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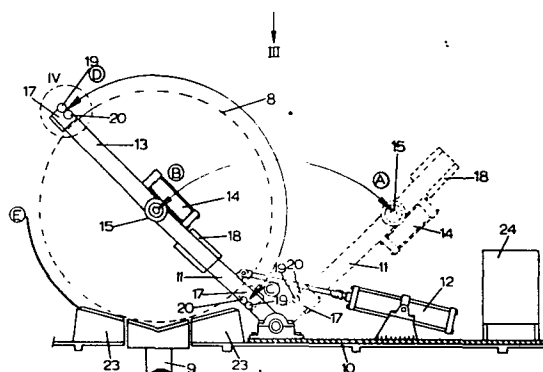
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54 **Method for circumferentially binding a coil having an axis extending horizontally and binding apparatus for use in the method.**

57 To avoid the need for awkward and possibly hazardous movements by an operator when binding a large coil, e.g. of steel strip, a binding apparatus has an arm 13 swingable about an axis 15 by cylinder 14 and carrying at its end a binding head 17. In use, the arm 13 is brought into position D where the binding element is inserted into the head which holds it while the arm 13 is then swung to the position C. The head 17 then operates to pass the binding strip through the head so that its end reaches the position E where it can conveniently be tied by the operator.



1.

Method for circumferentially binding a coil having an axis extending horizontally and binding apparatus for use in the method.

The present invention relates to a method for
5 circumferentially binding a coil having an axis extending horizontally and binding apparatus for use in the method. In the process, an elongate binding element in the form of a length of binding material, such as for example a binding strip is laid around the circumference of the
10 coil and its ends are fastened together. By saying that the coil has its axis extending horizontally, we do not mean that the invention is restricted to coils whose axis is precisely level. We intend the term to cover any coil which is supported lying on its side, not on its end.

15 The invention is especially applicable to the binding of coils of steel strip, but is not restricted to this use. The binding of such coils has generally been done manually which, as described below, is an uncomfortable and even hazardous operation. The coil
20 being large, awkward positioning of the body is required, in order to pass a binding strip around it.

Proposals for at least partial automation of this binding have been made. NL 70.05235 briefly describes a device which apparently contains a channel along which
25 the binding strip is passed so as to encircle the coil.



2.

FR 2 024 187 illustrates a machine for binding stacks of newspapers, in which a swinging arm carries string around the stack.

The object of the present invention is to relieve
5 the difficulties, in the form of an awkward position of the body and low reliability encountered during manual binding of large coils.

The present invention as claimed is intended to provide a remedy.

10 The binding element can be easily secured by the operator, for example when a strip is used as the binding, by sliding a seal over one part of the strip and by stretching and sealing the strip with a known stretching and sealing device. The bound coil can be
15 transported vertically, for example by means of an overhead crane, or horizontally, for example with the aid of a fork-lift truck.

The advantage of the process according to the present invention are that it is no longer necessary for
20 the operator to bend down to insert and pick up the binding element and that increased reliability is achieved in that the coil can now be bound by the operator who remains at one side, so that, as will be described in further detail below, it is no longer
25 necessary for the operator to cross the coil delivery

conveyor. In addition, the time needed for binding is shorter because, even in the case of small coils, no more binding is delivered than is strictly necessary.

Furthermore, the binding arm can be brought to a rest position in which the coil can be lifted vertically by a crane, since there is no obstacle above the coil.

One embodiment of the invention will be described below and illustrated with reference to the drawings, in which:

10 Figure 1 is a diagrammatic overhead view of a stretcher leveller installation for cold-rolled steel strip, including a coil binding station,

Figure 2 is a side view, on section line II-II of Figure 1 of the binding machine embodying the invention,

15 Figure 3 is an overhead view of the binding machine in the direction of arrow III in Figure 2, and

Figure 4 is a more detailed view of the drive unit marked IV in Figure 2.

Figure 1 shows a stretcher leveller for cold-rolled steel strip. The strip is delivered by the feeding conveyor 2 in the form of coils which are then uncoiled at 3. After being coiled again at 4, the coil is transported by a delivery conveyor 5 which includes a coil lifting carriage 9 (see Figure 2), extending beneath the coiling station, by means of which the coil is

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transferred to a binding station 60. Here, the coil, which is lying on saddles 23, is bound. Following binding, the coil can be transferred by the coil lifting carriage 9 to one of positions 61 to 65, being rotated
5 about a vertical axis through a quarter of a turn. The coils are removed either from positions 60 to 65 by means of an overhead crane or from position 61 to 65 with a fork-lift truck. The usual coil dimensions are: width 600 to 1500 mm and diameter 1000 to 1800 mm.

