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(54) Apparatus particularly for manufacturing electrical cables with sheathing made of silicone rubber and the like

(57) An apparatus particularly for manufacturing electrical cables with a sheathing made of silicone rubber and the like, comprising a catalysis oven (11), which in turn comprises a tank for containing molten salts, which has a predominantly longitudinal extension and has mutually opposite access openings; means (12a, 12b) for unwinding a conductor from a reel, means (13a, 13b) for extruding insulating material onto the conductor, means (14a,14b) for tensioning the outgoing cable, and means (15a,15b) for winding the cable onto a reel being functionally arranged upstream and downstream of each one of the access openings in order to make two cables (16,17) being treated slide with a longitudinal orientation and opposite directions.

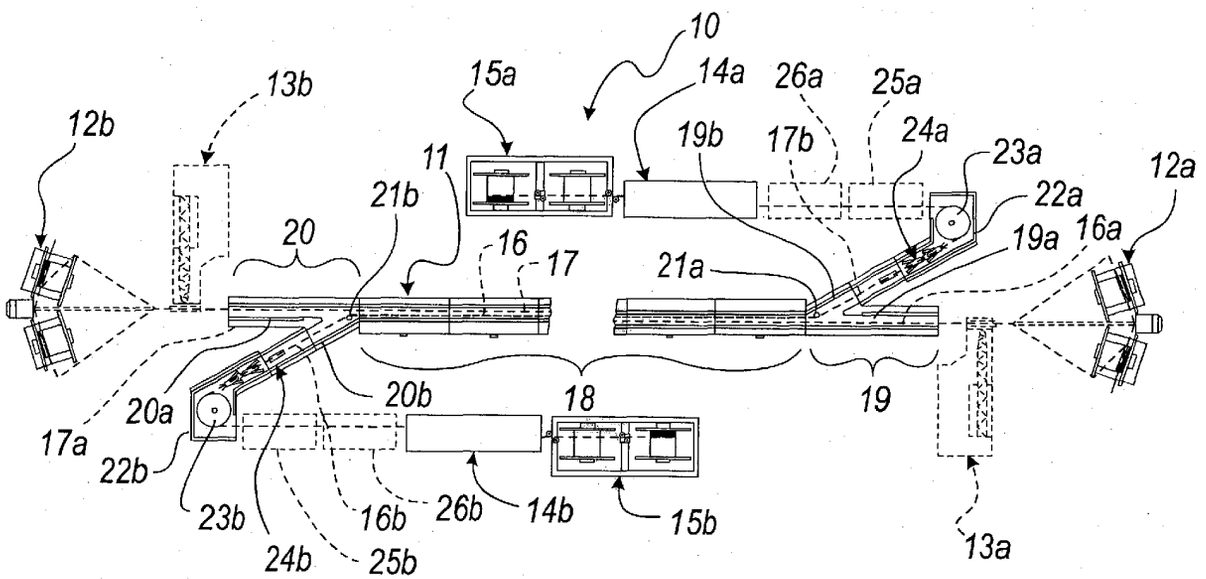

Fig. 1

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Description

[0001] The present invention relates to an apparatus particularly for manufacturing electrical cables with sheathing made of silicone rubber and the like.

[0002] Electrical cables are known commercially which comprise a conductor, made for example of copper, which is sheathed with insulating material constituted by silicone rubber.

[0003] An electrical cable with silicone rubber sheathing is manufactured, after a process for extruding the insulating material (essentially an operation for cladding the copper conductor with a silicone rubber mix activated with suitable chemical components), by catalysis of the mixture of insulating material, performed by passing through a linear oven which is approximately 20-25 meters long and in which a bath of molten salts, kept at 250-270 °C, allows to complete the process.

[0004] At the output of the oven there are means for washing, drying and testing the finished product.

[0005] However, the ovens that contain the bath of molten salts are not free from drawbacks.

[0006] The main limitations are in fact linked to their structure and to the cable feed rate.

[0007] Since the catalysis time of the insulating material is constant, the relation that links time with the ratio between movement and speed entails that in order to increase the transit speed of the cable and accordingly increase the productivity of the apparatus it is necessary to increase the length of the oven.

