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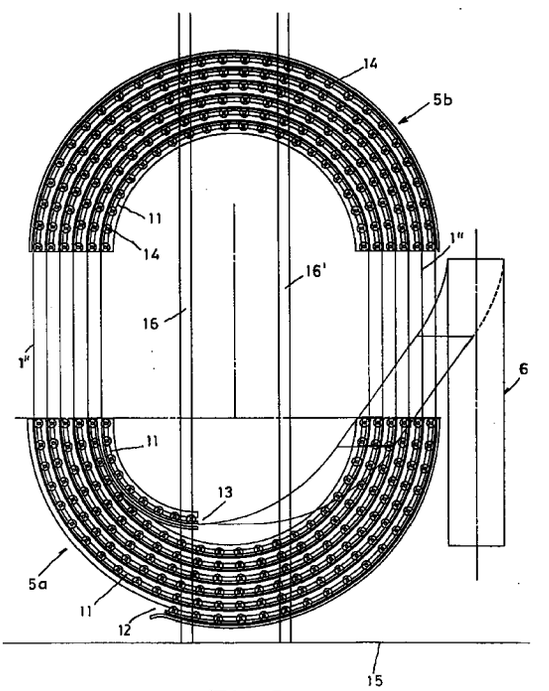
(54) CONTINUOUS SUPPLY SYSTEM FOR PRESS

(57) The disclosed system is comprised of a welding device (4) intended to weld a bobbin running out to a new bobbin; a rectifier (7) for rectifying the metal strip (1); and a storage device (5) formed by a lower frame (5a) and an upper frame (5b) which are independent of each other, facing each other and one on top of the other; the frames (5a, 5b) comprise guides (11) which define an ideal spiral along which the metal strip (1) may slide from its external extremity (12) up to its internal extremity (13), both being situated in the lower frame (5a); the latter is fixed, whereas the upper frame (5b) is displaceable vertically, thereby varying consequently the total length of the stored metal strip (1).



F16.6

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Description

The present invention relates to a continuous supply system for press, precisely stamping presses fed by a metal strip wound on a bobbin, of the type comprising: a welding device located downstream of the bobbin, by which a butt weld is made between the tail end of an exhausted bobbin and the leading end of a new bobbin; a variable capacity storage device in which the length of metal strip required for maintaining the supply during the bobbin changing and welding stages is accumulated; and a strip rectifier, delivering the strip to the press.

As is well known, in the present state of the art an infinite number of metal items are obtained by cold pressing in presses which are supplied with a continuous web of metal strip supplied on bobbins. Particularly, this system is used for producing metal parts by the so-called progressive dies, namely, dies along which the metal strip advances and which comprise two, three, four or more steps, operating simultaneously in each press operation and in which the parts are successively deformed until they are conferred the desired final form. To this end, it may be pointed out that, while admitting an infinite number of different specific applications, the invention has been specifically devised for ensuring the continuous supply of the presses which are currently used for the manufacture of magnetic plate bundles from which there are obtained, in a subsequent overinjection operation of aluminum, the so-called "squirrel cage" rotors for electric motors.

As is also well known, the said presses reach very high working speeds, while the metal strip bobbins from which they are fed cannot exceed relatively modest overall strip lengths. Therefore, in the present state of the art, it is necessary to interrupt the running of the said presses with exaggerated frequency to replace the exhausted bobbin with another. These operations notably increase the cost of the manufacturing process, seriously affecting the overall throughput of the machine, since each of them also requires the end of the new strip to be threaded through the rectifying and pulling devices and to set the press running again, which requires some time to recover its normal working rate. But the above operations involve, above all, a serious risk of causing the breakage or serious damage to the punches of tooling which, in general, is extremely costly, because these punches may become unbalanced on operating only partially on the free end of the new strip inserted.

To overcome these drawbacks, certain solutions have already been proposed allowing the tail end of the exhausted bobbin to be butt welded to the leading end of a new bobbin, with a view to guaranteeing a really continuous supply of the corresponding press. These solutions require the provision of a storage system in which a certain length of strip may accumulate, for supply to the press during the relatively long period of time required for replacing the exhausted bobbin with a new one and for carrying out the corresponding butt weld between the ends of both bobbins. And it is precisely these storage systems which have led to the failure of the above solutions, particularly because of the exaggerated size of the space occupied by the strip accumulator and the distance which, as a result thereof, there is between the bobbin stand and the press, making it hard for a single operator to control the whole unit. Thus, in a known solution, the variable strip accumulation store consists of obliging the strip to form a meander between a set of lower guide rolls and a set of upper guide rolls which may move vertically, varying the length of accumulated strip. The radius of all these guide rolls may not be less than a limit, which depends on the gauge and the characteristics of the strip, but which is always considerable, such that the sum of the diameters of all these rolls, added to the need that all the items integrating the plant be aligned on the forward feed direction of the metal strip, means that the distance required between the bobbin and the press is unacceptable.