10 In the binding operation, a binding element, e.g. a binding strip, has to be wrapped around the circumference of the coil, including being passed under the coil, and then sealed or secured. When this operation is performed manually, the operator's initial position is at 70.

15 After being placed over the coil, the binding has to be passed back under the coil from position 71. This means that to insert the binding at 71 and to pick it up at 70, the operator has to perform awkward bending movements. In addition, before inserting the binding, the operator
20 has to cross the delivery conveyor line 5, which is a deep, open trough containing the moving coil lifting carriage 9, and after inserting the binding, he has to return from position 71 to 70. These movements are uncomfortable and hazardous.

25 The binding machine embodying the present invention,



which overcomes these difficulties, is shown in Figures 2 and 3. The coil 8 is shown lying on the saddles 23 (which are provided with grooves for insertion of the binding band under the coil) of the binding position 60 of the delivery conveyor 5, which is provided with the coil lifting carriage 9. Mounted on a base plate 10 is a swivelling main arm 11, which can be swung about its pivoting axis by the pneumatic cylinder 12. The end of the main arm 11 remote from the pivoting axis is attached to a rotary binding arm 13, which is pivotally mounted on the main arm so that it can be rotated by a pneumatic rotation cylinder 14 about its centre of rotation 15. At the end of the binding arm 13 which is cranked so as to extend parallel to the axis of the coil, is the binding head 17. The binding arm 13 is balanced around its centre of rotation 15 by a counter-weight 18.

The binding head 17 has a drive unit shown in Figure 4 and a set of hardened steel rollers 19 and 20. The set of steel rollers are able to run freely in one direction, for example by means of a ratchet mechanism (not shown) and can be driven in the same direction by a pneumatic motor 21. The lower roller 20 is mounted on a shaft 25 so that it can be retracted from the upper roller by the actuation of a locking cylinder 22 (see broken lines in Figure 4).



The binding machine operates as follows: the operator remains standing at the left-hand side as seen in Figure 2; after a coil 8 is placed on the saddles 23 of the binding station 60 by the coil lifting carriage 9, the main arm 11 is moved from a rest position A to a working position B by the pneumatic cylinder 12 when the start command has been given. In this working position, the swinging axis of the binding arm 13 is substantially at the axis of the coil (but it may be slightly offset from the coil axis). The binding arm 13 is then swung by the rotation cylinder 14 from position C to its initial operating position D. The binding strip (which is for example one quarter of an inch wide) is then inserted by the operator between the free-running rollers 19 and 20 of the drive unit of transport head 17 and is thus clamped and held by the binding head. A further command is given, which causes the binding arm 13 to be swung from position D to its second operating position C.

This causes the binding head to move through 180° around the circumference of the coil, through a point vertically above the coil axis, so that the binding strip is brought to lie over at least 180° of the coil circumference including more than 90° of the upper half of the coil. Then the set of rollers 19 and 20 are set in motion by the pneumatic motor 21, so that the binding



7.

strip is pushed through the grooves (not shown) in the saddles 23 until a predetermined length EC of free strip has been delivered and is protruding up to a position suitable for securing of the ends of the strip.

5 Following this, roller 20 is folded back by the pneumatic cylinder 22 from position F to position G (Figure 4) so that the binding strip is released. Finally, the ends of the strip are secured by the operator and the main arm 11 is returned from position B to its rest position A.

10 With the main arm 11 in the rest position A, the coil 8 can be removed vertically by means of an overhead crane.

The binding machine is in this embodiment powered by compressed air at 6 atm. The necessary pneumatic
15 equipment is housed in a control cabinet 24. The binding cycle lends itself to control by a programmable control unit.