[0008] However, the relation is not linear, since as the speed increases, owing to the entrainment of the salts produced by the cable that is immersed therein, the initial part of the oven is gradually emptied and the molten salts accumulate toward the outlet part, in practice limiting the useful length of the oven, with a consequent reduction of the immersed part of the cable.

[0009] The balance between the length of the oven, the distribution of the fluid part (the molten salts) and the production rate is therefore a physical limitation that cannot be overcome easily.

[0010] Italian patent application No. PD2000A000232, filed on 6 October 2000 in the name of the same Applicant, discloses an oven that comprises a tank for containing the molten salts that has, in functional sequence, a longitudinally elongated initial portion, a substantially cylindrical intermediate portion, and a final portion that is extended longitudinally in a direction that is suitable to form an angle of approximately 30 sexagesimal degrees with the direction of the longitudinal extension of the initial portion on the horizontal plane.

[0011] A wheel for guiding the electrical cable being treated from the direction of the longitudinal extension of the initial portion to the direction of the longitudinal extension of the final portion is located in the intermediate portion, is completely immersed in the bath of molten salts and is associated with a corresponding support.

[0012] The oven further comprises a duct for the passage of the molten salts, which is immersed in said salt bath and is arranged at the bottom of the tank, so that its inlet is arranged at the intermediate portion in the same direction as the motion of the molten salts and its outlet is arranged proximate to the inlet part of the initial portion.

[0013] In this manner, by utilizing the turbine effect of the guiding wheel immersed in the salt bath, a certain quantity of molten salts passes through the submerged duct and is returned to the initial portion, dynamically compensating the difference in the level of the salt bath between the end part and the initial part of the oven caused by the entrainment effect of the electrical cable.

[0014] This type of oven solves effectively the problems related to known types of apparatus, in which a difference in the level of the bath of molten salts is produced between the inlet and outlet portions of the oven during the treatment of the cable; however, its structure is rather complicated.

[0015] The aim of the present invention is to solve or substantially reduce the problems of known types of apparatus for manufacturing electrical cables sheathed with silicone rubber and the like.

[0016] Within this aim, an object of the present invention is to provide an oven whose structure is such that the level of the salt bath is practically constant over the entire length of the oven.

[0017] Another object is to provide an apparatus that allows to increase production speed and capacity.

[0018] Another object is to provide an apparatus that as a whole is more efficient than known apparatuses and at the same time provides an energy saving.

[0019] Another object is to provide an apparatus that allows to save on logistic and personnel costs.

[0020] Another object is to provide an apparatus that optimizes the spaces occupied.

[0021] Another object is to provide an apparatus that has a simple structure and can be manufactured with equipment and technologies of a known type.

[0022] This aim and these and other objects that will become better apparent hereinafter are achieved by an apparatus particularly for manufacturing electrical cables with a sheathing made of silicone rubber and the like, characterized in that it comprises a catalysis oven, which in turn comprises a tank for containing molten salts, which has a predominantly longitudinal extension and has mutually opposite access openings; means for unwinding a conductor from a reel, means for extruding insulating material onto said conductor, means for tensioning the outgoing cable, and means for winding said cable on a reel being functionally arranged upstream and downstream of each one of said access openings in order to make two cables being treated slide with a longitudinal orientation and opposite directions.

[0023] Further characteristics and advantages of the invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limitative ex-

ample in the accompanying drawings, wherein:

Figure 1 is a schematic plan view of an apparatus according to the invention;

Figure 2 is an enlarged-scale view of a portion of the apparatus of Figure 1;

Figure 3 is a transverse sectional view of a component of the apparatus.

[0024] With reference to the figures, an apparatus particularly for manufacturing electrical cables with a sheathing made of silicone rubber and the like, according to the invention, is generally designated by the reference numeral 10.

[0025] The apparatus 10 comprises a catalysis oven 11, which has a predominantly longitudinal extension and has mutually opposite access openings that are described in detail hereinafter.

[0026] The apparatus further comprises means 12a and 12b for unwinding a conductor, made for example of copper, from a reel, means 13a and 13b for extruding insulating sheathing material, for example silicone rubber, onto said conductor, means 14a and 14b for tensioning the outgoing cable and means 15a and 15b for winding said cable onto a reel that are arranged functionally upstream and downstream of each one of the access openings, in order to make two cables 16 and 17 being treated slide with a longitudinal orientation and with opposite directions inside the oven 11.