It is an objective of the invention to overcome, in a practically radical way, the above mentioned drawbacks. This objective is accomplished with a system of the type first mentioned above which is characterized in that said variable capacity storage device is formed by mutually independent facing lower and upper frames situated one above the other; each of said frames comprising a series of guides disposed on the successive coils of an ideal spiral, which are mating and complementary in both frames, jointly defining a spiral, along which said metal strip is for sliding from the outer end thereof, situated in the lower frame up to the inner end, also situated in the lower frame; said lower frame being fixed, while said upper frame is displaceable vertically, away from or towards said lower frame and varying consequently the total length of stored metal strip.

In accordance with this solution, in fact, the metal strip is guided, both inside the accumulator store and, particularly, at the exit therefrom, by a rigid metal track, which may be provided with running and/or sliding members allowing the total space occupied by the store to be notably reduced and allowing the strip to be rotated in any way in the direction of feeding, for example in ninety degree turns, allowing the whole unit to be situated in the immediate proximity of the press being fed, such that the whole unit may comfortably remain under the control of a single operator.

The main features and advantages of the system forming the object of the invention will be more easily understandable in the light of the accompanying drawings referred to hereinafter and in which a specific embodiment has been very schematically shown.

In the drawings:

Figure 1 is a schematic side elevation view of the overall system;

Figure 2 is a schematic upper plan view of the same

unit;

Figure 3 is a schematic front elevation view, also of the said unit;

Figure 4 is a schematic perspective view showing the basic principle of the present system and which turns of any angle, particularly turns of approximately ninety degrees to be impressed on the strip, in the feed direction, without causing any type of permanent deformation;

Figure 5 is a schematic side view of the storage device for a variable length of metal strip, corresponding to the storage of a minimum length of strip;

Figure 6 is a view similar to the previous one, corresponding to the storage of the maximum length of strip;

Figure 7 is a schematic perspective view of the rigid track by which the metal strip is guided from its exit from the store to its entry in the rectifier from which it is fed to the press.

The system of the invention comprises, in the first place, a standardized device for supplying the metal strip 1 from a bobbin 2. This device is well known in the art and does not require any special explanation and has been designated overall with the reference 3 and is, preferably as may be schematically seen in Figure 2, of the type which is arranged to allow the assembly of two supply bobbins, one of them in use and the other standby. This second bobbin may be placed in the supply position when the first one is exhausted by a simple lateral translation of the stand. This arrangement allows the time required for the bobbin change operations to be reduced to a minimum.

Secondly, downstream of the device 3, the system comprises a welding device 4 (also of known type which does not require any special explanation either), by which, in the first place, the trailing end of the exhausted metal strip 1 bobbin and the leading end of the new bobbin are accurately cut transversally, and secondly these ends are butt-welded together, such that both bobbins form a single strip 1, with no break in continuity.

Downstream of the welding device 4, the system comprises a specially designed variable length storage device 5 for the metal strip 1 to which reference will be made hereinafter.

At the exit from the storage device 5, the metal strip 1 passes to a guide device 6 which is an indispensable complement of the storage device 5 and to which further reference will also be made hereinafter.

Finally, at the exit from the guide device 6, the metal strip 1 is forced to pass through a known rectifier 7 which erases the resilient tendency of the strip 1 to curve, as a result of its stay in the bobbin 2 and of its passage through the storage 5 and guide 6 devices and delivers it directly to the press 8, causing it to form a loop 1' (Figure 3), the purpose of which is simply to compensate small differences which may occasionally exist between the speed of supply of the strip 1 and the operating speed of the press.