Claims:

1. A method for circumferentially binding a coil (8) having an axis extending horizontally, wherein an elongate binding element in the form of a length of binding material is passed around the circumference of the coil and its ends are secured together, characterised by the steps of
- 5 a) moving a binding head (17) into an initial operating position (D), said binding head having means (19,20) for holding said binding element and for causing said binding element to pass longitudinally through the binding head and being carried by a binding arm (13) which is arranged to swing around an axis spaced from the binding head,
- 10 b) engaging the binding element in said binding head (17) so as to be held thereby,
- 15 c) causing said arm (13) to swing around its said axis from said initial operating position (D) to a second operating position (C) so as to carry the binding element held by the binding head circumferentially around the coil so that the binding element is caused to lie around at least 180° of the coil circumference including a major part of the upper half of the circumference of the coil,
- 20 d) operating said binding head when in said second operating position (C) so as to pass a sufficient length of said binding element longitudinally through the
- 25

binding head to provide a free end length of the binding element suitable for securing to the other end of the binding element, and

e) causing the binding head to release the binding
5 element so as to allow the securing of the ends of the binding element to each other.

2. A method according to claim 1 wherein said binding arm is arranged to swing through at least 180° from said initial operating position (D) to said second operating
10 position (C) so as to move said binding head along a path which includes a point located vertically above the coil axis.

3. A method according to claim 1 or claim 2 wherein, during said step (d), the said free end length of the
15 binding element is guided under the coil by a groove located in a support (23) for the coil.

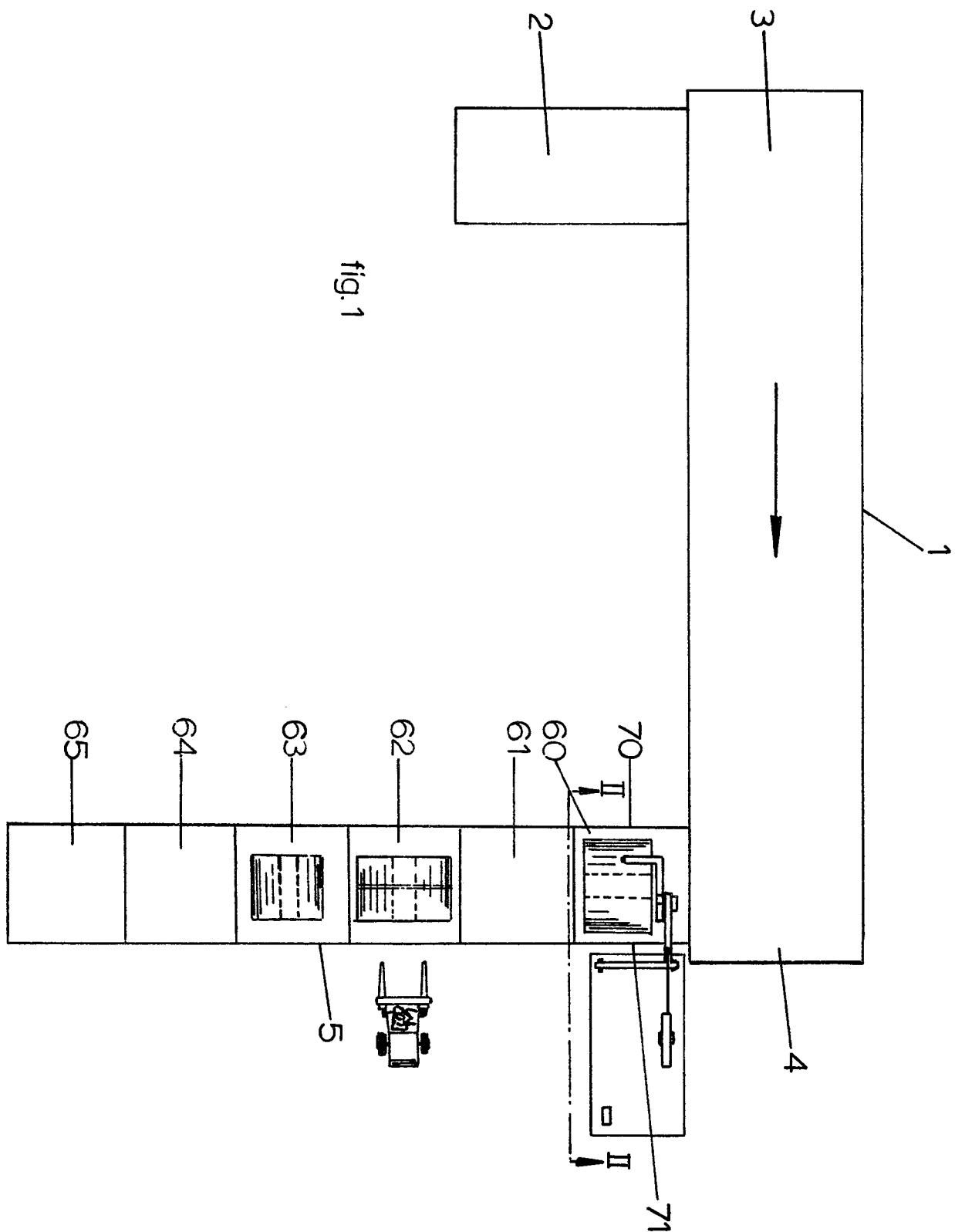
4. Binding apparatus for use in carrying out the method of claim 1, having a binding arm (13) carrying a binding head (17) and rotatably mounted so as to swing around an
20 axis spaced from said binding head from an initial operating position (D) to a second operating position (C), the binding head (17) having releasable holding means (19,20) for an elongate binding element and drive means (19,20,21) adopted to cause the binding element,
25 when held by the holding means, to pass longitudinally