[0027] The unwinding means 12a and 12b, the extrusion means 13a and 13b, the tensioning means 14a and 14b and the winding means 15a and 15b are shown schematically, since they are of a kind that is already known in the background art.

[0028] The catalysis oven 11 comprises a tank for containing molten salts, which in turn comprises a central portion 18, which has a rectilinear longitudinal extension and inside which the cables 16 and 17 being treated are substantially parallel, and mutually opposite end portions 19 and 20, which form the access openings and inside which respective inlet portions 16a and 17a and outlet portions 16b and 17b of the two cables 16 and 17 being treated slide, as shown in Figures 1 and 2.

[0029] Inside the oven 11 there are also pulleys, not illustrated for the sake of simplicity, for guiding the cables 16 and 17.

[0030] The end portions 19 and 20 respectively comprise a first rectilinear portion 19a and 20a for the entry of the cables 16 and 17 being treated, which is aligned with the central portion 18 of the tank, and a second portion 19b and 20b for the exit of the cables 17 and 16 being treated, which is inclined with respect to the direction of longitudinal extension of the corresponding first portion 19a and 20a.

[0031] Each one of the end portions 19 and 20 supports, with a rotary coupling, a corresponding pulley 21a and 21b for guiding the cables 16 and 17 being treated from the direction of the rectilinear extension of the central portion 18 to the direction of the longitudinal extension of the corresponding second portion 19b and 20b.

[0032] The second portion 19b and 20b is inclined with respect to the direction of the longitudinal extension of the corresponding first portion 19a and 20a substantially by an angle of 30 sexagesimal degrees.

[0033] The apparatus 10 further comprises, downstream of each second portion 19b and 20b, on a corresponding supporting structure 22a and 22b, a wheel 23a and 23b for guiding the corresponding outgoing cable 16 and 17, within the longitudinal dimensions of the oven 11, toward the tensioning means 14a and 14b and the winding means 15a and 15b in a direction that is substantially parallel to the central portion 18.

[0034] Advantageously, the tensioning means 14a and 14b and the winding means 15a and 15b are arranged within the longitudinal dimensions of the oven 11.

[0035] The apparatus 10 further comprises cleaning and drying means 24a and 24b of a per se known type for the outgoing cable 16 and 17; such means are arranged on the corresponding supporting structures 22a and 22b, downstream of the second portion 19b and 20b, and upstream of the guiding wheel 25a and 25b.

[0036] Downstream of the guiding wheels 23a and 23b there are, in succession, marking means 25a and 25b and talc application means 26a and 26b for marking and applying talc to the corresponding cables 16 and 17 before they pass through the tensioning means 14a and 14b and the winding means 15a and 15b.

[0037] Advantageously, in order to minimize space occupation, as shown in Figure 1, the end portions 19 and 20 are mutually opposite with respect to the transverse and longitudinal planes of the central portion 18; in this manner, the longitudinal dimensions of the apparatus 10 are determined solely by the oven 11, by the unwinding means 12a and 12b and by the extrusion means 13a and 13b.

[0038] As regards operation, the electrical cables 16 and 17 being treated, constituted by a conductor sheathed with insulating material made of activated silicone rubber, enter the oven 11 respectively at the end portions 19 and 20, and exit from it respectively from the end portions 20 and 19.

[0039] By way of the parallel motion, in opposite directions, of the cables 16 and 17 being treated, it is possible to utilize the entire length of the oven 11, since a dynamic compensation of the difference in level of the molten salt bath is achieved, such bath therefore having a uniform level.

[0040] The apparatus 10 is capable of treating cable pairs having the same diameter or different diameters.

[0041] Whereas in the case of the production of a pair of cables having the same diameter the cables must in fact advance at a speed whose modulus is identical, if it is necessary to provide pairs of cables having mutually different diameters it is possible to make the cable having the larger diameter advance at a lower speed than

the cable having a smaller diameter; in this manner, one still has a uniform level of the bath of molten salts.

