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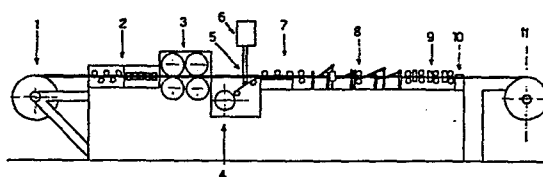
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(54) **Method and machine for insulating electric conductors for transformers by glueing insulation coating sheet and conductors thus insulated.**

(57) **Method and machine for producing electric strap conductors for carrying out transformers in general, by glueing to the conductor an insulating tape in longitudinal direction instead of helical direction. The conductor thus obtained has improved characteristics and can be produced at lower cost.**



Method and machine for insulating electric conductors for  
transformers by glueing insulation coating sheet and conductors  
thus insulated

5 The present invention relates to a method and machine for  
insulating electric conductors for transformers by glueing  
insulation coating sheet, and conductors thus insulated.

The invention is particularly suitable for use in continuous  
10 insulating of conductors by coating with one or more glued  
insulating sheets, especially of strap type for both dry and oil  
transformers.

At the present state of the art, insulation of electric  
15 conductors, generally aluminium or copper straps, for producing  
dry and oil transformers has always been carried out by lapping  
helically the conductor with an insulating material tape very thin  
in thickness (0.025-0.05 mm) in one or more coating layers in the  
same direction or in opposite direction, alternate or not. The  
20 tapes of insulating sheet used are kraft paper or aramide paper,  
cotton fabric or fiber glass or polyester fibers, and also  
enameling. Coating with tape or sheet according to the above-  
mentioned prior art was carried out without glueing but simply by  
adhesion.

25 Recent improvements have shown that insulation by glueing coating  
sheet on the underlying surface improves considerably insulating  
yield and effectiveness, see for example Italian Patent  
Application No. 22172 A/80 filed on May 19, 1980 in the name of  
Paolo Zanettin, Trezzano Sul Naviglio (Milan) entitled "Electric  
30 conductor coated with adhesive and wound with insulating tape",

which describes the advantages obtained by using glued tape which is wound on the conductor by helical winding method well known to those skilled in the art.

Winding machines are also known for winding helically insulating tape on bar in order to obtain insulation and are of two types:

- a first type utilizes an equipment which comprises rotation of tape rolls and simultaneous advance of same for helical winding around the bar to be insulated;
  - a second type utilizes rotation of advancing bar while winding tapes unwind in a fixed position;
  - another solution causes the bar to pass inside the roll of a winding tape and while said bar is advanced, the tape roll is rotated determining the desired winding still helically but with feed of the coating sheet inside the tape.
- All these solutions can provide either applying a tape without glueing or by previous smearing glue on the coating surface as known to those skilled in the art (e.g. glue sprayer) or applying self-adhesive insulating tape.

The drawbacks of the currently used solutions and of the above-mentioned prior art consist essentially in that these machines are complex and expensive and when the resulting product, involving helical winding coating, has to be bent, said coating is very likely to detach from the underlying surface thus reducing insulating effect.

The invention as claimed is intended to provide a remedy to the above-mentioned disadvantages. It solves the problem by coating the conductor by means of glueing with side envelopping of a continuous longitudinal sheet.

The advantages offered by this invention are mainly that insulation is extremely quicker and less expensive. Moreover, the result of insulation is much more effective.

- 5 One way of carrying out the invention is described in detail below with reference to drawings which illustrate some preferred embodiments, in which:

Figure 1 is a schematic side elevation view of the machine for  
10 treating conductors according to the present invention; Figure 2 is a plan view of the machine of the preceding figure; Figures 3-4 are scrap views of the machine of the preceding figures enlarged respectively in side elevation view and in plan view of the unit relating to the glue smearer on the coating-insulating tape;  
15 Figures 5-6 are scrap view of the machine of Figures 1,2 enlarged respectively in side elevation and plan views of the opposite rollers pressure unit relating to the pressing-glueing step of the insulating tape on the lower surface of the strap conductor; Figures 7, 8 and 9 are plan enlarged scrap views of the machine of  
20 figures 1,2 relating the units respectively: the first one to the lateral envelopping bend and the remaining envelopping upper edge with successive glueing lateral and upper pressing respectively of the tape on a corresponding lateral and upper surface, the second lateral envelopping bend on the corresponding lateral surface  
25 opposed to the preceding one, and finally the third envelopping bend on the upper side corresponding on the same upper surface in overlapping; Figures 10, 11 and 13 show in the same scrap enlarged plan and side elevation view the final pressing step for complete the adhesion-glueing of the insulating sheet by means of opposite  
30 rollers and smooting devices to obtain the final product Fig.13.

According to the above figures the present invention consists in a machine suitable for realizing a coating insulating tape glued longitudinally with lateral envelopping on a strap conductor (40, Fig. 13).

5

The machine comprises a set of operative units placed in line in rational succession which include at least: - a support for feeding coil (1) of bare strap conductor (12); - a roller straightener unit (2); - opposite roller advancing means (3); - a lower coil feeder (unwinder) (4) of insulating paper tape (12); -  
10 a smearing device (5) of glue coming from the feeding tank (6) on the upper surface of the insulating paper tape (16), placed downstream the feeding-unwinding device of the insulating tape (4); - a roller pressing device (7) for pressing under the strap  
15 conductor (12) said insulating tape (16) with simultaneous glueing on the lower surface of said conductor (12) due to the preceding glue smearing (5); - a set of envelopping device (8) for envelopping the lateral edges of the tape (16) advancing continuously with the strap conductor (12) for envelopping first  
20 one edge and then the other one superimposing the first one around the strap conductor (12); - an opposite roller pressing unit on the four sides for completing the glueing by compression with final rolling of adhesion and glueing of the coating thus envelopped (16) on the strap of bar conductor (12); - a smoothing  
25 runner device in sliding material for smoothing the surfaces of the conductor thus insulated (40) removing possible air bubbles or harmful wrinklins; - a coil rewinding device (11) of the conductor thus insulated (40).

In the glueing system it is very important that excess glue did  
30 not get out of the coating edges causing possible glueing between

turns during rewinding.

More in detail, the glue smearing device (5) includes also the tape feeding device (4) with an insulating tape idle coil (16) suitably braked with adjustable braking means of adjustable plate type clutch (20) axially movable (19) in order to center the position of the insulating tape (16) with respect to the strap to be coated (12) and comprising downstream two lower transmission rollers (15) between which upwards a glue smearing roller presses, (13) by means of the supporting and glue feeding arm (14) of the glue coming from the tank (6). (Figs. 3, 4).

Downstream the glue feeding device (5) a roller pressing device (7) is provided comprising a smoothing runner (17) placed under the advancing strap conductor (12), ending with a guiding roller arm (22) and including on the conductor (12) a set of idle pressing rollers (18) supported by a plate (17) with adjustable spring risers (21) for pressing and glueing the tape smeared with glue (16) against the lower surface of the conductor (12) (Figs. 5, 6).

The set of envelopping devices (8) for envelopping the tape (16) around the strap conductor (12) comprises a sequence of belts (25,28,31,33) longitudinally stretched by an hooking upstream spring (24), placed under the conductor (12) and the coating tape (16) in horizontal flat position, and hooked downstream after partially envelopping the conductor to be coated (12) with the tape (16), transversally movable, on a respective stretching and orientable bar, placed over the conductor (12), the first bar (26) being horizontal for envelopping from a first lateral base corner,

the second bar (26') being vertical for the remaining envelopping of the same edge on the corresponding upper corner; the third bar (32) being horizontal for envelopping from the other opposite base corner; the fourth bar (32') being vertical for the final  
5 envelopping on the corresponding upper corner with superimposition on the preceding edge already envelopped on the upper face of the conductor (12), a lateral pressing roller (27) for adhering glueing the tape on the corresponding lateral surface of the conductor (12) being provided between the envelopping of the first  
10 belt (25) and the envelopping of the second belt (28), and analougously an upper pressing roller (30) with a lower counterroller (29) being provided between the envelopping of the second belt (28) and the envelopping of the third belt (31).

