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(54) Method and apparatus for coiling pile weatherstrip on a reel.

(57) Two methods and apparatus for coiling pile weatherstrip (9) on a reel (1 or 2) are disclosed, so that the weatherstrip is fed to the reel under little or no tension, so that the pile is not crushed when on the reel. The weatherstrip (9) is advanced either by means of a pair of nip rollers (31,33) or by a smooth surfaced capstan (53) around which there are several turns of weatherstrip, and it is then placed on the rotating reel (1 or 2) by a head (10) on the end of an arm which can move in two different planes to place the weatherstrip in parallel adjacent rows and concentric layers on the reel (1 or 2). The capstan is rotated at a constant speed which is such that weatherstrip is fed therefrom at a rate which is never less than the speed with which the weatherstrp passing through the head (10) is placed on the reel (2), whereas the nip rollers (31,33) have their speed controlled by a tension sensing control roller (37) mounted on an arm (41) connected to a rotary roller speed control device (43). This ensures that the weatherstrip is never placed on the reel (1 or 2) under tension.

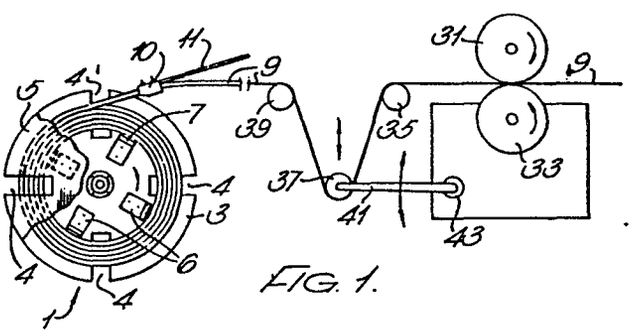

FIG. 1.

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METHOD AND APPARATUS FOR COILING PILE WEATHERSTRIP ON A REEL

The present invention relates to a method and apparatus for coiling pile weatherstrip or like crushable elongate material (hereinafter called weatherstrip), and more especially pile weatherstrip with a central barrier fin such as our FIN-SEAL weatherstrip, on a reel. The invention is particularly suitable for coiling pile weatherstrip which has a central barrier fin which projects beyond the sealing surface of the pile. We market such weatherstrip as HI-FIN weatherstrip.

In the past, such weatherstrip has been coiled in traditional fashion on a reel, in the same manner as wire, and has been wound upon itself under tension. This means that once coiled, the weatherstrip in the coil is under compression. This is satisfactory for some weatherstrip, but with pile weatherstrip, there is a tendency for the weatherstrip to be wound so tight that the pile is crushed. This can have an adverse effect on the performance of the weatherstrip. The damage to the weatherstrip is even worse when a barrier fin is provided, especially if it upstands from the pile, because the barrier fin will be crushed, and more often than not, will be laid over the pile, sometimes one way and sometimes the other, so that when the weatherstrip is removed from the reel for installation in a window or door, the fin will be laid over the pile in random fashion to the left and right, and may not upstand from the pile at all. As a result, the fin, instead of enhancing the sealing and other performance properties of the weatherstrip, will have an adverse effect.

The present invention seeks to overcome the problems associated with the traditional coiling of weatherstrip on reels.

According to the present invention, we provide apparatus for coiling pile weatherstrip or like crushable elongate material, comrpising a reel on which the weatherstrip is to be wound, means for placing the weatherstrip on the reel in parallel adjacent rows and in concentric layers, means for rotating the reel so that the weatherstrip is coiled thereon, and means for advancing the weatherstrip to the reel at a sufficient speed so that the weatherstrip is under substantially no tension when it is placed on the reel.

The means for advancing the weatherstrip may comprise a capstan around which several turns of weatherstrip are wound, the capstan being rotated at such a speed relative to the speed of rotation of the reel that the weatherstrip is wound onto the reel at a tangential speed which is less than the tangential speed of the surface of the capstan and the capstan having a surface which is sufficiently smooth so as to allow the turns of weatherstrip thereon to slip so that at all times during placing of the weatherstrip on the reel, there is slippage at the capstan.

Alternatively, the means for advancing the weatherstrip may comprise a pair of co-operating contra-rotating rollers between the nip of which the weatherstrip is advanced, in which case, a speed control is provided for the rollers, and a sensing device connected to the speed control to sense any change in tension in the weatherstrip as it is placed on the reel to enable the speed of rotation of the rollers to reach such a speed that the weatherstrip is not placed on the reel under tension. The sensing device therefore forms part of a "feed-back" mechanism to enable the correct speed of rotation of the rollers to be achieved.