In accordance with the invention, the metal strip 1 is stored, forming the necessary reserve to be able to maintain the press 8 feed uninterrupted during the supply bobbin changeovers and the operation of the welding device 4, in spiral form and is guided from the center region of the spiral towards the press, with the necessary change(s) of direction being impressed thereon by the device 6. The basic principle on which these changes of direction are based is shown schematically in Figure 4. As is known, a metal strip 1, the gauge of which is, by definition, much smaller than the width, always has some possibility of adapting itself to curvatures around axes orthogonal to the longitudinal axis thereof and the reason for this is that with the gauge being very small, the tension differential between both sides of the strip 1 is also very small. On the other hand, if the curvature is around an axis which is not orthogonal to the longitudinal axis of the strip 1, both longitudinal edges, which are appreciably apart, are subjected to different tensions, this appreciable separation resulting in the tension differential also being appreciable and it is these which in a word cause permanent deformation. Thus, an essential feature of the present invention is that the changes of direction to which the strip is subjected be determined by a rigid strip-form guide 9 on which the metal strip bears, this guide being adapted helically to an ideal cylindrical surface 10, the radius of which is equal to or greater than the minimum radius of curvature admitted by said metal strip 1, without undergoing permanent deformation, on an axis perpendicular to its longitudinal axis. This arrangement allows the metal strip 1 to be guided with absolute freedom, allowing as many changes of direction as may be interest to be impressed thereon, with no risk of permanent deformation.

As stated above, the metal strip 1 reserve is formed by storing the strip spirally. To this end, as shown schematically in Figures 5 and 6, there is contemplated a device (indicated overall in Figures 1 to 3 with the reference 5) formed by two separate frames 5a and 5b (Figures 5 and 6). These two frames 5a and 5b are positioned one above the other exactly facing each other, each comprising a series of guides 11 arranged essentially on the successive coils of an ideal spiral which extend continuously from one frame 5a to the other 5b, jointly defining the spiral. The metal strip 1 is guided along the spiral, entering therein through the outer end 12 thereof and extending therefrom at the inner end 13, both ends being positioned in the lower frame 5a. To facilitate the sliding of the metal strip 1 along the guides 11, there are preferably disposed therein a series of idler rollers 14 or, possibly, sliding shoes or similar members, on which the strip 1 is supported, with the consequent reduction of friction. Obviously, the curvature of the innermost coil of the unit may never have a radius smaller than the minimum radius of

curvature that the strip 1 may support without undergoing permanent deformation.

Essentially, the lower frame 5a is fixed, being rigidly attached to a base 15, whereas the upper frame 5b may be moved vertically on guides 16, 16', from a position (corresponding to the storage of a minimum length of metal strip 1) in which it is resting on the lower or fixed frame 5a to an opposite maximum position in which it is spaced apart a certain distance vertically above the fixed frame 5a and in which the portions of metal strip 1 occupying the successive half coils defined by the guides 11 are connected together with vertical straight portions 1" which significantly increase, up to the limit of interest in each case, the total length of strip 1 stored in the unit. The expert in the art will understand that it is easy to calculate these movements of the upper frame 5b, coordinating them with the operating speed of the press and the supply speed of the metal strip, such that the length of metal strip 1 stored in the device is minimal on starting to feed a new bobbin, is gradually increased (by a upward vertical movement of the upper frame 5b) until it reaches a maximum value on exhaustion of said bobbin and is reduced (maintaining the press supply uninterrupted) during the replacement of the exhausted bobbin by the new one and welding of the ends of both bobbins, to start a new operative cycle. These movements may be determined by electric motors and, possibly, counterweights and/or tension devices as deemed desirable in each case. As is logical, the difference between the length of metal strip stored in the device when this is in the maximum position (Figure 6) and when it is in the minimum position (Figure 5) should coincide with the length consumed by the press during the period of time that the external supply is interrupted, namely, while the said bobbin changeover, new threading and welding operations are being performed.

According to an important feature of the invention, from the inner end of the spiral defined by the guides 11, the metal strip 1 is guided by the guide device 6. This guide device 6 is formed by a track 9, the working surface of which has a smooth straight section, which uninterruptedly extends the end of the guide 11 and, like the latter, it may be provided with a series of idler rollers 14, shoes or like members which reduce the friction between the working surface of the track 9 and the metal strip 1 sliding thereon as far as possible. Figure 7 is a very schematic perspective view, with omission of the said sliding members and the supports to hold it in position, of one embodiment of the rigid guide track 9. Following the basic principle mentioned in connection with Figure 4, the track 9 may adopt any curvatures of interest, in one way or another, while adapting itself always helically to the surface of an ideal cylinder, without this causing tension in the metal strip which could cause permanent deformation. A first curve 9a is absolutely necessary to remove the metal strip from the center region of the spiral formed by the independent frames 5a and 5b, i.e. to withdraw it from the vertical plane of the spiral and, as from this curve, the track must only direct the strip towards the rectifier 7 which finally delivers it to the press 8, it being possible for it to extend practically in a straight line. Nevertheless, it is very advantageous that the track have a second curve 9b, causing the metal strip to turn on the horizontal plane of approximately 90 degrees. This arrangement, as may be seen in Figure 2, allows the overall supply plant to be located very close to the press, so that a single operator may comfortably control the operation of both one and the other.