15 After the last belt (33) a final pressing device (9) is situated with opposite rollers (43, 35) on all four faces of the conductor already coated (40).

Downstream the pressing roller device (9) a smoothing runner  
20 device (10) is placed comprising a base runner (37) and an upper runner (38) pressed by springs (36), a lower idle bearing roller (39) is provided thereafter for guiding the finished insulated conductor (40) in coiling into the rewinding coil (11).

25 In the illustrated embodiment smearing of room temperature setting glue is provided, but it is obvious that also a hot-setting glue can be used, but in this case a more complex machine is required as heating devices have to be provided for drying glue getting out of the envelopping.

Of course, changes and modifications can be made without departing from the spirit or scope of the invention as defined in the appended claims.

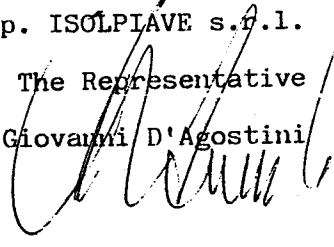
Udine, June, 1984.

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p. ISOLPIAVE s.r.l.

The Representative

Dr. Giovanni D'Agostini





Claims:

1. Method for producing electric insulated conductors by coating the conductor with one or more glued insulating sheets, particularly of strap type for carrying out transformers, characterised in that it comprises:
  - continuous feeding by advancing means (3) of a bare strap conductor (12) on a working line from a coil (1);
  - straightening said bare strap (12) on said continuous line (2);
  - 10 - feeding under said strap (12) a continuous insulating material tape (16) with adhesive upper surface (5), wider than said conductor strap (12) and larger in width than the length of the perimeter development of the section of said strap (12);
  - glueing centrally approx (7) said continuous insulating tape 15 (16) under and with said conductor strap (12) making same to advance together;
  - envelopping at an envelopping unit (8) first an edge (25, 28) and then the other (31, 33) of the said insulating tape and making them to adhere around the strap conductor for coating thereof in 20 superimposition glued on the top;
  - pressing the coating applied for making it to adhere glued (9, 10);rewinding the insulated conductor (40) on a coil (11).
- 25 2. Machine for carrying out the method as claimed in claim 1, characterised in that it consists in a set of operative units placed in line in rational sequence, said units comprising at least:
  - a support (1) for nude conductor bare strap conductor coil (12);
  - 30 - a roller straightening unit (2);

- an opposite roller conveying conductor advancing device (3);
- a lower feeding coil (4) of insulating tape (12);
- a roller pressing device (7) for pressing under the strap conductor (12) said insulating tape (16) with simultaneous glueing on the lower surface of said conductor (12) due to the previous glue smearing (5);
- a ser of envelopping devices (8) for envelopping the lateral edges of the tape (16) advancing continuously with the strap conductor (12) to envelop first one edge and then the other one superimposing to the first around the strap conductor (12);
- a pressing unit with opposite rollers on the four sides for sopping compression with final rolling of adhesion and glueing of the coating thus envelopped (16) on the bare strap conductor (12);
- a smoothing device in sliding material for smoothing the surfaces of the conductor thus insulated (40) removing possible air bubbles or harmful wrinklins;
- a coil rewinding device (11) of the conductor thus insulated (40).

3. A machine as claimed in claims 1 and 2, characterised in that a glue smearing device (5) is installed on the upper surface of the insulated paper tape (16) between said insulating tape feeding device (4) and said glueing device (17, 8).

4. A machine as claimed in the preceding claims, characterised in that said glue smearing device (5) comprises also said tape feeding device (4) with an idle insulated tape coil (16) conveniently braked by adjustable breaking means of adjustable plate type clutch (20) and axially movable (19) for centering the insulated tape position (16) with respect to the strap to be

coated (12) and provided downstream with two mower transmission rollers (15) between which a glue smearing roller (13) presses upwards, by means of the supporting and glue feeding arm (14) of the glue coming from the tank (6).

5

5. A machine as claimed in the preceding claims, characterised in that said roller pressing device (7) for glueing the insulated tape (16) under the surface of the bare conductor (12) comprises a smoothing runner (17) placed under the advancing strap conductor (12), ending with a guiding roller arm (22) and provided on said conductor (12) with a set of idle pressing rollers (18) supported by a plate (17) provided with adjustable spring risers (21) for pressing and glueing the tape smeared with glue (16) against the lower surface of the conductor (12).

15

6. A machine as claimed in the preceding claims, characterised in that said set of envelopping devices (8) for envelopping the tape (16) around the strap conductor (12) comprises a sequence of belts (25, 28, 31, 33) longitudinally stretched by an upstream spring (24), placed upstream hooked in horizontal flat position under the conductor (12) and coating tape (16), and downstream hooked after partially envelopping the conductor to be coated (12) with the insulating tape (16), in transversally adjustable hooking position on a respective stretching and orienting bar, placed over the conductor (12), respectively:

25

- the first bar (26) being horizontal for envelopping from a first lateral base corner;

- the second bar (26') being vertical for the remaining envelopping of the same edge on the corresponding upper corner;

30 - the third bar (32) being horizontal for envelopping from the

other opposite base corner;

- the fourth bar (32') being vertical for the final envelopping on the corresponding upper corner superimposing the preceding edge already envelopped on the upper face of the conductor (12);

5 - at least one respective lateral pressing roller (27) for adhesion glueing of the tape on the corresponding lateral surface of the conductor (12) being provided between the envelopping of the first belt (25) and the envelopping of the second belt (28), and analogously at least one respective upper pressing roller  
10 being provided between the envelopping of the second belt (28) and the envelopping of the third one (31).

7. A machine as claimed in the preceding claims, characterised in that after the last belt (33) a final pressing device (9) is  
15 placed with opposite rollers (43, 35) on all four faces of the conductor already coated (40).

8. A machine as claimed in the preceding claims, characterised in that downstream the final pressing roller device (9) the smoothing  
20 device (10) is placed comprising a base smooting (37) and an upper smooting (38) pressed by spring (36).

9. A machine as claimed in the preceding claims, characterised in that at the end of the coating and smoothing treatment (10) an  
25 idle support lower roller (39) is provided for guiding the finished insulated conductor (40) coiling in a rewinding coil (11).

10. Insulated conductor obtained by means of the method as claimed  
30 in claim 1 and/or by means of a machine as claimed in claims 2 to

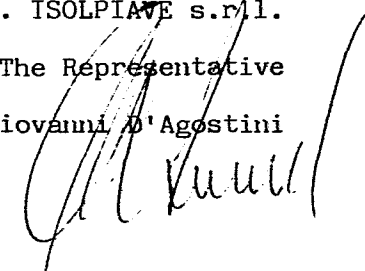
9, characterised in that said insulated conductor comprises a  
metallic strap electric conductor (12) longitudinally coated by  
glueing with at least one insulating tape in lengthwise direction  
and with opposed lateral transversally envelopping with with  
5 respective overlapping in one of his surfaces.

Udine, June, 1984.

