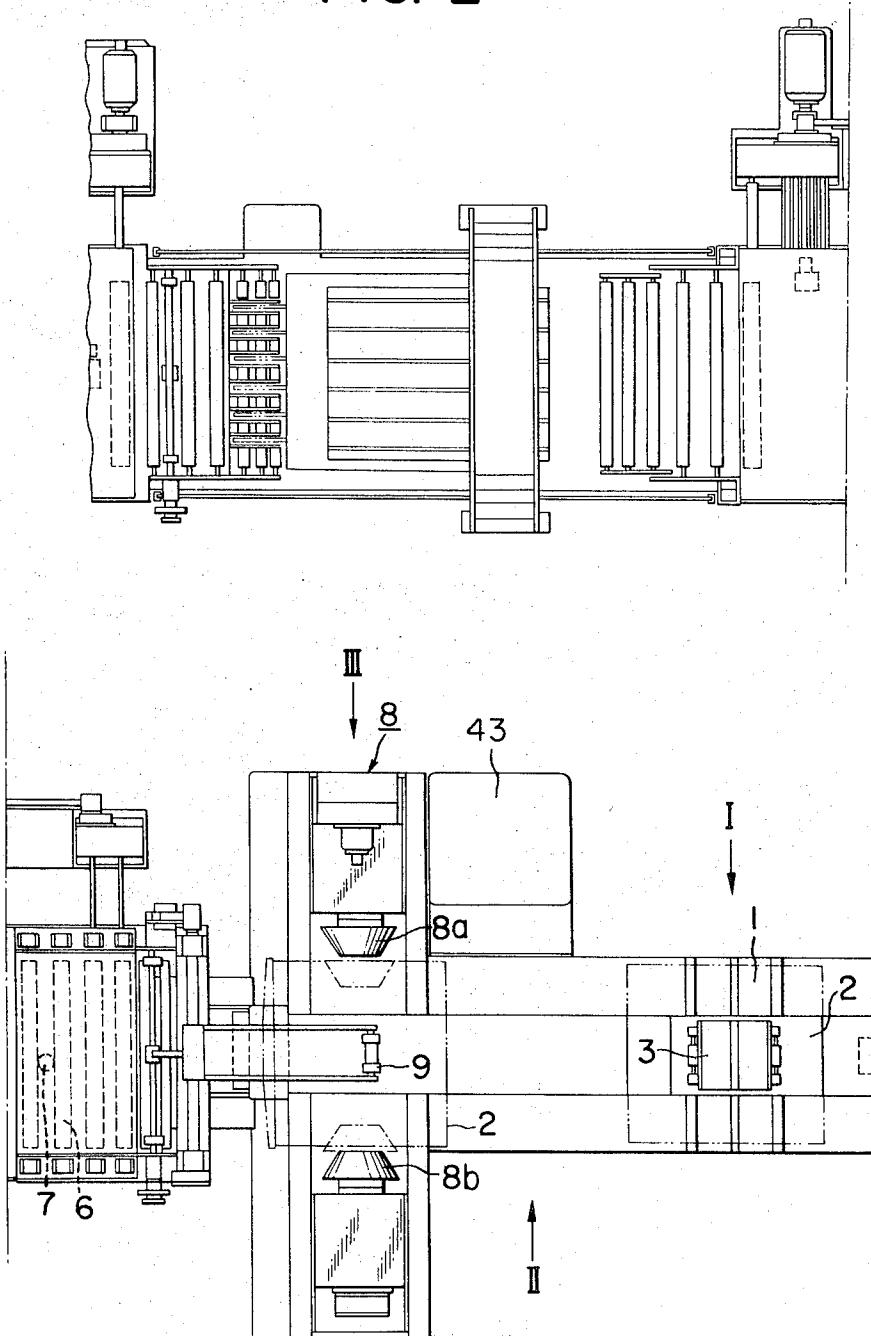
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FIG. 2



