MACHINE FOR TYING UP COILS OF FILAMENT SUCH AS WIRE

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ABSTRACT

Machine for tying up a coil of metal wire and the like by means of a tie. The tie is folded about a cross-section of the coil and the end portions of the tie are bent into a hair-pin shape and the desired tension is imparted to the tie by acting on the hair-pin shaped portions. Thereafter, the hair-pin shaped portions are twisted by a twisting device, the twisting progressing in a direction from the coil cross-section to the free ends of the tie. A plurality of ties may be arranged around the coil, put under tension and twisted by a plurality of tying units. The twisted portions of the tie are disposed inside the coil.

8 Claims, 8 Drawing Figures
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MACHINE FOR TYING UP COILS OF FILAMENT SUCH AS WIRE

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a Continuation-In-Part of my application Ser. No. 541,500, filed July 14, 1969, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the tying up of coils of filament such as wire.

2. Description of the Prior Art

The usual practice is to tie up the coils of filament with ties obtained from a reel of filament, such as wire, constituting a supply. This tying filament is strengthened by passage under tension over guide pulleys or rollers, formed into a tie on the article to be tied up, cut to the required length and finally end portions of the tie are twisted. Before cutting the filament, the ends of the filament are generally pulled in opposite directions so as to take up any excess amount of filament unwound and render the tie suitably taut.

This manner of proceeding presents various drawbacks. Owing to the fact that the twisting proceeds from the ends of the tie to the surface of the article being tied up, the tie is subjected not only to high tensile stresses but also to torsional stresses which are maximum in the twisted end portions in the vicinity of the coil or other article tied up. Consequently, frequent fractures occur in the course of tying up and, above all, in the course of handling, and this constitutes a serious drawback. Further, this method is relatively expensive.

Further, known tying up machines effect the tying on the top or on the side of the coil of material to be tied up. Unfortunately, there is a consequent danger of hooking or catching owing to the presence of the free ends of the twisted tie portions outside the package. This hooking is a hindrance in the storage of the coils and a danger to the personnel handling the coil. Having the twisted tie portions outside the coil can also result in undesirable marks on the filament or wire.

SUMMARY OF THE INVENTION

The object of the present invention is to remedy the aforementioned drawbacks and to provide a machine for tying up coils of filament, such as wire, which is simple in construction and effects the twisting of the tie inside the ring, the twisting of the gathered end portions of the tie progressing from the surface of the coil toward the free ends of the end portions of the tie.

The invention provides a machine for tying up coils of filament, such as wire, comprising a first plate and a second plate which are substantially parallel to each other and means for urging the plates toward and away from each other, at least one supply device for supplying lengths of tie located in the vicinity of the first plate, there being associated with the supply device: a deflector disposed on the second plate in facing relation to the supply device for bending a first portion of the tie at about 90° to a remaining portion of the tie about a cross section of the coil to be tied up, a first jaw pivotably mounted on the first plate for taking hold of a second portion of the tie and folding it around the cross section of the coil in the direction of the first portion of the tie, a second jaw mounted on the second plate and movable in translation in a direction substantially perpendicular to the second plate for engaging the first portion of the tie and folding a portion of the first portion of the tie inside the coil about the cross section of the coil, and a twisting head mounted on one of the plates and located between the plates for twisting end portions of the tie which have been brought in proximity to each other, whereby the twisted portions are located inside the coil.

The machine according to one example of the invention is most suitable for tying up coils of filament such as wire which are supplied one by one by a conveyor. It can be adapted to move in the direction of and in synchronism with the conveyor to effect the tying up with no need to stop the conveyor.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings:

In the drawings:

FIG. 1 is a sectional view, taken along line 1—1 of FIG. 2 of a tying up machine according to the invention;

FIG. 2 is an end elevation view of the machine shown in FIG. 1 with parts cut away;

FIGS. 3 and 4 are diagrammatic views showing how the tie is placed in position around the ring;

FIG. 5 is a diagrammatic detail view on an enlarged scale showing the ends of the jaws and the twisting head;

FIG. 6 is a perspective view of a coil of wire tied up by means of the machine according to the invention;

FIG. 7 is a diagrammatic view of another embodiment of the machine according to the invention in the process of tying up of a coil of wire which travels on a conveyor, and

FIG. 8 is a diagrammatic and elevational view of the machine shown in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the figures identical elements carry the same reference characters.

With reference to FIGS. 1–5, the machine according to the invention comprises two vertical parallel plates P1 and P2 which are movably mounted on a base 1 by rollers 2 fixed at the lower part of the plates and guide rails 3 disposed on the base 1. The plates can be moved toward or away from each other by means of a fluid motor V1, in particular a hydraulic motor having a cylinder 4 whose end is secured to the plate P1 and a piston 5 having an end 6 secured to the plate P2.