[0042] Moreover, the apparatus 10 can be associated with a safety device that is capable of interrupting its operation if one of the two cables breaks.

[0043] In practice it has been found that the present invention has achieved the intended aim and objects.

[0044] An apparatus has in fact been provided which allows to compensate for the reduction in the level of the bath of molten salts, allowing to utilize the catalysis oven along its entire length.

[0045] The apparatus allows to increase production capacity, which is practically twice that of a conventional apparatus with a catalysis oven of the same length, doubling the work space and reducing the logistic and personnel costs.

[0046] One obtains a finished product of better quality and a simultaneous energy saving.

[0047] Finally, the apparatus has a simple structure.

[0048] The present invention is susceptible of numerous modification and variations, all of which are within the scope of the appended claims.

[0049] The technical details may be replaced with other technically equivalent elements.

[0050] The materials, so long as they are compatible with the contingent use, as well as the dimensions, may be any according to requirements.

[0051] The disclosures in Italian Patent Application No. PD2002A000118 from which this application claims priority are incorporated herein by reference.

[0052] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. An apparatus particularly for manufacturing electrical cables with a sheathing made of silicone rubber and the like, **characterized in that** it comprises a catalysis oven (11), which in turn comprises a tank for containing molten salts, which has a predominantly longitudinal extension and has mutually opposite access openings; means (12a, 12b) for unwinding a conductor from a reel, means (13a, 13b) for extruding insulating material onto said conductor, means (14a, 14b) for tensioning the outgoing cable, and means (15a, 15b) for winding said cable on a reel being functionally arranged upstream and downstream of each one of said access openings in order to make two cables (16, 17) being treated slide with a longitudinal orientation and in opposite directions.

2. The apparatus according to claim 1, **characterized in that** said tank for containing molten salts comprises a central portion (18), which has a rectilinear longitudinal extension and inside which the two cables (16, 17) being treated are substantially parallel, and end portions (19,20), which are mutually opposite, form said access openings, and within which respective incoming portions (16a, 17a) and outgoing portions (16b, 17b) of said two cables being treated (16, 17) slide.

3. The apparatus according to claim 2, **characterized in that** each one of said end portions (19,20) comprises a first straight portion (19a, 20a) for the entry of one (16,17) of said cables being treated, which is aligned with said central portion (18) of the tank, and a second portion (19b,20b) for the exit of the other one (17,16) of said cables being treated, which is inclined with respect to the direction of the longitudinal extension of said first portion (19a,20a).

4. The apparatus according to claim 3, **characterized in that** each one of said end portions (19, 20) is provided with a corresponding rotatably coupled pulley (21a, 21b) for guiding the cable being treated (16, 17) from the direction of the longitudinal extension of said central portion (18) to the direction of the longitudinal extension of the corresponding second portion (19b, 20b).

5. The apparatus according to claims 3 and 4, **characterized in that** said second portion (19b, 20b) is inclined with respect to the direction of the longitudinal extension of the corresponding first portion (19a, 20a) by an angle of less than 90 sexagesimal degrees.

6. The apparatus according to claim 5, **characterized in that** said second portion (19b, 20b) is inclined with respect to the direction of the longitudinal extension of the corresponding first portion (19a, 20a) substantially by an angle of 30 sexagesimal degrees.

7. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises, downstream of each second portion (19b, 20b), on a corresponding supporting structure (22a, 22b), a wheel (23a, 23b) for guiding a corresponding outgoing cable (16, 17), within the longitudinal dimensions of said oven (11), toward said tensioning means (14a, 14b) and winding means (15a, 15b).

8. The apparatus according to claim 7, **characterized in that** said wheel (23a, 23b) guides the corresponding cable (16, 17) in output from said second portion (19b,20b) in a direction that is substantially parallel to said central portion (18).

9. The apparatus according to one or more of the preceding claims, **characterized in that** said tensioning means (14a, 14b) and said winding means (15a, 15b) are arranged within the longitudinal dimensions of said oven (11).

10. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises corresponding means (24a, 24b) for cleaning and drying the outgoing cable (16, 17) which are arranged downstream of each second portion (19b, 20b).