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FIG. 5

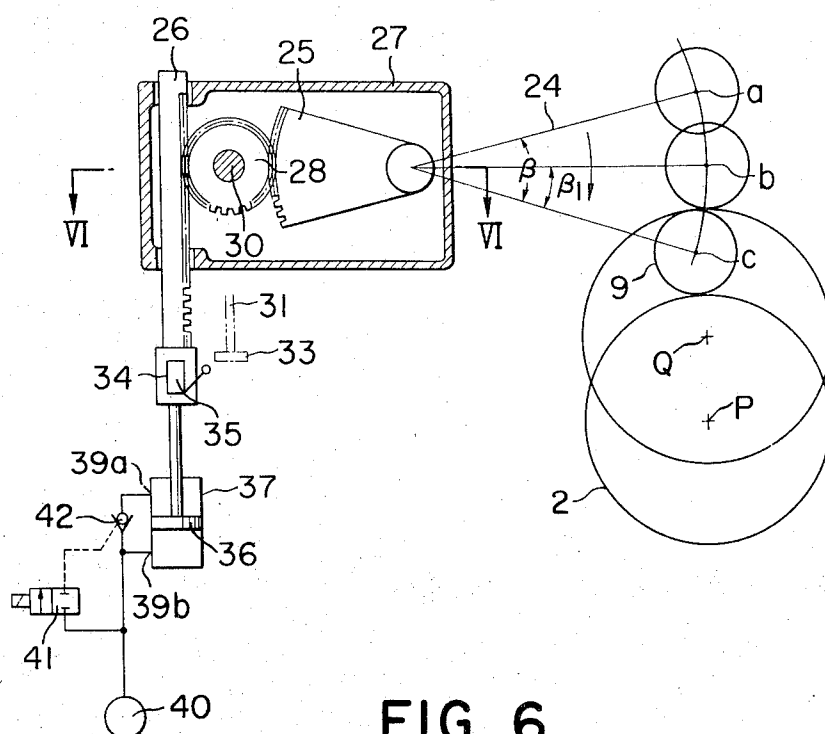
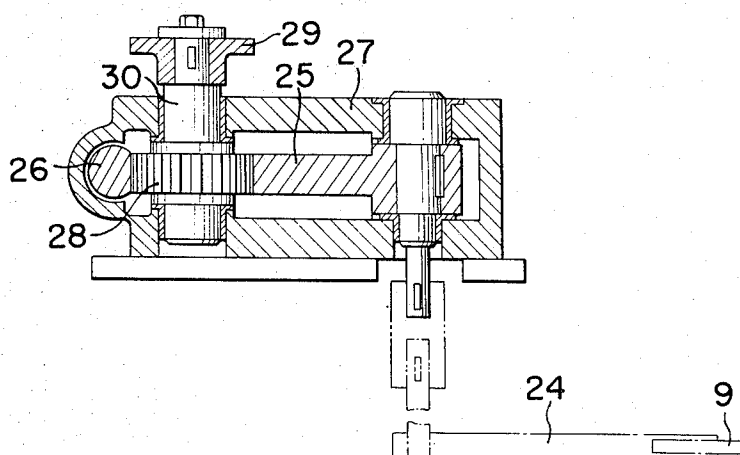