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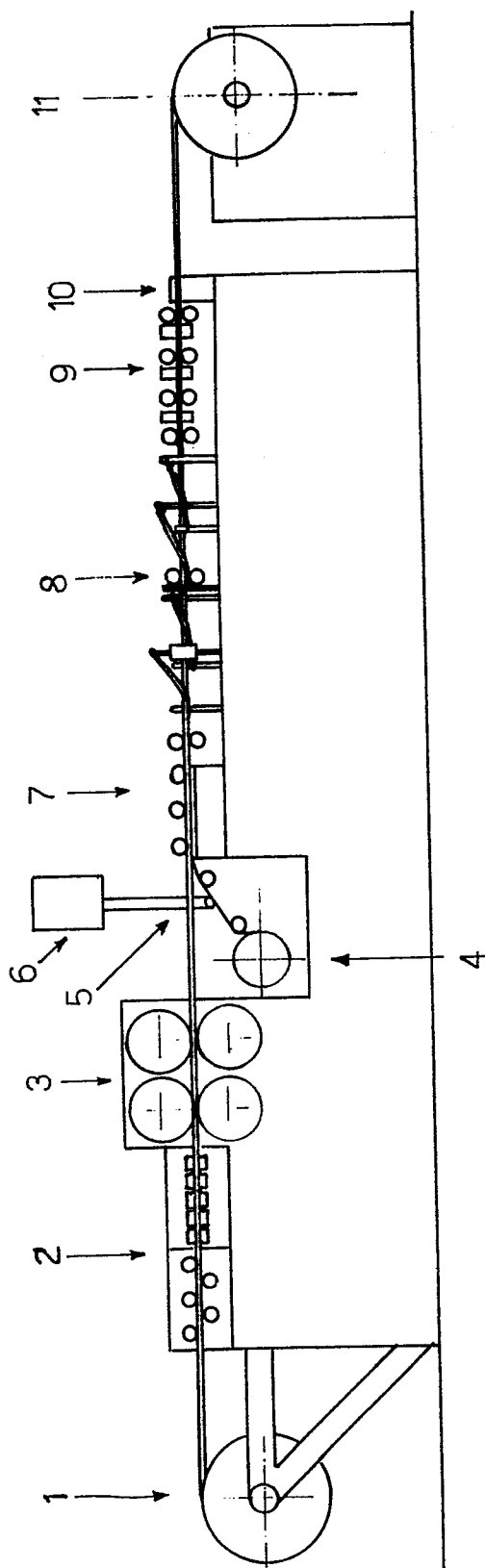