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through the binding head.

5. Binding apparatus according to claim 4 wherein said binding arm (13) is rotatably mounted on a second arm (11) which is itself swingable about an axis spaced from the swinging axis of the binding arm (13), the swinging movement of the second arm (11) being such as to bring the swinging axis of the binding arm substantially to the position of the coil axis.

6. Binding apparatus according to claim 4 or claim 5 wherein the binding arm (13) is balanced about its swinging axis by a counterweight (18).



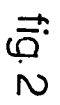


fig. 2

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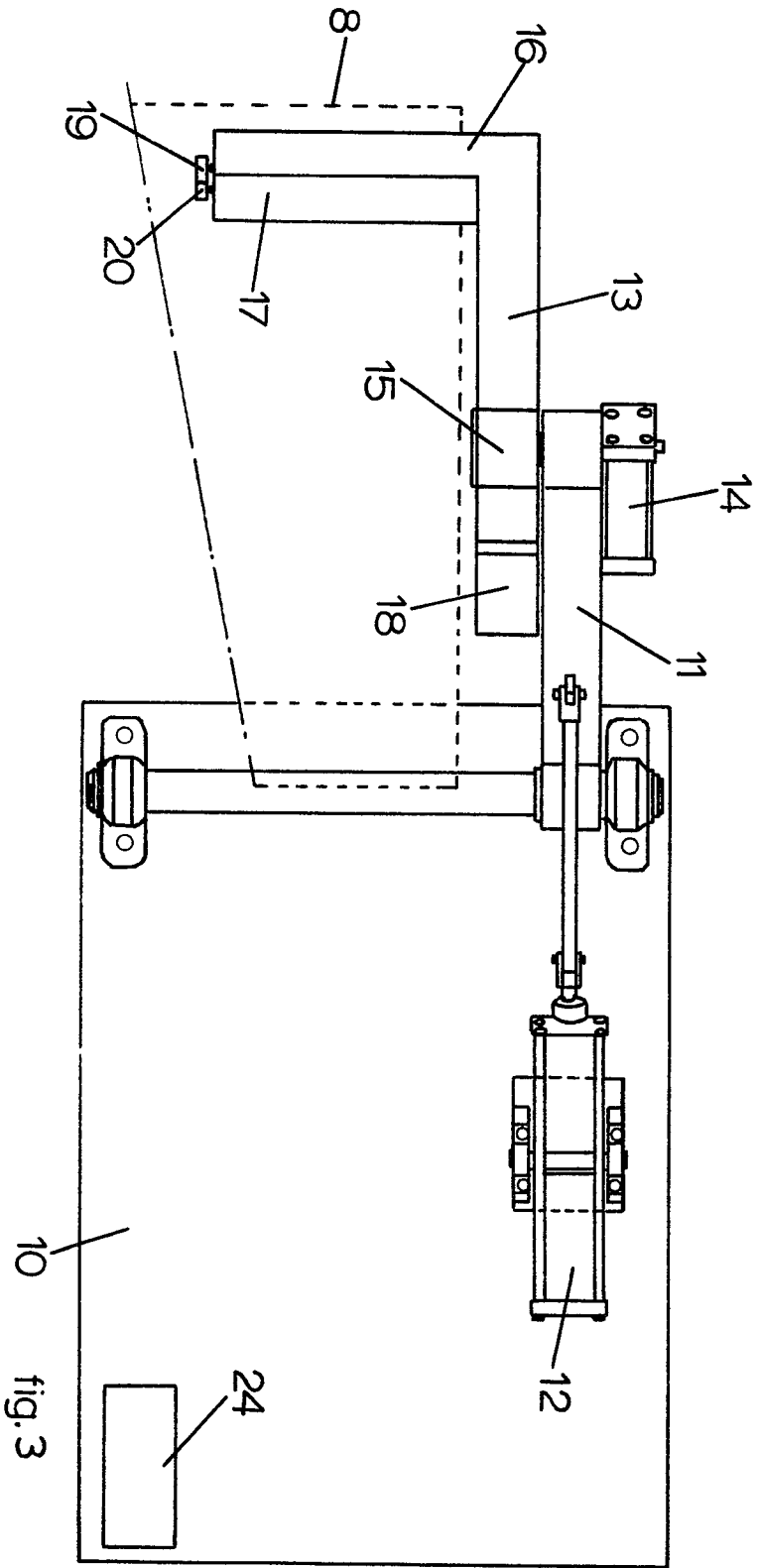