FIG. 6



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FIG. 7

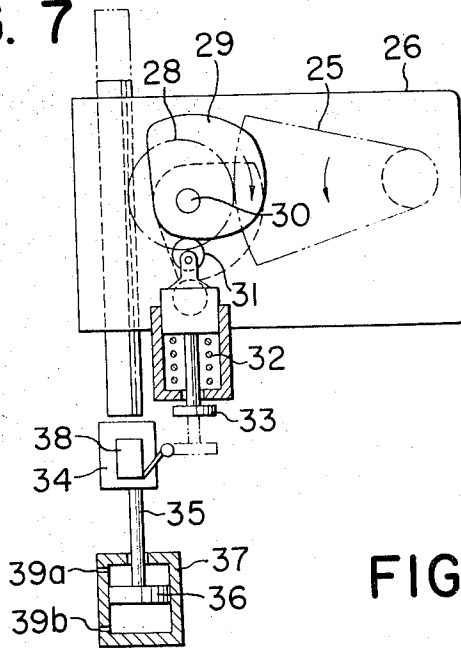
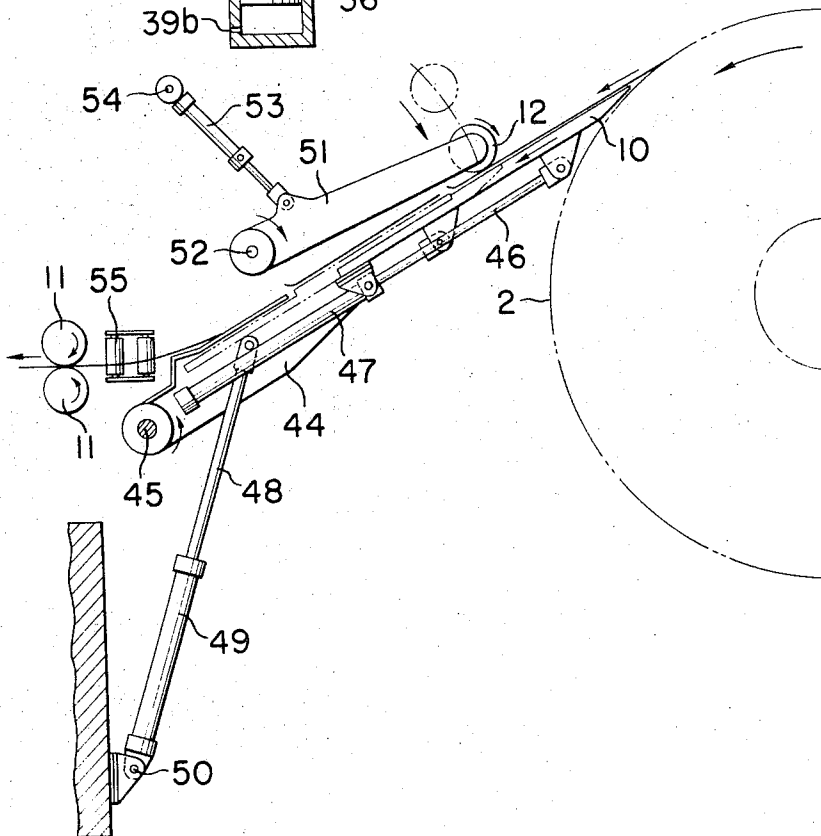


FIG. 8



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METHOD OF AUTO-LOADING OF COILED MATERIAL IN BLANKING LINE

BACKGROUND OF THE INVENTION:

Heretofore, the loading of a coiled material to a blanking line is effected by loading the coil on coil car, running the car by operating a manual valve based on an artificial, visual judgement, stopping the car when it reaches directly below an uncoiler, after which centering visually the center of an uncoiler cone and the center of the coiled material, raising the coil car by operation of the manual valve, clamping the coil material by the uncoiler cone, then lowering the coil car, after which centering the coil material by shifting the whole uncoiler assembly with the coiled material while watching a width indicating scale, thus to complete the loading operation.

Thus, when the loading is effected by manual operation of valve exclusively through the intuition and experience of the operator, there appears a considerable personal difference in the time required for the loading, and there occurs a number of difficulties in not only that the operation is inefficient but also the operators are always exposed to great danger.

SUMMARY OF THE INVENTION

The present invention relates to a method of auto-loading of a coiled material in a blanking line in which forming blanks are obtained from a coiled material.

The object of the present invention is to provide a effective and convenient method of auto-loading which is free of said difficulties, and which is characterized by the steps of loading a coiled material at a predetermined position where a coil car returns, stopping the coil car at a stand-by point, detecting the passing of the end portion of the coiled material at a decoiler, starting the running of the coil car, stopping the coil car below the uncoiler, detecting the outer diameter of the coil by lowering a snubber roll, stopping a coil car lifter, lowering an uncoiler clamp and the coil car lifter, and resuming the running of the coil car, whereby, by repeating these steps and detecting and interlocking each of the steps, the loading can be effected continuously.