FIG. 1

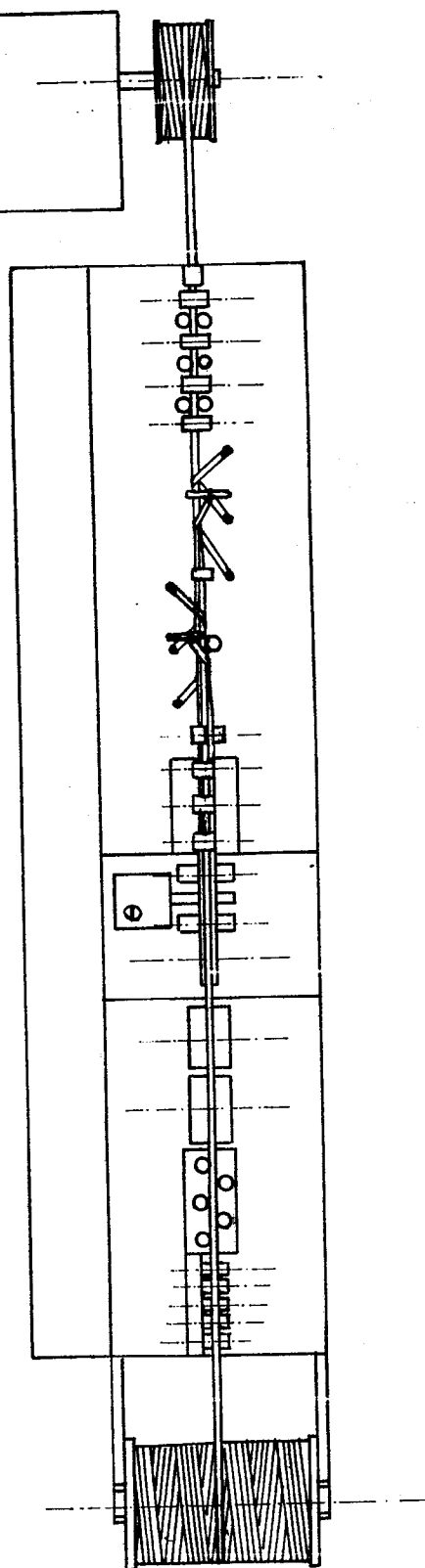


FIG. 2

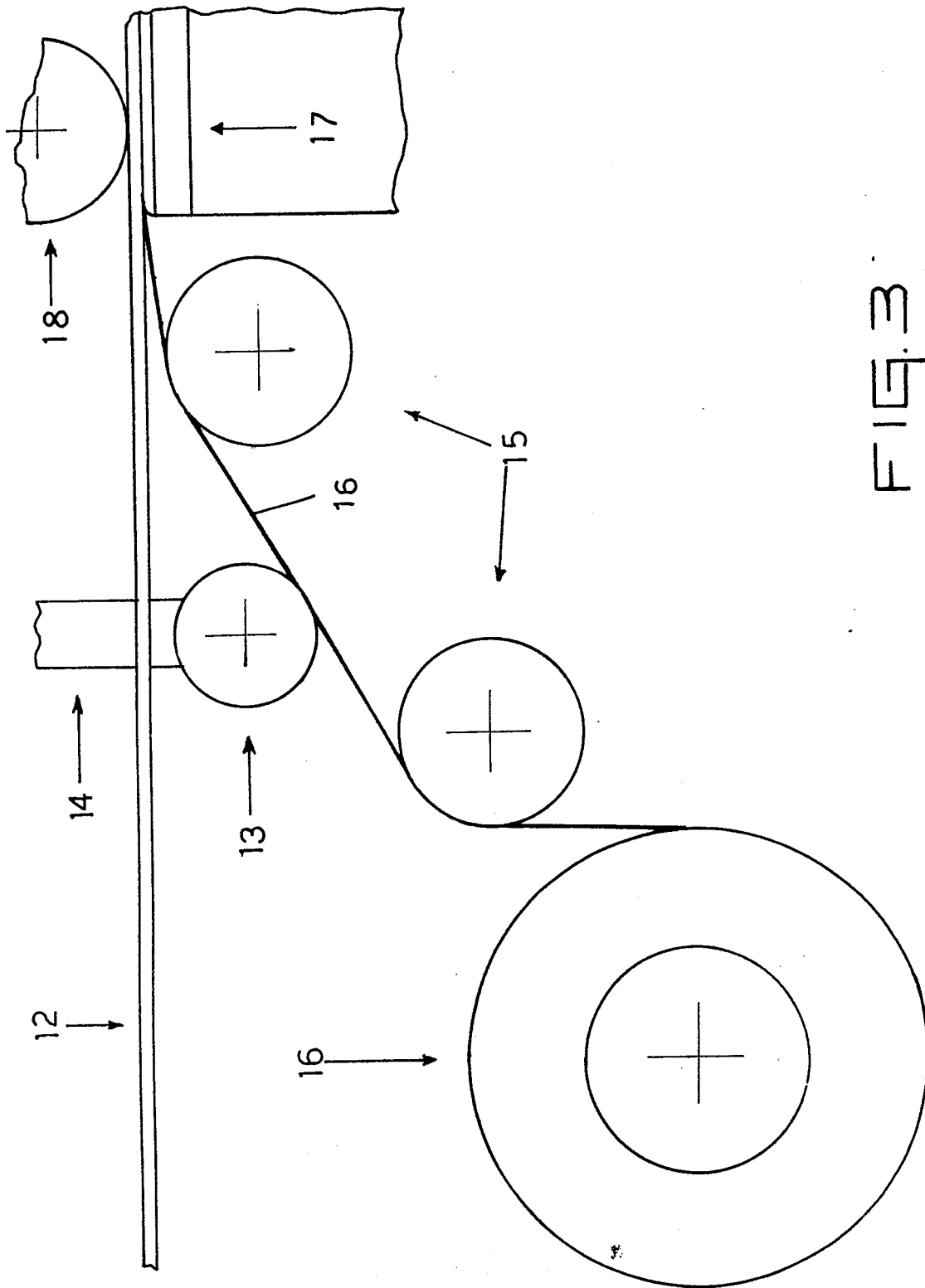
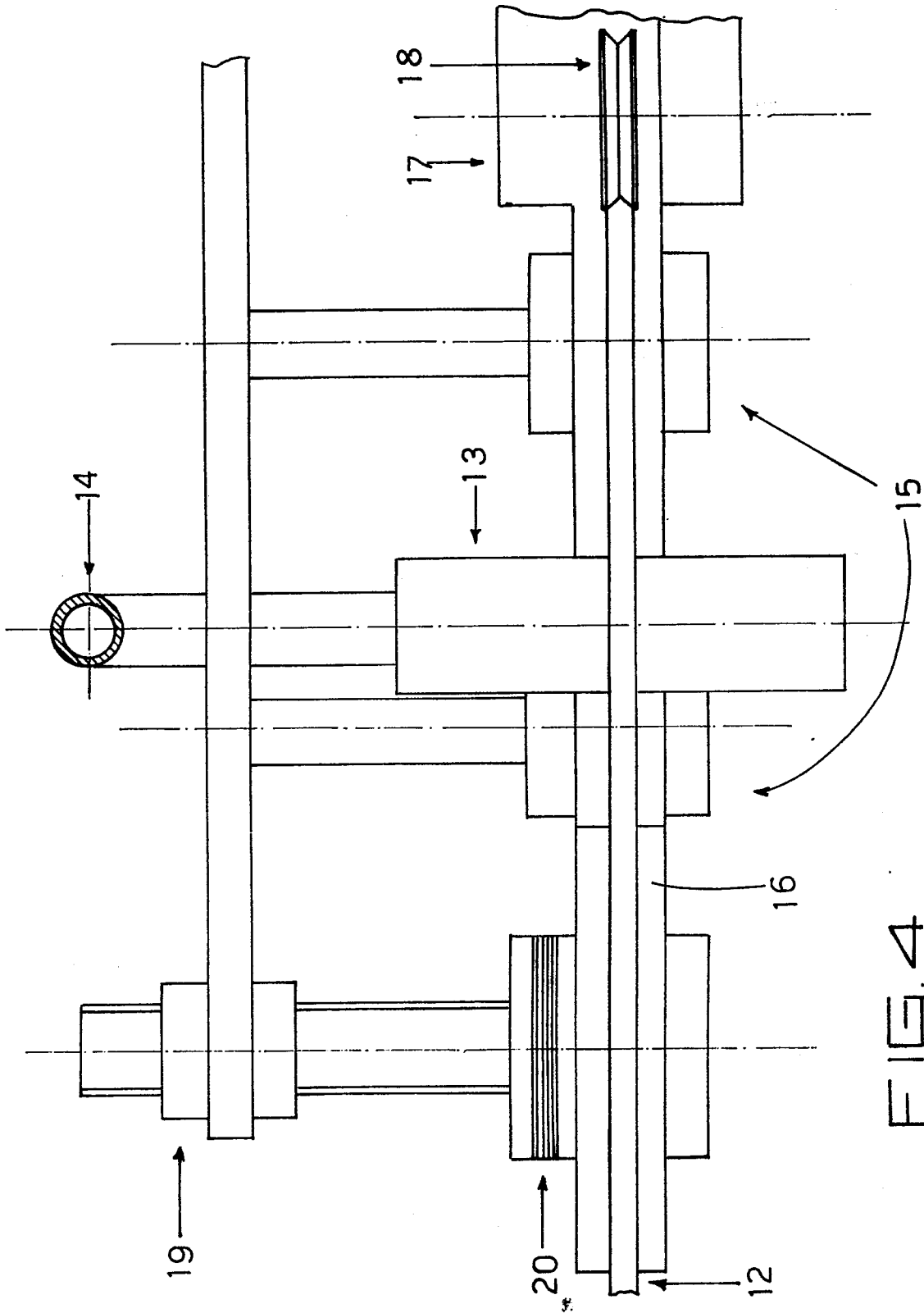
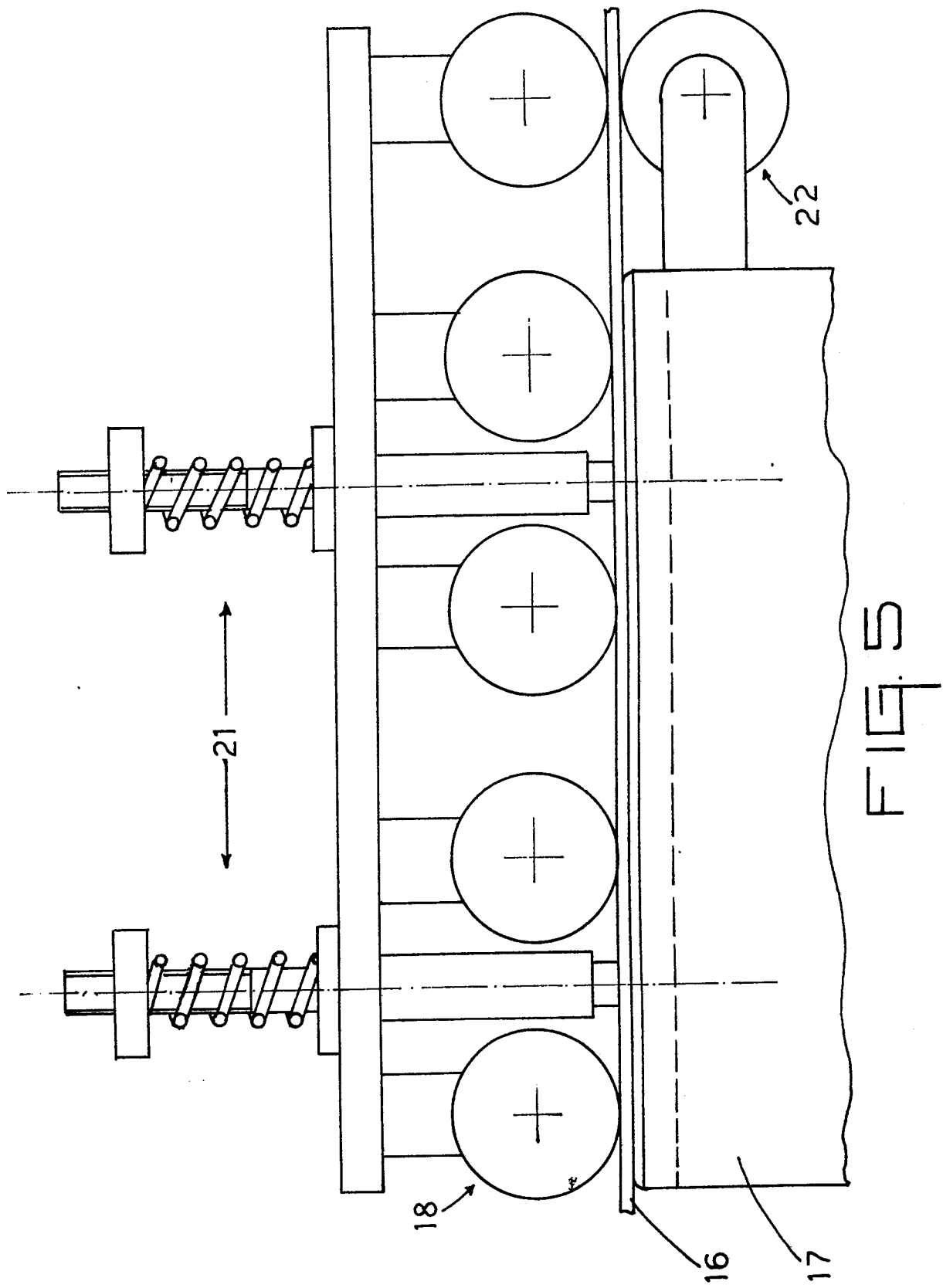