The means for placing the weatherstrip on the reel may comprise a feeder arm having a head with a T-shaped slot therein which moves radially outwards for each layer so as not to tension the weatherstrip

and lay it loosely on the reel, and which moves from side to side axially of the reel to lay the weatherstrip on the reel. This arm may lay the weatherstrip, especially if it incorporates a barrier fin, in position with the pile facing inwards. Radial movement of the head, as well as its side to side movement, is controlled by a commercially available traverse unit.

Also according to the present invention, we provide a method for coiling weatherstrip on a reel comprising advancing weatherstrip under substantially no tension to the reel, rotating the reel, and placing the weatherstrip on the reel under substantially no tension in parallel adjacent rows and in concentric layers.

Preferably, the method includes the further step of securing the weatherstrip temporarily so that the weatherstrip will not uncoil by itself. Alternatively, it may be secured with one or more bands, and then be removed from the reel by separating the reel into two or more parts.

Preferably, the weatherstrip is placed on the reel with an arm which is movable towards and away from a central rotational axis of the reel and to and fro parallel to said axis so that each layer of weatherstrip on the reel is laid gently onto the reel or a preceding layer under little or no compression, in parallel rows and concentric layers, using a traverse unit.

The weatherstrip may be wound on the reel with its pile facing outwards or inwards. The latter method is particularly advantageous when a barrier fin is associated with the pile, because when the weatherstrip is coiled, the tip of the fin will lie on a circle of smaller diameter than the base of the fin, thus causing the free edge or tip to corrugate slightly. This then supports the next outer layer of weatherstrip and acts as a cushion for it. This means that the resultant coil of weatherstrip has a resiliently

deformable support built into it which means that the whole coil is less likely to be damaged during transit, and is itself self supporting and resiliently deformable.

The weatherstrip may be advanced to the reel by means of a capstan rotating at a constant speed, or by means of a pair of contra-rotating rollers, between the nip thereof, the speed of which is controlled to ensure that the weatherstrip as it is placed on the reel is under substantially no tension.

Two embodiments of the invention are now described by way of example with reference to the accompanying schematic drawings, in which:-

FIGURE 1 is a partly schematic, side elevation view of one embodiment of apparatus for feeding weatherstrip to a reel, with a coil of weatherstrip partly formed on the reel;

FIGURE 2 is a perspective view of a second embodiment of apparatus for coiling pile weatherstrip, and

FIGURES 3 and 4 are respectively an end and a section on line IV-IV of Figure 3 of a dispenser head for laying the weatherstrip on the reel of either embodiment.

Referring first to Figure 1 of the drawings, a reel 1 is shown, made up of two spaced side walls 3,5, each in the form of a circular plate, having a plurality of recesses 4 therein, extending from the periphery of the plate towards the centre. As shown, four recesses 4 are provided in each plate, at 90° spacings. On each plate, between each recess 4, a projection (shown at 7) provided by one arm of an L-shaped bracket (shown at 6) is provided, the other arm of each bracket being secured to the side wall plate 3 or 5 in known manner, spaced approximately 30° from its respective recess 4. Thus, when the two side wall plates are assembled in parallel spaced relationship, as shown with the recesses in one plate opposite those

in the other plate, there will be two projections extending between each adjacent pair of recesses, one projecting from the side wall plate 3 and the other from the side wall plate 5, one spaced about 30° and the other about 60° from each recess 4. As is described in greater detail in the specification of U.K. Patent Application No.8421448, the projections lie on a circle, the radius of which is greater than that on which the bases of the recesses 4 lie. It will thus be appreciated that the eight projections provide a central, generally circular, core for the reel with a discontinuous circumference on which weatherstrip 9 is to be coiled.

The weatherstrip 9 is dispensed from a feeder arm 20 which is shown in more detail in Figures 3 and 4 to which reference is now also made. The feeder arm 20 comprises a dispensing head 10 having a holder 21 with a T-shaped slot therein, which is supported on an arm 11. The holder 21 is supported on bolts 22 passing through the top of the head 10. The position of the holder 21 in the head 10 can be varied by screwing up or unscrewing nuts 23 to accommodate weatherstrips of different heights. The holder 21 is held in position by coil springs 24 encircling the bolts 22 and located between the holder 21 and the top of the head 10. If desired, the slot 21 may be changed to accommodate weatherstrips of different widths by unscrewing completely the nuts 23 and inserting a new holder.