BRIEF DESCRIPTION OF DRAWINGS:

FIG. 1 is a front elevation of the device for practising the method according to the invention,

FIG. 2 is a plan view of the same,

FIGS. 3 and 4 are respectively explanatory view of the principle for seeking the center of the coiled material,

FIG. 5 is a sectional view of the apparatus of the principle which has been explained in FIGS. 3 and 4,

FIG. 6 is a sectional view taken along VI—VI in FIG. 5,

FIG. 7 is a partial sectional view of the cam portion in FIG. 6, and

FIG. 8 is a side view of the drawing and guiding mechanism of the coiled material.

DETAILED DESCRIPTION OF THE INVENTION

Now an embodiment of the present invention will be described referring to the drawings. The predetermined restoring position I of the coil car is the position adjacent to fixed skids 1, and the loading is effected by the steps of mounting the coiled material 2 on a sliding skid 3 and on the coil car 5 having a lifter 4, causing a

standby of the coil car at a stand-by and stop position II, starting the coil car from the position II upon receiving a signal which shows that the end portion of the preceding coiled material has passed a pass detector provided on a decoiler 6, stopping the coil car 5 at a stopping position III of the coil car below the center line of an uncoiler 8, detecting the outer diameter of the coiled material 2 by contacting the coiled material 2, which is in the III position, with a snubber roll 9, raising the coil car lifter 4 upon the detection of the outer diameter of the coiled material 2, stopping the lifting of the lifter 4 upon coincidence of the axial center of the coiled material 2 with the center line of the uncoiler 8, clamping the coiled material 2 by immediately transferring the uncoiler cone in a direction of the center upon the coincidence of the axes, lowering the lifter 4 after the clamping, and repeating and detecting electrically each of the above-stated steps of restoring the coil car 5 to the I position after lowering and restoring to mount new coiled material on the coil car 5 which is returned to the I position, whereby each of the steps are interlocked and the loading is effected full-automatically and continuously. In the drawing, the numeral 10 designates a sliding table forwarding the coiled material 2 from its tip end to washing rolls 11, the numeral 12 is a holding roll clamping and holding the coiled material between it and the sliding table 10. The snubber roll holds the tip end portion of the coiled material downwardly.

The sliding skid 3 of the coil car 5 is provided on a base 13. The base 13 is fixed on the upper end of a rod 14 capable of up and down movement which is fitted in the cylinder 15 of the lifter 4.

The coil car 5 has wheels 16, 16, 16, these wheels are rotated by a rotary torque of the hydraulic motor 17 through the reducing mechanism 18, whereby the coil car 5 runs on the rail 19.

A cam 20 is provided on the coil car 5, and a limit switch 21 is provided at a predetermined position to change the speed and torque of the coil car 5. When said cam 20 contacts said limit switch 21, the control signal is produced and then transmitted to the control mechanism. Consequently, the control mechanism is operated, and the controlled pressure and flow quantity are fed to the driving mechanism and as a result the coil car 5 enters the running state in the low speed and low torque.

Further, when the cam 20 of the coil car 5 contacts another limit switch 22 for stopping the coil car at a pre-determined position, the signal is produced and the feeding of the actuating liquid to the hydraulic motor 17 is cut off by said signal, as a result, the coil car 5 operates at very slow speed. Next, when the front wheel 16 of the coil car is engaged with the stopper for stopping at a predetermined position, the coil car 5 is stopped. When the end portion of the coiled material 2 fed from the uncoiler 8 passes through the detector 7, a signal is produced from the detector 7, and the base on the cylinder of the coil car 5 at the position I is lifted, said cylinder 15 being actuated by said signal.

In such state, new coiled material 2 is fed to the sliding skid 3 of the coil car 5 from the fixed skid 1. The coil car 5 runs as far as the position II by actuating the driving mechanism of the coil car 5 and stops there, when the base 13 of the coil car 5 is lowered slightly. Thereafter, the coil car 5 runs toward the uncoiler 8.