FIG. 3







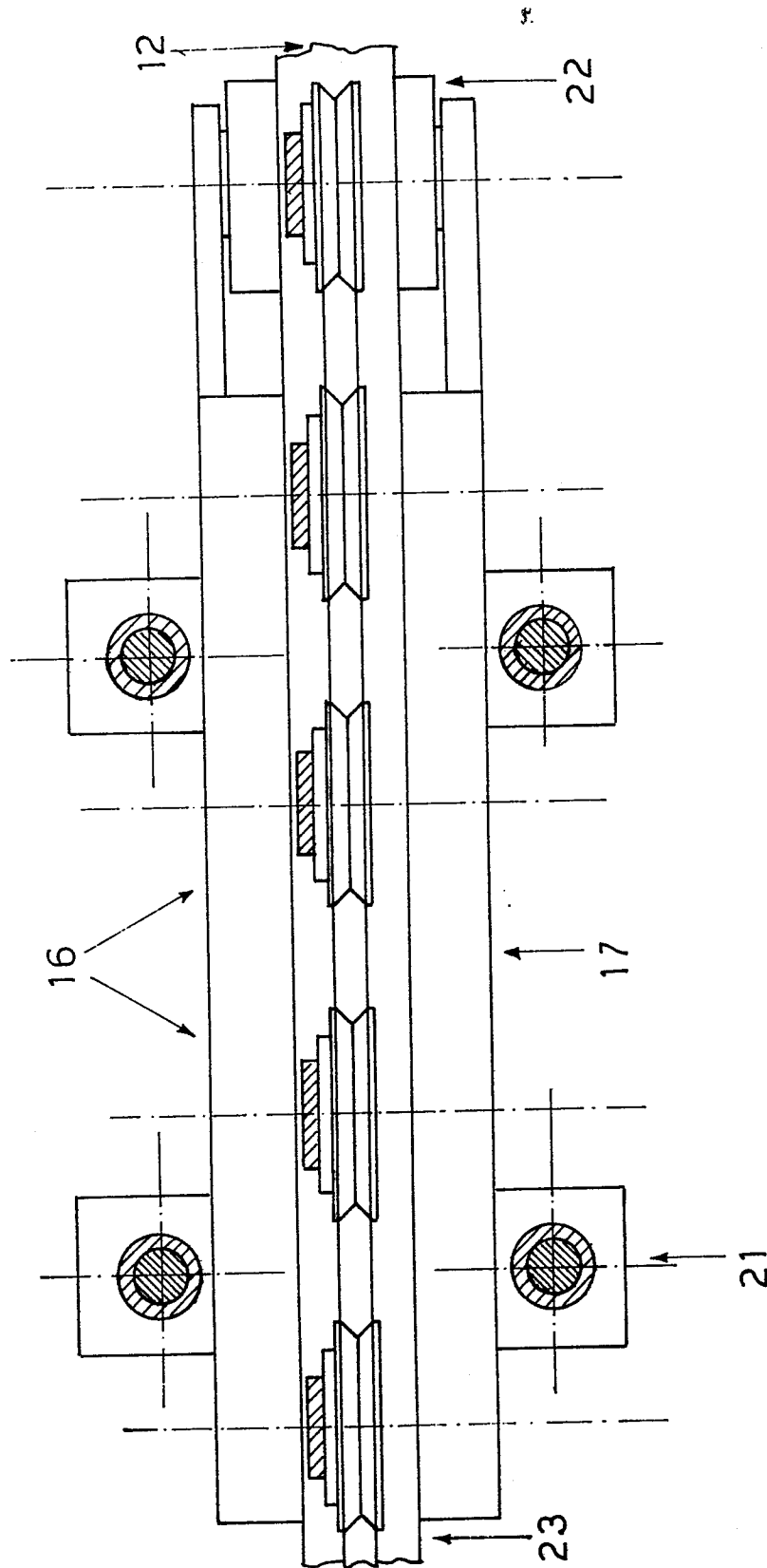


FIG. 6

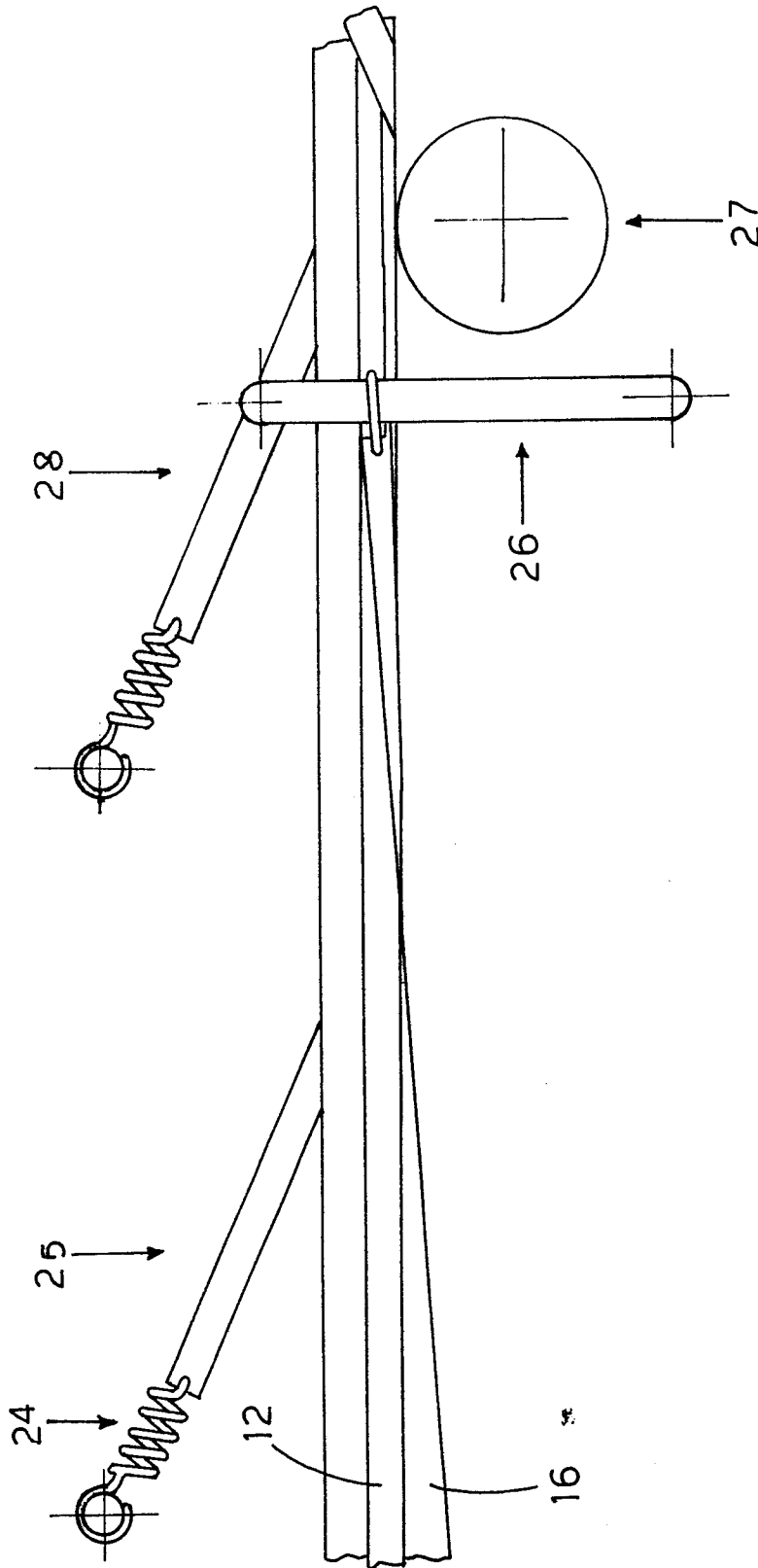