Claims

1. A continuous supply system for press, precisely stamping presses fed by a metal strip (1) wound on a bobbin (2), of the type comprising: a welding device (4) located downstream of the bobbin (2), by which a butt weld is made between the tail end of an exhausted bobbin and the leading end of a new bobbin; a variable capacity storage device (5) in which the length of metal strip (1) required for maintaining the supply during the bobbin changing and welding stages is accumulated; and a strip (1) rectifier (7), delivering the strip to the press (8), characterized in that said variable capacity storage device (5) is formed by mutually independent facing lower (5a) and upper (5b) frames situated one above the other; each of said frames (5a, 5b) comprising a series of guides (11) disposed on the successive coils of an ideal spiral, which are mating and complementary in both frames (5a, 5b), jointly defining a spiral, along which said metal strip (1) is for sliding from the outer end thereof (12), situated in the lower frame (5a) up to the inner end (13), also situated in the lower frame (5a); said lower frame (5a) being fixed, while said upper frame (5b) is displaceable vertically, away from or towards said lower frame (5a) and varying consequently the total length of stored metal strip (1)

2. The system of claim 1, characterized in that said metal strip (1) is directed from said variable capacity storage device (5) towards said rectifier (7) by a rigid track (9), the working surface of which, along which said strip (1) slides, is provided with a straight line cross section and describes at least one warped curve (9a), helically adapting itself to the surface of an ideal cylinder having a radius greater than the minimum radius of curvature admissible by said metal strip (1) without undergoing permanent deformation.

3. The system of claim 2, characterized in that said track (9) for guiding said metal strip (1) describes at least two warped curves (9a, 9b) impressing on said metal strip a turn of approximately 90 degrees on the horizontal place in the feeding movement

thereof from the storage device (5) to the press (8).