The illustrated machine has four identical tying up units which permit simultaneously effecting four tying up operations on the same coil of filament, hereinafter termed wire. It will be understood that the machine can have any number of tying units (for example one, two, three, or more units) without departing from the scope of the invention.

Each tying unit comprises a device A supplying the machine with lengths of tie, a jaw M pivotably mounted on the plate P1, a deflector D placed on the plate P2 in facing relation to the region in which the tie is supplied, a jaw M movable in translation with respect to the plate P2 toward and away from the plate P1 and a twisting head T mounted on the plate P1 and spaced from the latter in the direction of the plate P2.

The four units are arranged on a circle on the plates and are equally spaced angularly apart with respect to a common axis X–X perpendicular to the plates. The four units are constituted by identical elements and only one unit will therefore be described in detail.

The supply device A (FIG. 1) comprises a magazine 7 preferably in an inclined plane and adapted to receive a pile of superimposed bars L which constitute lengths of ties for tying up the coil C, a bearing face 8 at the base of the magazine for supporting the lower bar, a vibrator 9 mounted on the magazine and acting so as to destroy any equilibrium between the bars L and thereby facilitate the descent of the bars, and a ram 10 actuated by a fluid motor 11, for example a hydraulic motor, which exerts a thrust against the end of the lower bar so as to force it out of the magazine between two drive rollers 12 which may be driven in rotation by a motor (not shown).

The supply device A are mounted on a stand having two posts 13, 14 shown in FIG. 1.

Disposed in front of the drive rollers 12 of the supply device are two other rollers 15 which are rotatable in a yoke 16 secured to the plate P1. The rollers 15 are freely rotatable on their spindles 17 as shown or they may be driven in rotation by a motor if desired.

A slot 18 (FIGS. 2–4) is formed in the plate P1 for the passage of the pivotable jaw M. The latter comprises an arm 19 pivoted to the plate P1 at an intermediate point of its length by a pin 20 carried by the plate. One of the ends of the arms is pivoted by a pin 21 to the end of a piston rod 22 of a fluid
motor 23, for example a hydraulic motor, whose cylinder is pivotably connected to the plate P by a pin 24 (FIG. 2-4). The other end of the arm 19 passes through the slot 18 through which the tie L coming from the magazine and the rollers 12 and 15 also passes.

Disposed in facing relation to the slot 18 and on the axis of displacement of the tie L coming from the magazine and mounted on the side of the plate P which faces the plate P is a deflector D comprising a face 26 which is roughly parallel to the plate and a face 27 which extends from the face 26 and makes therewith an angle slightly exceeding 90°.

Mounted between the deflector D and the axis X-X on the plate P is a slidable jaw M² which is longitudinally movable by a fluid motor 28 fixed on a support 29 which is fixed to the plate P on the side thereof opposed to the plate P.

The jaw can move through the plate P in an apertur 30 (FIGS. 3 and 4). It terminates in a seizing means 31 adapted to seize a portion of the tie. The means 31 constitutes a female part which is connected to the end 25 of the arm 19 of the jaw M² which performs the function of the male part as clearly shown in FIG. 5. The dimension and shape of the two seizing means 25 and 31 are so calculated as not to be a perfect fit one with the other so that it is possible to trap the end portions of the tie without clamping them.

The function of the jaw M² and the deflector D are such that the jaw M and the deflector D are outside the coil to be tied up and the jaw M is inside the latter as can be seen clearly in FIGS. 3 and 4.

The twisting head T is so disposed as to be located inside the ring. It comprises a twisting end portion 32 (FIG. 5) having a conical shape and longitudinal grooves 33 for engaging the end portions of the tie. The end portion 32 is driven in rotation by drive means comprising a shaft 34 carrying a bevel gear 35 which is meshed with another bevel gear 36 placed at the end of a shaft 37 disposed on the axis X-X, the shaft 37 being driven in rotation by a motor 38 carried by a support 39 integral with the plate P. This motor can be replaced if desired by a hydraulic piston and cylinder device with a rack and pinion drive.

The head T is carried in the space between the two plates at the end of an arm 40 whose length depends on the plate at which the coil is required to be tied up inside the coil.

Deflectors 41 are arranged in accordance with a generally V-shaped configuration around the twisting end portion 32 of each and have been explained hereinafter.

FIG. 1 shows a coil of wire C to be tied up hooked to a cable 42 by means of a hook K. The hook K and cable 42 are carried by support means, such as a conveyor (not shown), which moves in a plane parallel to the plates P and P and places the coil C in position between the plates P and P before they are urged toward each other by the fluid motor V.

In order to prevent the hook from encountering the plates when the latter are moved towards each other, a V-shaped notch 43 is formed in the upper part of the plate P, as shown in FIG. 2. An aperture 44 (FIG. 1) is formed in the plate P for the passage of the cable.