FIG. 2

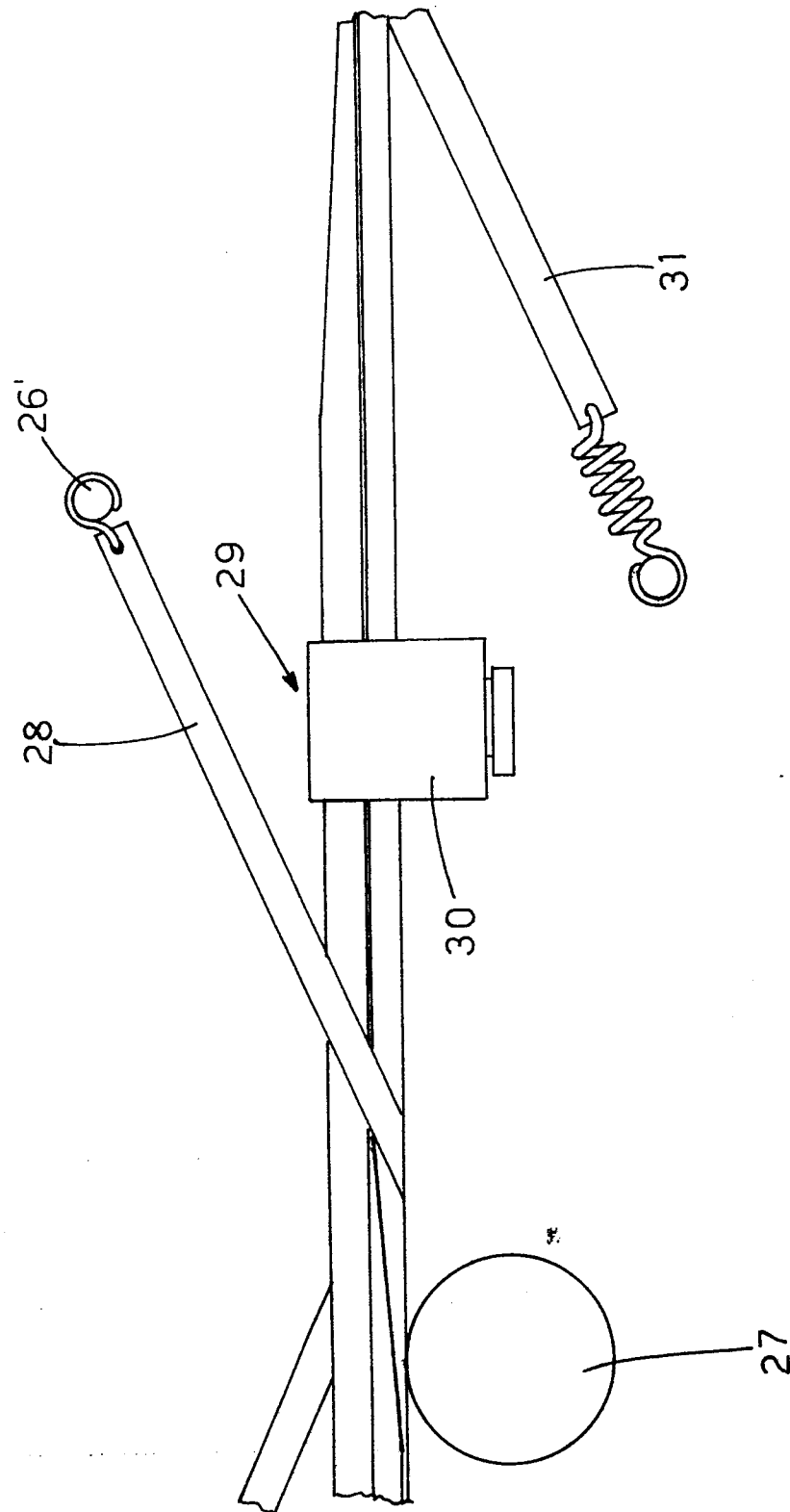


FIG. 8

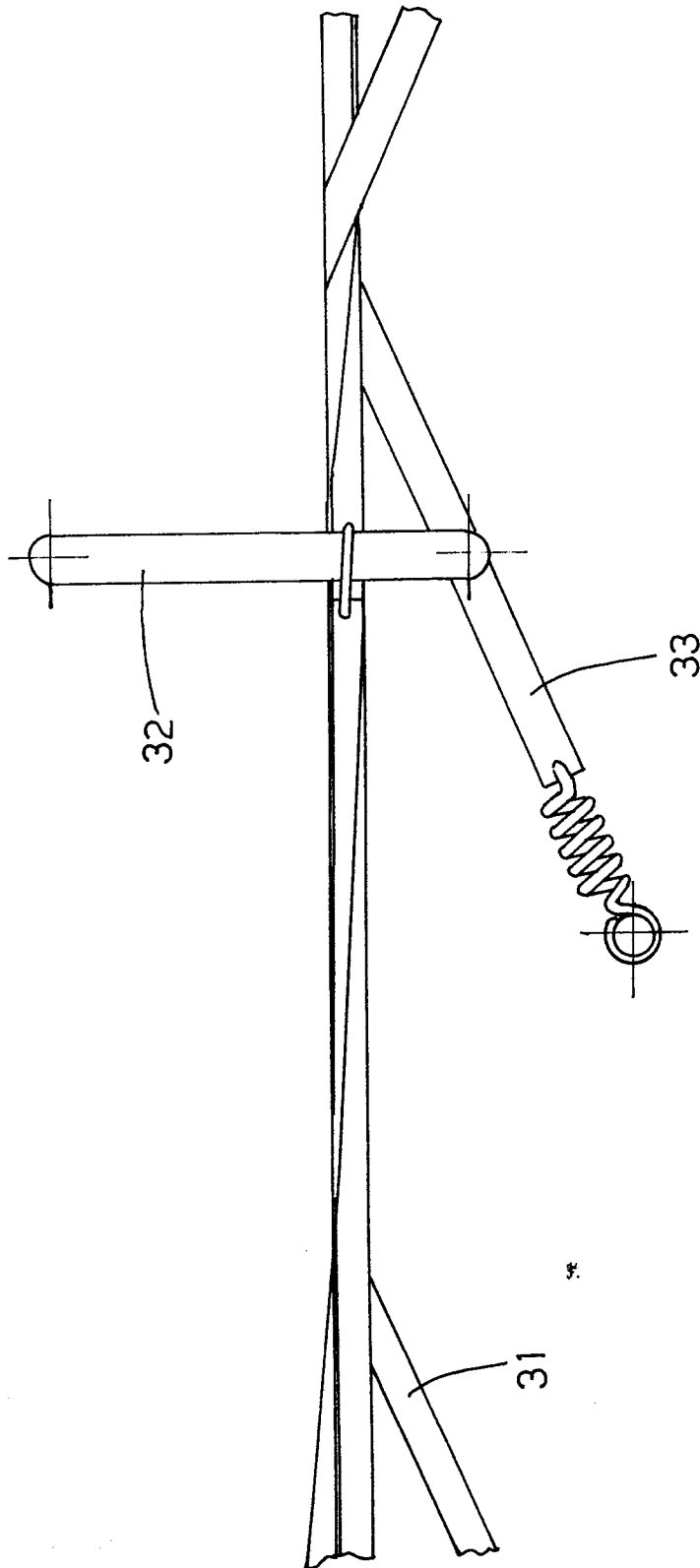