11. The apparatus according to one or more of the preceding claims, **characterized in that** said cleaning and drying means (24a, 24b) are arranged on said supporting structure (22a, 22b) downstream of said second portion (19b, 20b) and upstream of said guiding wheel (25a, 25b).

12. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises, downstream of said guiding wheel (23a, 23b) and upstream of said winding means (15a, 15b), means (25a, 25b) for marking the outgoing cable (16, 17).

13. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises, downstream of said guiding wheel (23a, 23b) and upstream of said winding means (15a, 15b), means (26a, 26b) for applying talc to the outgoing cable (16, 17).

14. The apparatus according to one or more of the preceding claims, **characterized in that** said marking means (25a, 25b), said talc application means (26a, 26b), said tensioning means (14a, 14b) and said winding means (15a, 15b) of the cable are arranged in succession downstream of said guiding wheel (23a, 23b).

15. The apparatus according to one or more of the preceding claims, **characterized in that** said end portions (19, 20) are mutually opposite with respect to the transverse and longitudinal planes of said central portion (18).

16. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises pulleys for guiding said cables being treated (16, 17), said pulleys being arranged inside said oven (11).

17. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises a safety device for interrupting its operation if one of said cables being treated (16, 17) breaks.

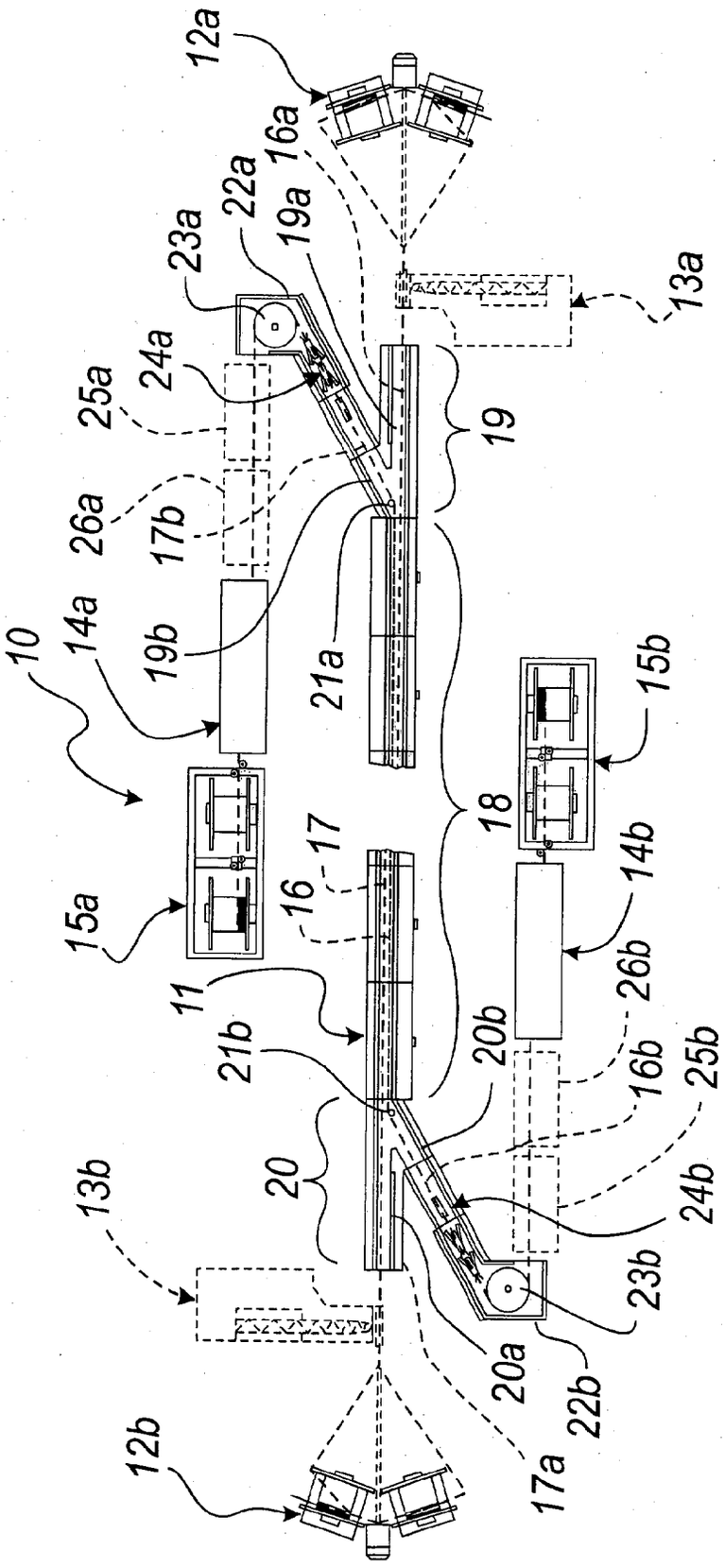
12a
16a
22a
19a
23a
13a
24a
25a
19
26a
17b
14a
10
19b
21a
15b
18
15a
17
16
14b
11
26b
21b
20b
16b
25b
13b
20
24b
23b
20a
22b
12b
17a