The head 10 is movable towards and away from a rotational axis 13 of the reel, and is also movable to and fro across the width of the reel between the side walls so as to lay weatherstrip in place. The mechanism for moving the head may be as shown in Figure 2. By moving the arm outwardly away from axis 13 as each layer of weatherstrip is placed onto the reel, the weatherstrip is coiled under minimum compression so as not to crush the weatherstrip. It is preferred that the weatherstrip is guided as shown in Figure 3

by the T-shaped slot in the holder 21 in the head 10 with its pile facing outwards. However, if the pile incorporates a barrier fin, it is almost impossible to coil such weatherstrip with its barrier fin facing outwards, because the barrer fin acts as a flange on a T-beam, so the head 10 would have to be reversed, so that the fin faces inwards; its free edge can then collapse by zig-zagging or corrugating (it will lie on a circumference of smaller radius than the base strip of the weatherstrip). In the finished coil, this corrugated fin supports the next layer of weatherstrip, and provides a cushion effect, thus improving the durability of the coil and giving it a resilience which improves its recovery characteristics during transport. The reel is rotated, as shown, in the direction of the arrow B, at a constant speed.

The weatherstrip 9 is fed to the reel through the nip of a pair of contra-rotating rollers 31,33 which urge the weatherstrip forward at a speed substantially equal to the tangential speed with which the weatherstrip 9 is placed on the reel by the head 10. As the size of the coil grows, the linear speed of the weatherstrip being placed on the reel will increase, thus tending to create tension in the weatherstrip being advanced by the rollers 31,33. To prevent such tension building up, the weatherstrip is entrained over an idler roller 35, under a speed control roller 37 and over another idler roller 39. The speed control roller 37 is supported on a lever 41 fixed to a rotary speed control device 43. Any tendency to tension in the weatherstrip will cause the roller to move upwards to swing the lever 41, and hence device 43, clockwise. This will have the effect of speeding up the speed of rotation of rollers 31,33 to keep the weatherstrip under little or no tension as it is being placed on the reel. Obviously, if the roller is allowed to move downwards too far, due to the rollers advancing the strip too quickly, this will activate

the speed control to slow down the rollers until the correct "equilibrium" speed is reached.

Once the coil of weatherstrip has been built up as required, the apparatus is stopped and one or more bands 15 (four, one for each recess, are preferred) of tape, wire, string or the like are wrapped around the coil to hold it in place, and the weatherstrip can then be severed from that on the supply arm 11. Ideally, the bands 15 are formed of tape on which a trade mark or brand name can be printed. The provision of the discontinuous core, and the recesses 4 providing a discontinuous periphery for the side walls 3 and 5, allows the band 15 easily to be placed in position.

After the coil has been secured, the side walls 3 and 5 are separated from each other. This can be achieved by first releasing or removing quick release fittings or nuts and bolts (not shown) or preferably a single screw spindle 17. The banded coil can then be removed from the reel, the reel re-assembled, and the apparatus is then ready for another coil to be formed.

In the apparatus shown in Figure 2, the weatherstrip 9 is entrained around guide and counter pulleys 51, and is then wound with several turns around a capstan 53 rotating preferably at a constant speed (e.g. 1200 rpm) and between associated guide bars. It is then fed through a guide to a head 10 on the end of arm 11, as in the previous embodiment, which places the weatherstrip on a standard reel 2 rotating at a fixed speed, this time with the pile facing radially outwards (there is no barrier fin in the weatherstrip) which means the head 10 is the other way up from the Figure 1 arrangement. In this construction, the rotational speed of the capstan 53 is always such that there is a tendency for weatherstrip to be fed from it at a speed greater than the speed at which weatherstrip is wound onto the reel 2. Accordingly, the tangential

speed at the surface of the capstan 53 is faster than the speed at which the weatherstrip 9 thereon is advanced, so that slippage is always occurring. The capstan 53 therefore has a polished surface, e.g. it may be chrome plated. Due to the slippage, it is ensured that the weatherstrip 9 is always placed on the reel 2 under substantially no tension, thus ensuring the pile is not crushed.

Once the coil is of sufficient size, the apparatus is stopped, and the weatherstrip 9 severed from the supply at the head 10, and the loose end is temporarily fixed so that the coil will not uncoil. The reel 2 is then removed from the apparatus, a new empty one put in place, and the apparatus is then ready for forming a new coil.