When the cam 20 of the coil car 5 contacts the limit switch 21, the coil car 5 runs at low speed.

When the cam 20 contacts another limit switch 22, the coil car 5 runs at very low speed, and said coil car 5 is stopped at the position of the stopper 23.

When the coil car 5 arrives in the uncoiler, the coiled material 2 on the coil car 5 is supported by the uncoiler 8 while actuating the snubber roll.

In this case, the coiled material 2 is supported by the uncoiler 8 so that the center of the coiled material coincides with the center of the cone of uncoiler 8 by the displacement of the snubber roll contacted on the outer top portion of said coiled material 2.

The coincidence of the center of the coiled material with the center of cone of the uncoiler is carried out as explained below.

The snubber roll 9 is mounted on the top end of the rocker arm 24, segment gear 25 is fixed at the back portion of said rocker arm 24, and said segment gear 25 is engaged with a vertical rack 26 in the casing 27 through a pinion 28. A cam 29 is fixed on the shaft 30 of the pinion 28, a follower 31 is in contact with the cam 29 at the lower portion of said cam 29 by means of a spring 32, and the lower portion of said follower 31 forms a switch operating portion 33.

A switch mounting plate 34 faces the lower portion of the rack 26, said switch mounting plate 34 is fixed integrally on a rod 35 of the piston 36 of the cylinder 37 fixed on the base, and a limit switch 38 is fixed to the switch mounting plate 34.

In FIGS. 5, 6 and 7, numerals 39a, 39b are each a connecting port of the cylinder 37; 40 is a hydraulic pressure feeding pump; 41 is a solenoid valve; 42 is a pilot check valve; P is the center of the coiled material 2 on the coil car 5; and Q is the center of the uncoiler 8 cone of the uncoiler 8.

The principle of seeking the centripetition of the coiled material 2 by displacement of the snubber roll 9 is explained in FIGS. 3 and 4.

In the following equations, if symbol l is the distance (constant) from the skid inclined surface of the coil car 5 to the floor face FL; x is the outer diameter of the coiled material, l_1 is the distance from the top portion of the coiled material to the floor surface FL; l_2 is the distance from the center P of the coiled material to the floor surface FL; y is the distance from the bottom portion of the skid inclined surface of the coil car to the center of the coiled material; θ is the angle (constant) of the inclined surface of the coil car; α is the complementary angle of θ (constant),

$$y = x/(2\cos\alpha)$$

$$l_2 = l + y$$

$$l_2 = l_1 - x/2$$

$$l_1 - x/2 = l + y = l + x/2 \cdot \sec\alpha$$

$$x = [2(l_1 - l)]/(\sec\alpha + 1)$$

Thus, if l_1 is given to the equation 4, x i.e. the diameter of the coiled material is obtained, and if x is given to the equation 3, l_2 (the distance from the floor surface FL

in the state of the coiled material loaded on the coil car to the center P of the coiled material) is obtained. That is,

$$l_2 = l_1 - [2(l_1 - l)]$$

$$l_1 = l_2 + [2(l_1 - l)]$$

Also, the lift amount of the coiled material, in other words, the lift amount of the coil car lifter is obtained in the following manner.

In the following equation, if R (constant) is a radius of the rocker arm of the snubber roll; H (constant) is a distance from the floor surface FL to the center Q of the uncoiler cone; a (constant) is an upper limiting point of the snubber roll; b is the position of the center of the snubber roll at the point which coincides the center of the coiled material with the center of the uncoiler cone; c is the position of the snubber roll in the case when the snubber roll is lowered in the lower limit state of the coil car lifter; β is an angle (radian) of the snubber roll in the case when the snubber roll is lowered from point c to point b ; β_1 is angle (radian) of the snubber roll in the case when the snubber roll lifts from point b to point c ; l_4 is the distance from the floor surface FL to the center of the snubber roll in the case when snubber roll positioned is at point a .