Fig. 1

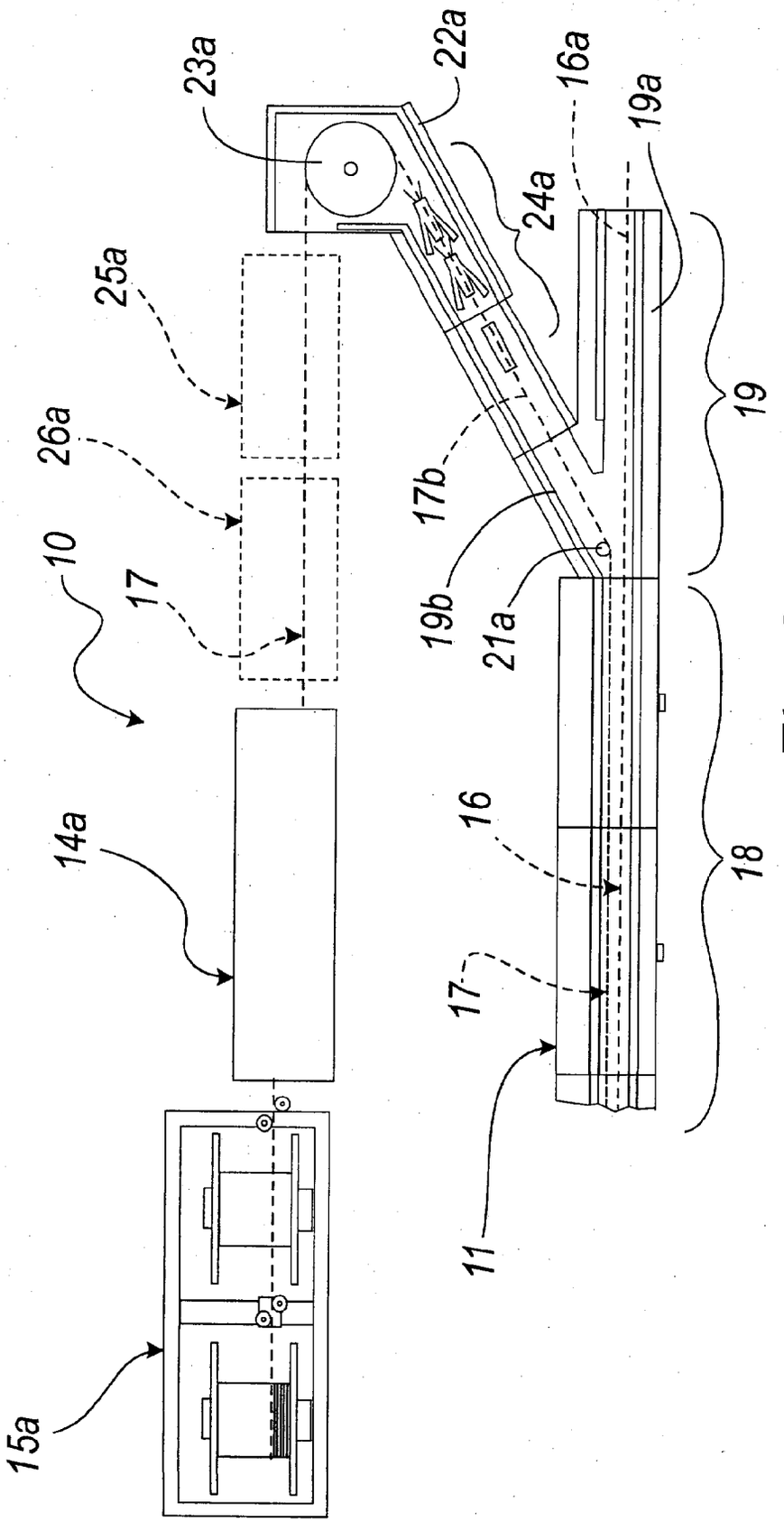
23a
22a
16a
19a
24a
25a
26a
10
17
17b
19b
21a
19
14a
16
18
17
15a
11