The machine further comprises a device for regulating the movement of the plates and comprising an abutment 45 which extends between the latter from the base 1 and carries on the face thereof in a direction facing the plate P an electric switch I which is connected by a conductor (not shown) to a control device controlling the supply of fluid to a fluid motor 46. The motor is mounted on the base 1 and has a piston 47 which terminates in locking means 48 capable of engaging a finger 49 secured to the plate P by an arm 50.

The machine shown in FIGS. 1-5 operates in the following manner:

The magazine 10 is first filled with metal bars or rods which have been straightened and cut to a given length and will constitute the ties L for tying up the coil C. These bars are preferably prepared from second class wires or wires pertaining to coil ends or end cropings. The wire can be of variable grades of mild or hard steel which may be bright de-steelled.

However, the hardness of the tie material must not exceed that of the wire of the coil C so that it does not mark or otherwise deform the wire of the coil.

At the start of the tying up operation the plates P and P are moved apart to the position shown in FIG. 1 so as to allow the insertion therebetween of a coil C to be tied up, this coil being, for example, suspended by a hook K from suspension means, as shown in FIG. 1.

When the coil is brought between the plates, it is in a loose uncompressed condition. In this initial position, the plate P is held stationary by the finger 49 of the arm 50 engaged in the locking member 48 which is held in its upper position by the fluid motor 46.

The fluid motor V is then actuated and, as the plate P is prevented from moving, it is the plate P which is shifted towards the plate P under the action of the rod of the piston 5. This movement continues until the plate P comes in contact with the switch I carried by the abutment 45. At this moment, the fluid motor 46 is actuated so as to withdraw the locking means 48 from the finger 49. As the plate P is thus released and the plate P is held stationary by the abutment 45, it is the plate P which in turn moves towards the plate P under the action of the motor P.

The function of first movement of the plate P is to correctly center the coil C on the base of the hook K but it normally produces no compression of the coil.

It is in the course of the movement of the plate P towards the plate P that the coil is compressed between the two plates. The plates and coil are then in the positions shown in FIG. 3.

It will be observed that in the course of the aforementioned movements of the plates, the jaws M and M are in the withdrawn positions as shown in FIGS. 1 and 3.

When the coil has been sufficiently compressed, the tying up operation is started. This is carried out in the following manner:

Under the combined actions of the ram 10 and rollers 12 and 15, a tie is projected through the slot 18 in the plate P in the direction of the deflector D which is carried by the plate P and constrains a portion of the tie to bend at an angle of about 90° and rise alongside the plate P so that the tie assumes approximately the shape of an L, as shown in FIG. 3. At this moment, the jaws M and M are brought into action and this has the effect to bend the end portions of the tie about the cross section of the coil C. In the course of this operation, the end portions of the tie encounter the deflectors 41 of the twisting head T and this has the result of bending each end portion in the shape of a hair-pin, as seen in FIGS. 4 and 5. At this moment, the end portions of the tie are seized by the grooves of the twisting head which is driven by the motor 38 so that the tying operation can be completed by twisting the end portions of the tie. Owing to the particular arrangement of the jaws and of the head, the twisting starts in the vicinity of the coil C and progresses from the coil towards the ends of the tie.

Owing to the position of the head T, the twisted portions of the tie are located inside the coil C, as can be seen in FIG. 6, which shows a tied-up coil C. In FIG. 6, the twisted portions are denoted by the reference character t.

When this tying up operation has finished, the jaws M and M are returned to their initial positions shown in FIG. 1 and the plates P and P are moved apart by means of the fluid motor V so that they resume the initial positions shown in FIG. 1. The locking device 48 assuming a position of engagement with the finger 49. Thus, a new tying operation can commence.

In the course of the preceding operation, the hook K does not encounter the plates owing to the presence of the notch 43 and aperture 44 formed in the plates P and P. It will be understood, of course, that if the coil C is brought between the plates by means other than the hook K the notch 43 and aperture 44 may not be necessary.
In the foregoing description, operation of the machine has been described with reference to a single tying unit, since the four units operate in the same manner and permit effecting simultaneously four tying operations on the same coil.

It will be understood that the operations described hereinbefore can be advantageously controlled automatically by conventional means from a single control station. This enables effecting the tying up in a very short period of time, namely in the neighborhood of about 10 seconds.

Figs. 7 and 8 show an embodiment of the machine according to the invention adapted to permit the tying up of coils of filaments, such as wires, which move continuously on a conveyor.

For this purpose, the base 51, which is similar to the base 1, is mounted on wheels 52 capable of rolling along rails 53 which are carried by a second carriage 54 provided with rollers 55 driven along rails 56 by means of a chain 57 and a motor 58 mounted on the carriage (see Fig. 7). The arrangement is such that the base 51 can move on the carriage 54 in a direction parallel to the plates P1 and P2 and in a direction perpendicular to the direction of movement of the coils on the conveyor shown by the arrows F in Fig. 7. The carriage 54 can move on the rails 56 in a direction parallel in the direction of motion of the coils C.