If symbols A, B, C, show respectively the proportional constant, D, E, F show respectively the constant. When R is very long, next equation is given approximately.

$$l_1 = l_4 - R\beta$$

$$L = R\beta_1$$

l_1 is obtained from the equation 6 by measuring β , simultaneously l_2 is obtained from the equation 5. Accordingly the lift amount L of the coil car is shown below.

$$L = l_3 - l_1$$

The following equation 9 is obtained by replacing equation 7 into equation 8. That is,

$$\beta_1 = (l_3 - l_1)/R$$

By measuring β , the lift amount L is obtained. By applying the above mentioned manner, the coiled material can be supported correctly by the uncoiler cone. That is, the coil car runs as far as the position of the uncoiler cone in the lower-most limit state of said coil car; the snubber roll 9 is contacted with the outer top surface of the coiled material 2; β is detected and memorized; and the coil car lifter is moved upwardly. When the snubber roll 9 reaches the position of angle β_1 , a signal is produced as the switch operating portion 33 is contacted with the limit switch 38, thereby stopping the upward movement of the lifter. Simultaneously, the hydraulic mechanism is locked, and the center P of the

coiled material coincides with the center Q of the uncoiler cones 8a, 8b. In this state, the coiled material 2 is supported with the uncoiler 8.

Further, the above mentioned manner will be explained concretely in the following.

The snubber roll 9 is lowered from the upper limit position a to the outer top portion of the coiled material 2.

The swinging motion of the snubber roll 9 is transmitted to the rack 26 through the segment gear 25 and pinion 28, whereby the rod 35 of the cylinder 37 is lowered by the rack 26 through the limit switch mounting plate 34.

Since the rod 35 is locked by the pilot check valve 42 at its lowered position, the limit switch 38 is held at the same position.

In this state, when the coil car 5 is lifted, the snubber roll 9 is also lifted while contacting the coiled material 2, and the arm having the snubber roll is swung upwardly thereby to rotate the shaft 30 of the pinion 28 and the cam 29.

The profile of the cam 29 is formed so as to signal at the point where the snubber roll 9 reaches from the point c to the point b and where the switch operating portion 33 of the follower 31 contacts with the limit switch 38, and accordingly, the coiled material 2 is stopped automatically and the center P of the coiled material 2 coincides with the center Q of the uncoiler 8. In this condition, the coiled material 2 is supported with the uncoiler 8 and at the same time, the center of the coiled material and the center of uncoiler cone are automatically set.

Actually, the coil car 5 is fed into between the two uncoiler cones 8a, 8b, each being positioned outermostly.

The coil car lifter is so operated that the center of the supported coiled material 2 coincides with the center of the uncoiler cone while measuring the height by the detecting means including the snubber roll 9. The coiled material 2 is clamped firmly by closing uncoiler cones 8a, 8b by operation of the hydraulic power unit 43.

In the present invention, the coiled material is fed smoothly, which is effected by mounting the tip end of the clamping band of the coiled material 2, which is in a clamped state on the uncoiler, on the sliding table 10, and holding it with a holding roll 12, and drawing out the coiled material successively by reciprocating the sliding table 10, engaging the coiled material with the washing rolls 11.

The drawing and guiding operations of the coiled material are carried out automatically. That is, referring to FIG. 8, a sliding table 10 is mounted slidably on a base 44, which is supported swingably by the shaft 45, which is a supporting point.

The end of the piston rod 46 of the cylinder 47 mounted on the base 44 is connected with the back surface of the sliding table 10, said sliding table 10 being moved forwardly and backwardly on the base 44 by operating the cylinder 47. Also, the base 44 is connected with the end of the piston rod 48 the cylinder 49 which is swingable at the supporting point 50, and the luffing motion of the base 44 is controlled by operating the cylinder 49.

The sliding table 10 is brought to the foremost position by advancing the piston rod 46. In this state, the upper surface of the sliding table 10 is aligned in the

tangential direction of the top portion of the coiled material 2 supported by the uncoiler 8, and the portion drawn out from the coiled material 2 is easily placed on the sliding table 10 in the tangential direction.