FIG. 9

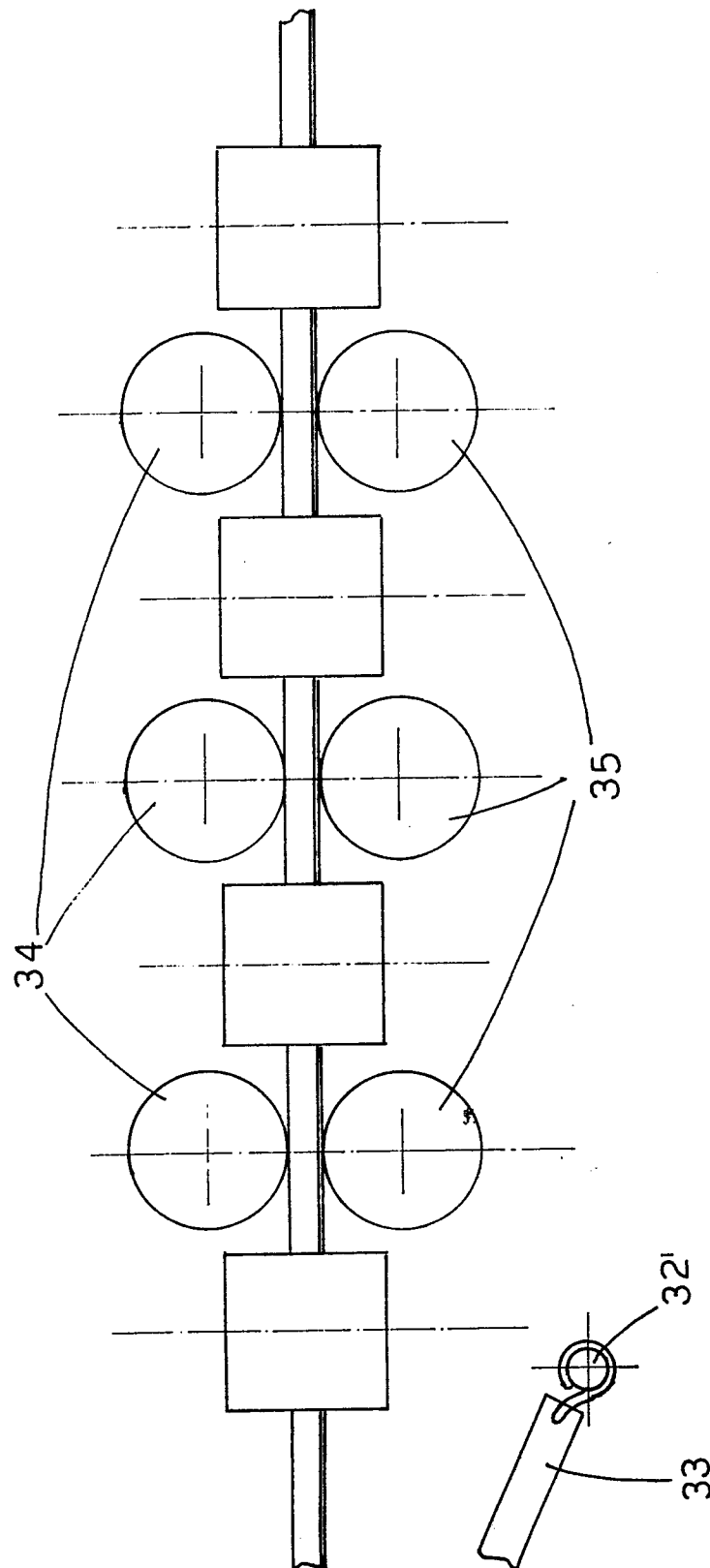


FIG. 10

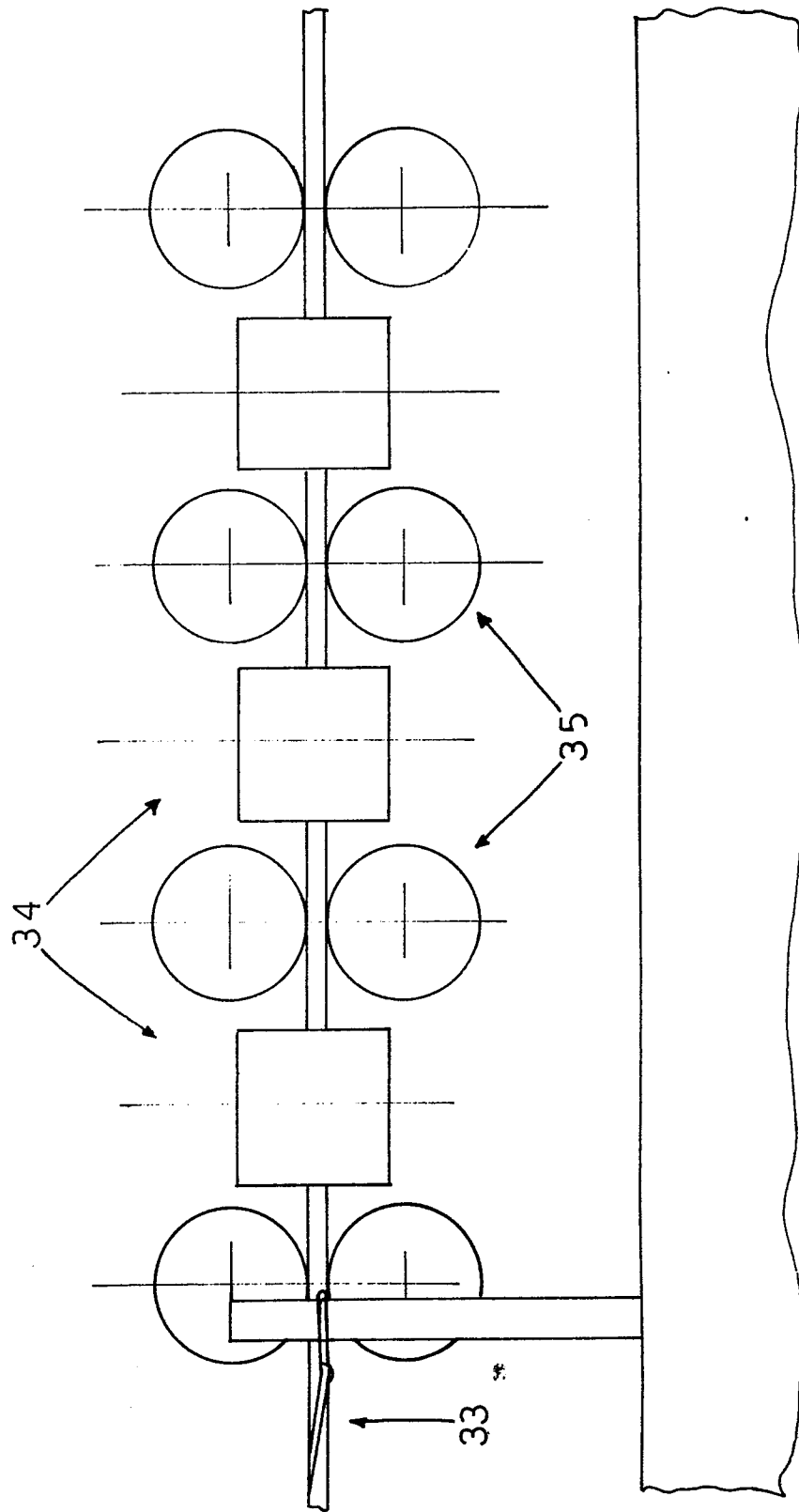


FIG. 11