Fig. 2

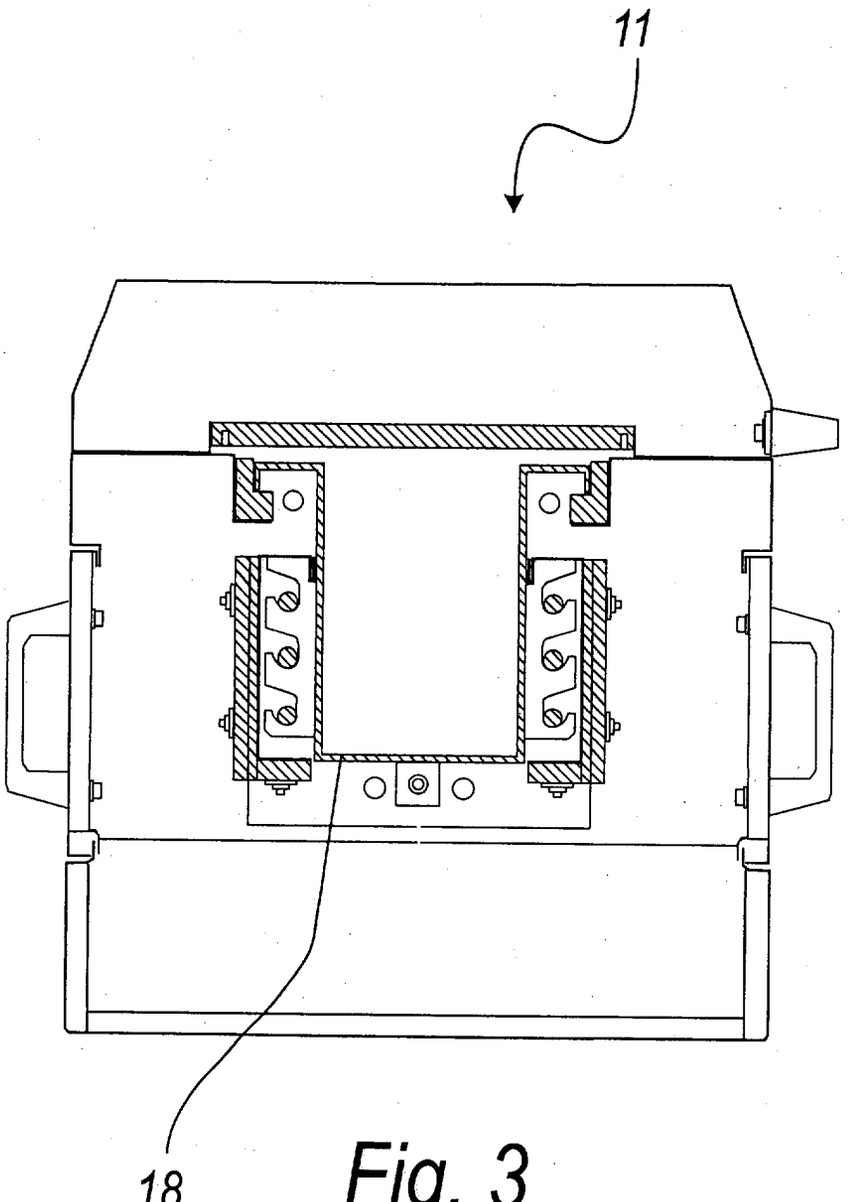

Fig. 3