5 An arm 51 is provided above the sliding table 10, and a press-contact roll 12 is pivoted on one end of the arm 51, and the other end of the arm 51 is pivoted on the shaft 52. At one side of the arm 51 is connected the rod of the cylinder 53, and the base portion of the cylinder 10 53 is pivoted on the shaft 54. The press-contacting roll 12 is press-contacted with the drawn out portion of the coiled material 2 on the sliding table 10. Numeral 55 is a guide roll. In this case, the drawn out end portion of the coiled material 2 must be positioned at the upper 15 portion of said coiled material 2. Accordingly, when the clamping band of the coiled material 2 is cut off, the drawn out end portion of the coiled material 2 is floated slightly, and then is placed on the sliding table 10 by rotating the uncoiler 8 slightly. By operating the cylinder 53 the end portion of the arm 51 is lowered, the press-contacting roll 12 hold down and draw out the end portion of the coiled material 2 on the sliding table 10.

Next, the sliding table 10 is retracted on the base 44 25 by the retracting movement of the piston rod 46 due to the operation of the cylinder 47, and the coiled material 2 is gradually drawn out according to the movement of the sliding table 10.

In this case, the position of the roll 12 is not displaced 30 on the drawn out portion of the coiled material 2.

By repeating the advancing and retracting movements of the sliding table 10, the drawn out portion of the coiled material 2 is engaged into the washing rolls 11 successively.

35 The drawing and guiding mechanism of the coiled material is so designed that when the winding diameter of the coiled material 2 decreases, the cylinder 49 operates in accordance with said decrease, and the upper surface of the sliding table 10 is always positioned in the alignment with the tangential direction of the coiled material 2. After which effecting the drawing out of the coiled material and the delivery thereof towards a leveller by repeated reciprocating motion of the sliding 40 table 10, and when the passing of tip end of the coiled material at the detector 7 is detected, the feeding of the following coiled material 2 to the uncoiler is commenced.

All of these operation are perfectly interlocked by the detections of each step and the synchronous operations followed therewith, so that it is possible to carry out a loading in a blanking line safely and reliably and at a high efficiency.

Accordingly, with the process according to the method of the present invention, it is possible to save 55 the labor in the blanking line and to manage the production steps rationally, thus the productivity can be highly improved.

What is claimed is:

60 1. A method of automatically loading coiled material in position in an uncoiler comprising the steps of positioning and holding a movable support surface at a loading station spaced from the uncoiler, loading a unit of coiled material on the movable support surface held 65 in the loading position, moving the support surface and the coiled material into a standby position spaced between the loading position and the uncoiler, holding the coiled material in the standby position, monitoring

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the movement of the coiled material located in the uncoiler and generating a signal when the trailing end portion of the coiled material in the uncoiler has passed a position downstream of the uncoiler, in response to the signal generated by the trailing end portion of the coiled material removed from the uncoiler moving the coiled material on the support surface into the position of the uncoiler, sensing the outside diameter of the coiled material on the support surface in the uncoiler, lifting the coiled material on the support surface and moving the coiled material into a position where the center axis of the coiled material coincides with the center axis of uncoiler cones which support the coiled material on the uncoiler, clamping the coiled material on the uncoiler cones whereby the axis of the coiled material is automatically positioned on the axis of the uncoiler cones and the uncoiled material is supported by the uncoiler.

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2. A method, as set forth in claim 1, characterized therein that after clamping the coiled material on the uncoiler cones, returning the support surface to the loading position for receiving another unit of the coiled material for repeating the operation of loading coiled material onto the uncoiler.

3. A method, as set forth in claim 2, characterized therein by drawing out the leading end portion of the coiled material mounted on the uncoiler cones and feeding the coiled material from the uncoiler to a working operation.

4. A method, as set forth in claim 3, characterized therein by aligning the longitudinal center of the coiled material mounted on the uncoiler with the center line of the working operation to which the coiled material is fed.

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