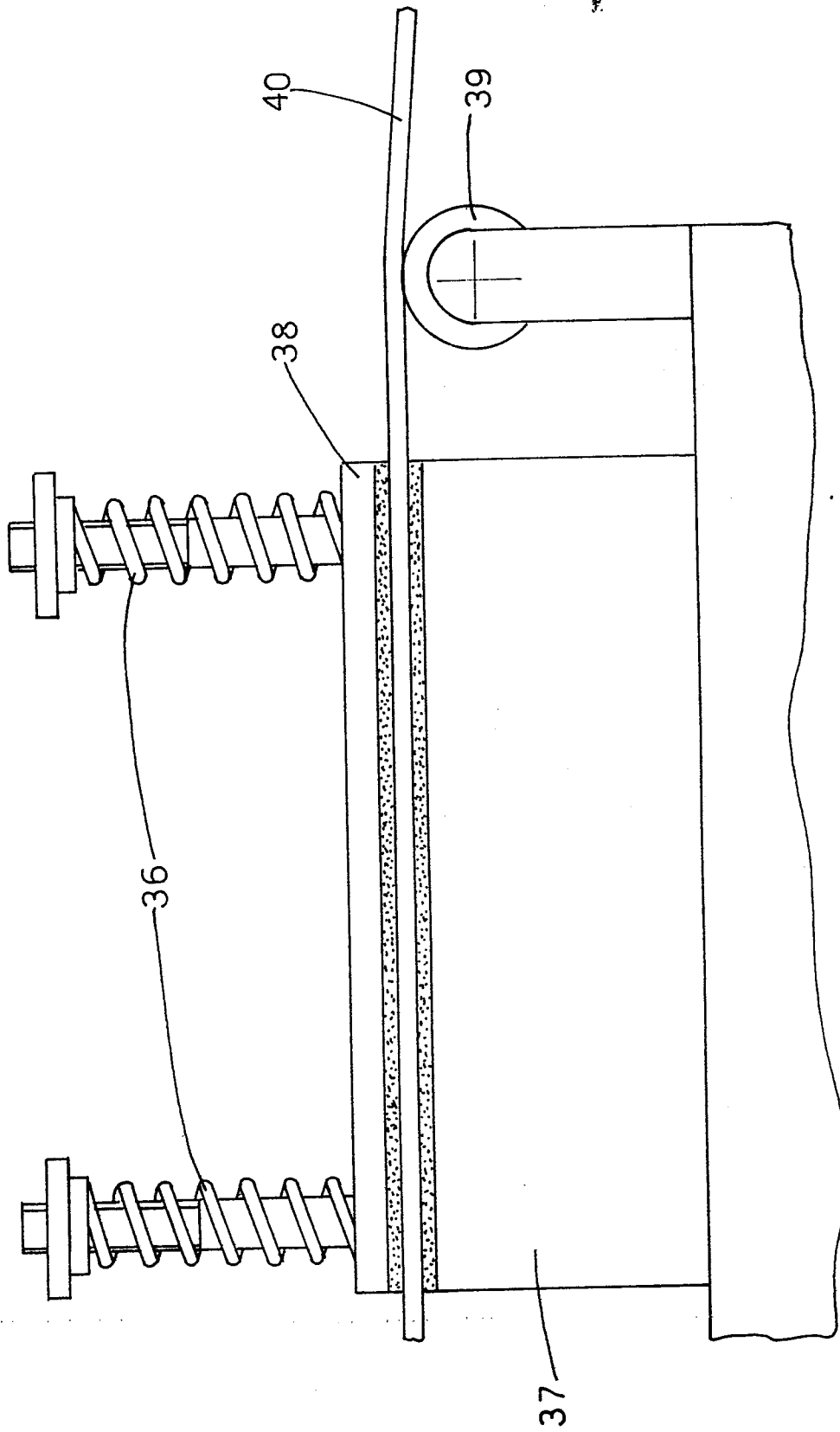


FIG. 12



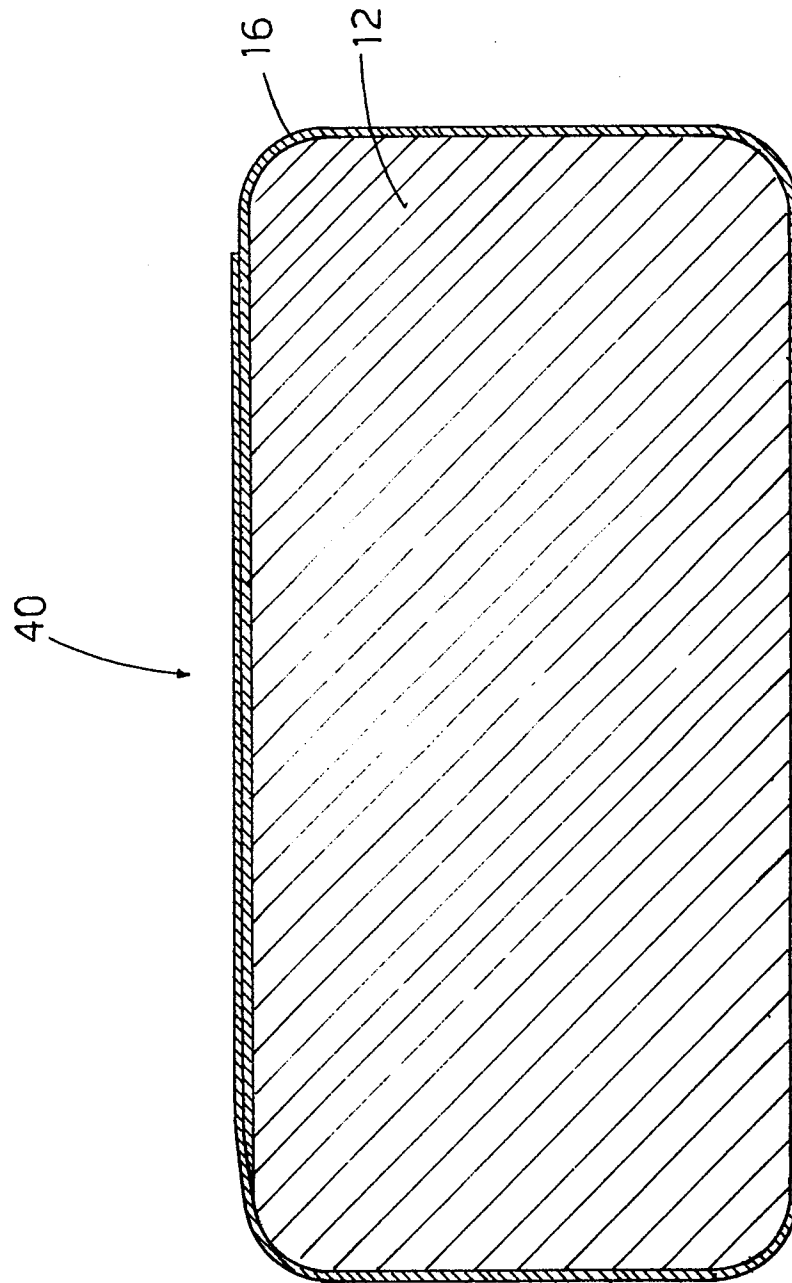


FIG. 13