The base 51 is moved with respect to the carriage 54 by means of a fluid motor 59 which is secured to the carriage 54 and which has a piston 60 whose rod end is secured to a member 61 integral with the base 51 (see Fig. 8).

In this embodiment, the supply devices A are mounted on the carriage 54 and disposed in pairs on each side of the passage for the coil C. The machine shown in Figs. 7 and 8 operates in the following manner:

In the starting position, the plates P1 and P2 are disposed in the positions shown in Fig. 1 outside the path of the coils C. When a coil C is presented in front of the space between the plates, the fluid motor 59 moves the base 51 and the plates, and all the associated elements carried thereby, in a direction perpendicular to the direction of movement of the coil and, owing to this movement, the plates P1 and P2 are placed on each side of this coil which is then in the position shown in Fig. 1. The carriage 54 is then driven by the motor 58 in the direction of arrows F (Fig. 7) at the same speed as the coil C so as to follow the movement of the latter on the conveyor shown at 62.

The operation for compressing the coil and tying up the coil are carried out exactly as described with respect to the embodiment shown in Figs. 1-5.

When the tying up has finished, the base 51 is returned by the fluid motor 59 to the withdrawn position it had at the start of the operation and the tied-up coil C continues to move and passes between the supply devices A. At this moment, the carriage 54 is driven by the motor 58 in the direction opposed to the direction of movement of the conveyor so as to come in the vicinity of a new coil C to be tied up, conveyed by the conveyor, and the cycle is repeated as described hereinbefore.

All the operations are advantageously entirely automatic and controlled from a single control station which permits tying up a moving coil in a very short period of time, of the order of 20-25 seconds.

The supply devices A supplying the ties may be replaced by a device supplied with wire from a reel of wire at a fixed station.

Having now described our invention, what we claim and desire to secure by Letters Patent is:

1. A machine for tying up a coil of filament, such as wire, comprising a first plate and a second plate which are substantially parallel to each other, means for supporting the coil substantially in a plane parallel to the plates, the coil having an axis about which the filament extends in the coil, said axis being substantially perpendicular to the plates, means for moving the plates towards and away from each other, at least one supply device for supplying lengths of tie disposed in the vicinity of the first plate, there being associated with the supply device: a deflector disposed on the second plate in facing relation to the supply device for bending a first portion of the tie at about 90° to a remaining portion of the tie about a cross section of the coil to be tied up, a first jaw pivotally mounted on the first plate for taking hold of a second portion of the tie and folding it around the cross section of the coil in the direction of the first portion of the tie, a second jaw mounted on the second plate and movable in translation in a direction substantially perpendicular to the second plate for engaging the first portion of the tie and folding a portion of the first portion of the tie inside the coil about the cross section of the coil, a twisting head mounted on one of the plates to be rotatable about an axis of rotation transverse to said coil axis and located between the plates for twisting end portions of the tie which have been brought in proximity to each other whereby the twisted portions are located inside the coil, and means for rotating the twisting head about said axis of rotation.

2. A machine as claimed in claim 1, wherein the end portions of the two jaws constitute a male seizing portion and a female seizing portion whereby the end portions of the tie are trapped between, without being clamped by, the seizing portions.

3. A machine as claimed in claim 1, comprising deflectors disposed on each side of the twisting head for guiding and bending end portions of the tie before said end portions are seized by the twisting head.

4. A machine as claimed in claim 1, comprising a plurality of first jaws, a plurality of second jaws, and a plurality of associated twisting heads arranged in angularly spaced positions about said coil axis for the purpose of simultaneously effecting a plurality of tying operations on the coil in circumferentially spaced regions of the coil, said means for rotating being a single drive means drivenly connected to the plurality of twisting heads.

5. A machine as claimed in claim 1, further comprising a first carriage carrying the plates and means for moving the first carriage in a direction parallel to said plates.

6. A machine as claimed in claim 5, further comprising a second carriage movable in a direction perpendicular to the direction of movement of the first carriage, said supply device being mounted on the second carriage.

7. A machine as claimed in claim 1, comprising means for stopping the movement of each of the plates while moving the other of the plates toward said each plate.

8. A machine as claimed in claim 1, wherein the supply device comprises a magazine adapted to contain lengths of superimposed ties, a support member at the base of the magazine for a bottom length of tie, a vibrator mounted on the magazine and adapted and arranged to destroy any equilibrium of the lengths of ties, a ram actuated by a fluid motor for urging said bottom length of tie out of the magazine, and driving rollers for urging said bottom length of tie in the direction of said deflector.

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