fig. 3

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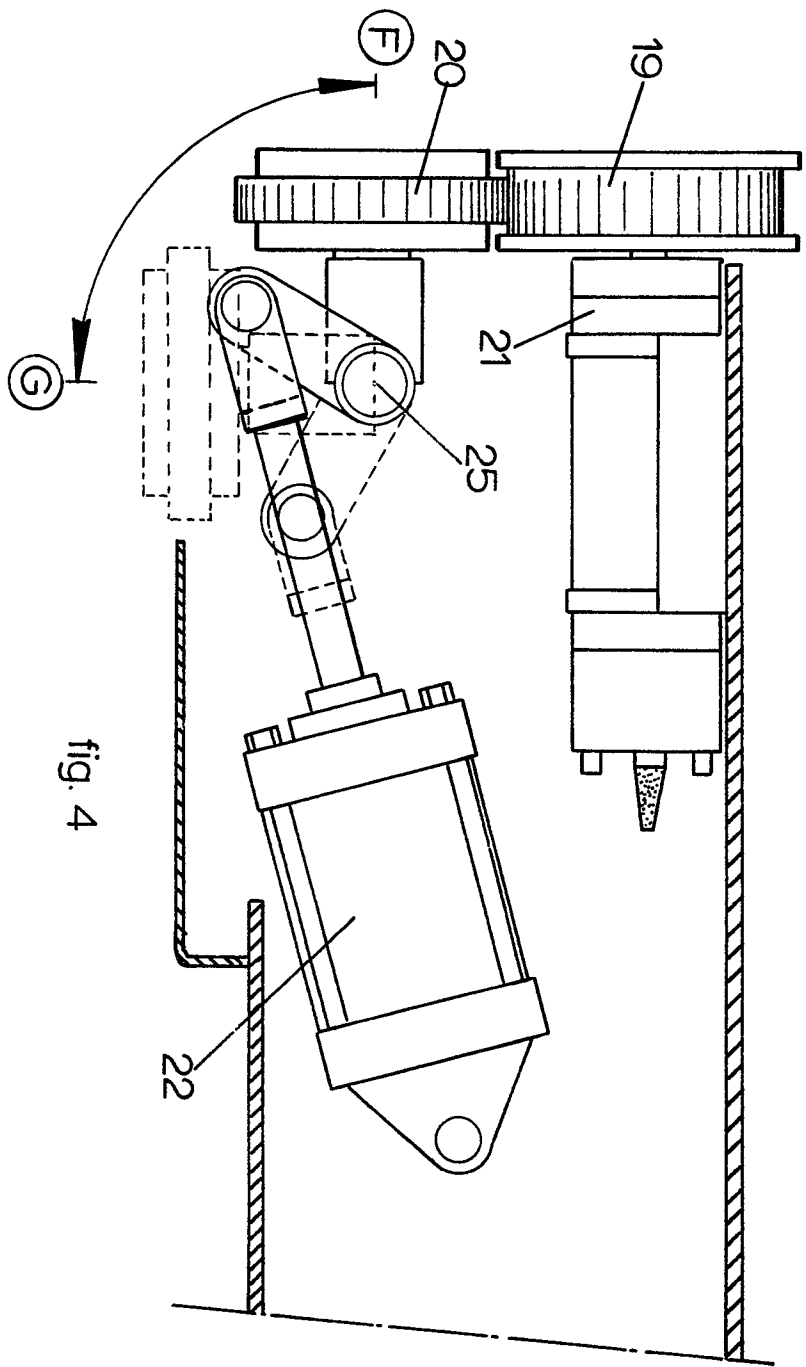


fig. 4