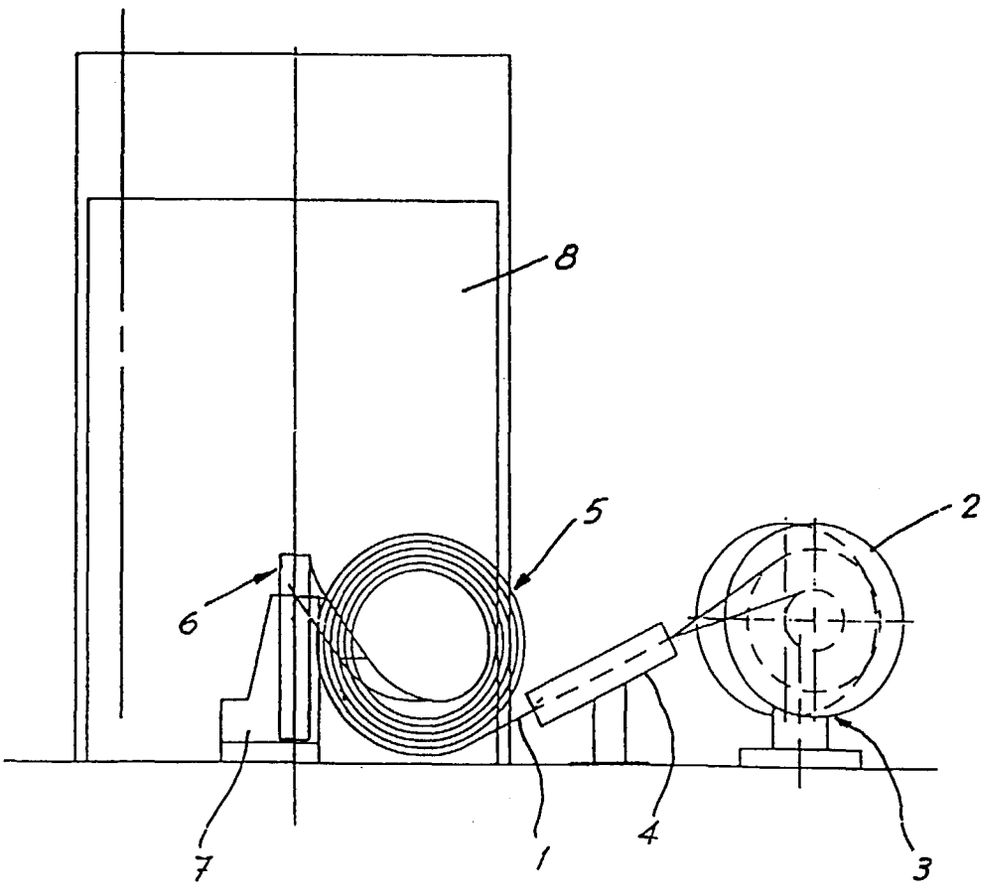

FIG. 1

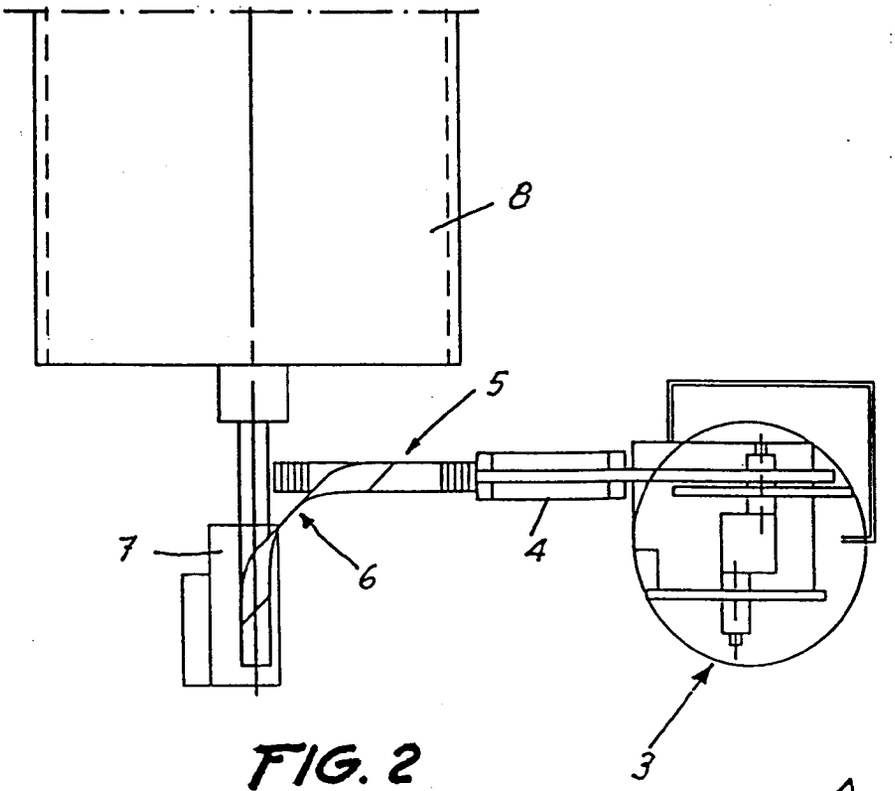

FIG. 2

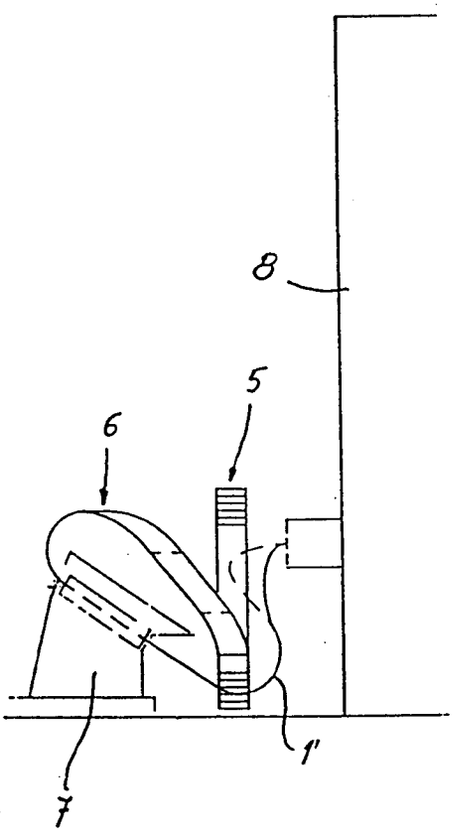

FIG. 3

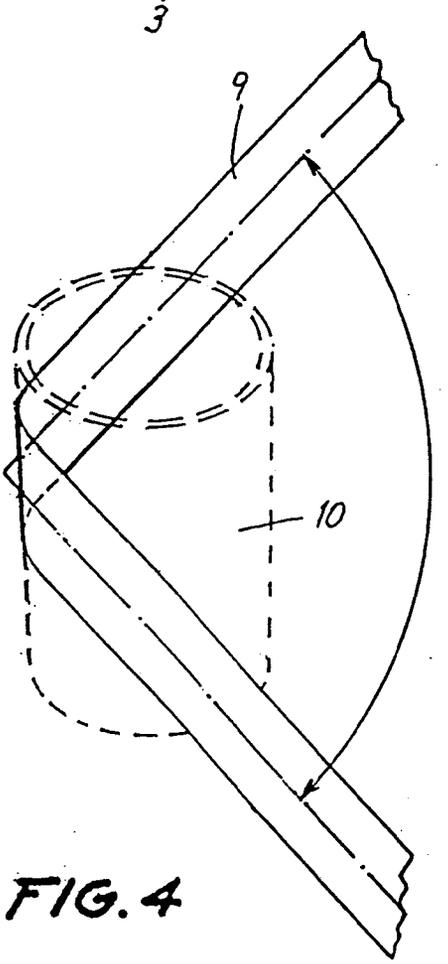

FIG. 4

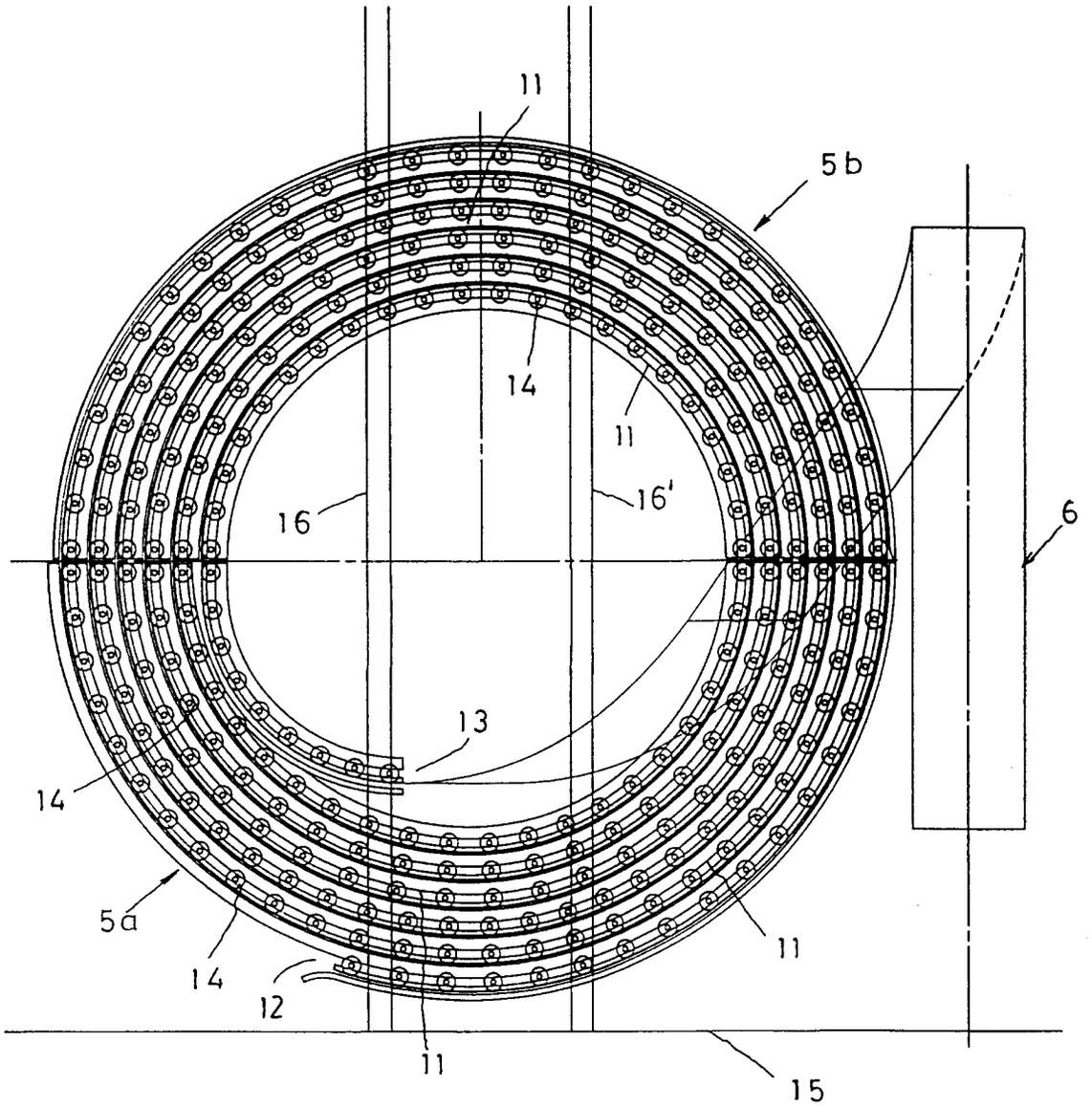

FIG. 5

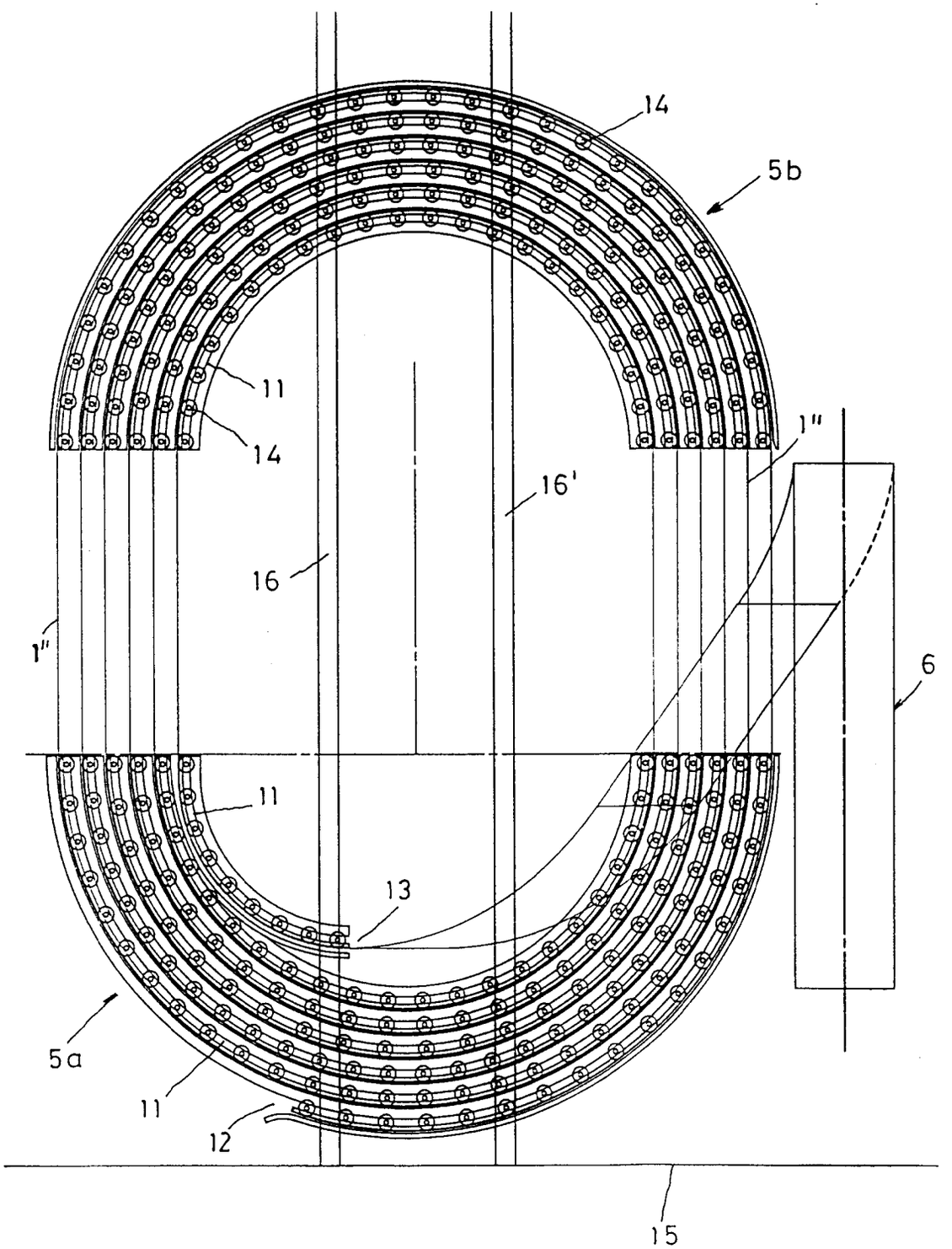

FIG.6

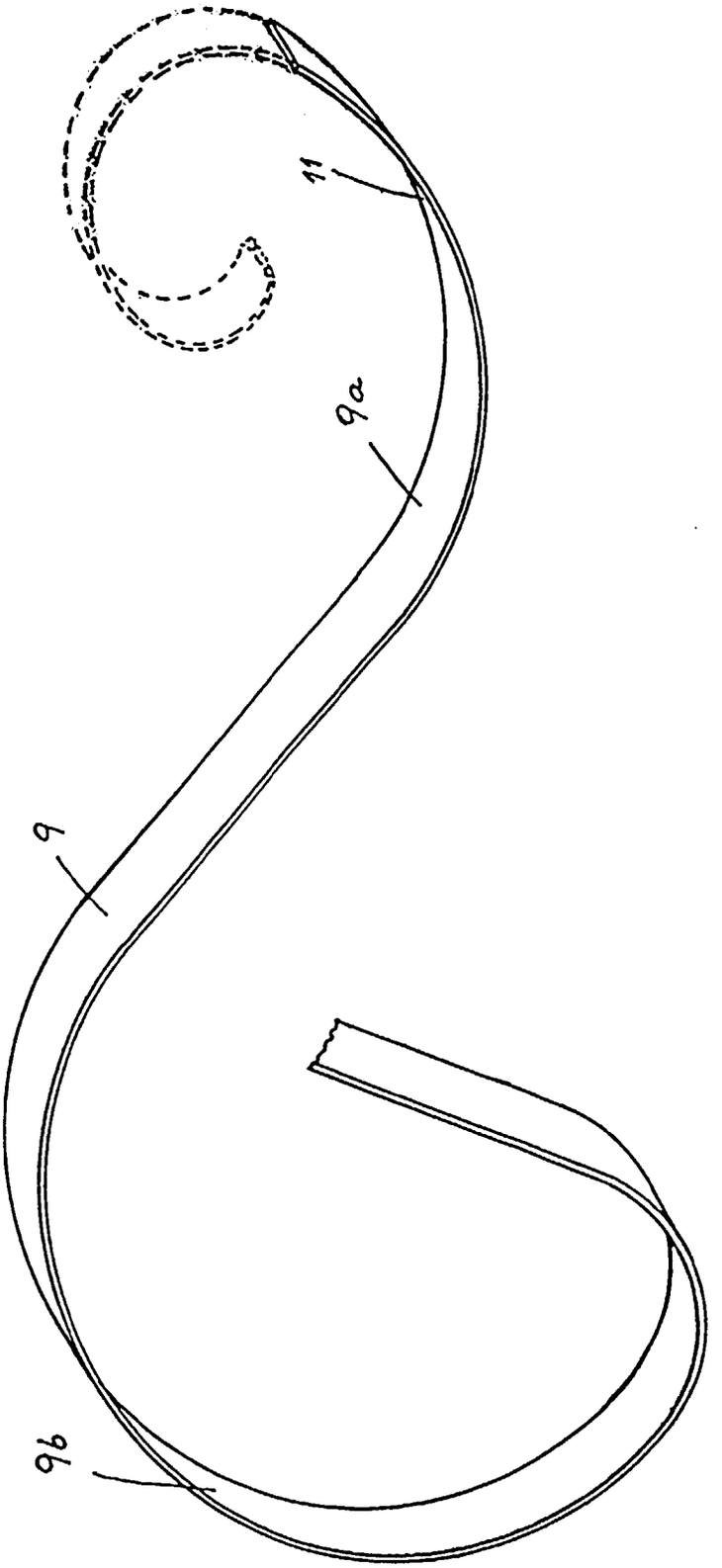

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES 97/ 00199

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 : B21C 49/00, B65H 20/30, B21D 43/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 : B21C, B65H, B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CIBEPAT, EPODOC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 3 175 776 A (M. Hughes Butterfield et al.) 30 March 1965 (30.03.65), the whole document	1 2
X	US 3 589 581 A (Donald A. Swindells) 29 June 1971 (29.06.71), the whole document	1
Y	US 4 605 178 A (Günter Bartzick et al.) 12 August 1986 (12.08.86), column 2, lines 42 - 50; column 3, lines 46 - 55; figures 1 - 2	2
A	US 5 193 757 A (Lev Talanker) 16 March 1993 (16.03.93), column 1, line 1 - column 2, line 55	1-2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 December 1997 (10.12.97)	15 December 1997 (15.12.97)
Name and mailing address of the ISA/ S.P.T.O. Facsimile No.	Authorized officer Telephone No.

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