In both the constructions of Figure 1 and Figure 2, the movement of the arm 11 and hence the head 10 is controlled by a commercially available traverse unit, in which are incorporated control shafts, limit switches, etc. Some of the control shafts are illustrated in Figure 2, between the capstan 53 and reel 2; this unit is not shown in Figure 1.

The present invention also extends to a coil of pile weatherstrip wound by the methods and apparatus described above.

It will of course be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope and spirit of the invention.

CLAIMS:

1. Apparatus for coiling pile weatherstrip (9) or like crushable elongate material, comprising a reel (1 or 2) on which the weatherstrip (9) is to be wound, means (10,11) for placing the weatherstrip on the reel in parallel adjacent rows and in concentric layers, and means for rotating the reel (1 or 2) so that the weatherstrip (9) is coiled thereon, characterised in that means (31,33 or 53) are provided for advancing the weatherstrip (9) to the reel (1 or 2) at a sufficient speed so that the weatherstrip (9) is under substantially no tension when it is placed on the reel (1 or 2).

2. Apparatus according to claim 1 characterised in that said means for advancing the weatherstrip (9) comprises a capstan (53) around which several turns of weatherstrip (9) are wound, the capstan (53) being rotated at such a speed relative to the speed of rotation of the reel (2) that weatherstrip (9) is wound onto the reel (2) at a speed which is less than the tangential speed of the surface of the capstan (53), and the capstan (53) having a surface which is sufficiently smooth so as to allow the turns of weatherstrip (9) thereon to slip so that at all times during placing of the weatherstrip (9) on the reel(2), there is slippage at the capstan (53).

3. Apparatus according to claim 1 characterised in that the means for advancing the weatherstrip (9) comprises a pair of co-operating contra-rotating rollers (31,33) between the nip of which the weatherstrip (9) is advanced and wherein a speed control (43) is provided for the rollers (31,33) and a sensing device (37,41) is connected to the speed control (43) to sense any change in tension in the weatherstrip (9) as it is placed on the reel (1) to cause the rate of rotation of the rollers (31,33) to be increased or decreased accordingly.

4. Apparatus according to claim 1, 2 or 3 characterised in that the means for placing the weatherstrip (9) on the reel comprises a feeder arm (11) having a head (10) with a T-shaped slot (21) therein

which moves radially outwards for each layer so as not to tension the weatherstrip (9) and lay it loosely on the reel (1 or 2), and which moves from side to side axially of the reel (1 or 2) to lay the weatherstrip (9) on the reel (1 or 2).

5. Apparatus according to claim 4 characterised in that the arm (11) lays the weatherstrip in position with the pile facing inwards.

6. A method for coiling weatherstrip (9) on a reel (1 or 2) characterised by advancing the weatherstrip (9) under substantially no tension to the reel (1 or 2), rotating the reel (1 or 2) and placing the weatherstrip (9) on the reel (1 or 2) under substantially no tension in parallel adjacent rows and in concentric layers.

7. A method according to claim 6 characterised by the further step of securing the weatherstrip (9) temporarily so that the weatherstrip will not uncoil by itself.

8. A method according to claim 6 characterised by the further step of securing the weatherstrip (9) with one or more bands (15) and then removing the coil from the reel (1) by separating the reel (1) into two or more parts (3,5).

9. A method according to claim 6, 7 or 8 characterised in that the weatherstrip (9) is placed on the reel (1 or 2) with an arm (11) which is movable towards and away from a central rotational axis of the reel (1 or 2) and to and fro parallel to said axis so that each layer of weatherstrip on the reel (1 or 2) is laid gently onto the reel (1 or 2) or a preceding layer under little or no compression, in parallel rows and concentric layers.

10. A method according to any one of claims 6-9 characterised in that the weatherstrip (9) is advanced to the reel (2) by means of a capstan (53) rotating at a constant speed.

11. A method according to any one of claims

6-9 characterised in that the weatherstrip (9) is advanced to the reel (1) by means of a pair of contra-rotating rollers (31,33) between the nip thereof, the speed of which is controlled to ensure that the weather-strip (9) as it is placed on the reel is under substantially no tension.

12. A coil of weatherstrip when formed by the apparatus or methods disclosed herein.

13. A coil of weatherstrip or the like when made by the apparatus of claim 1 or the method of claim 6.

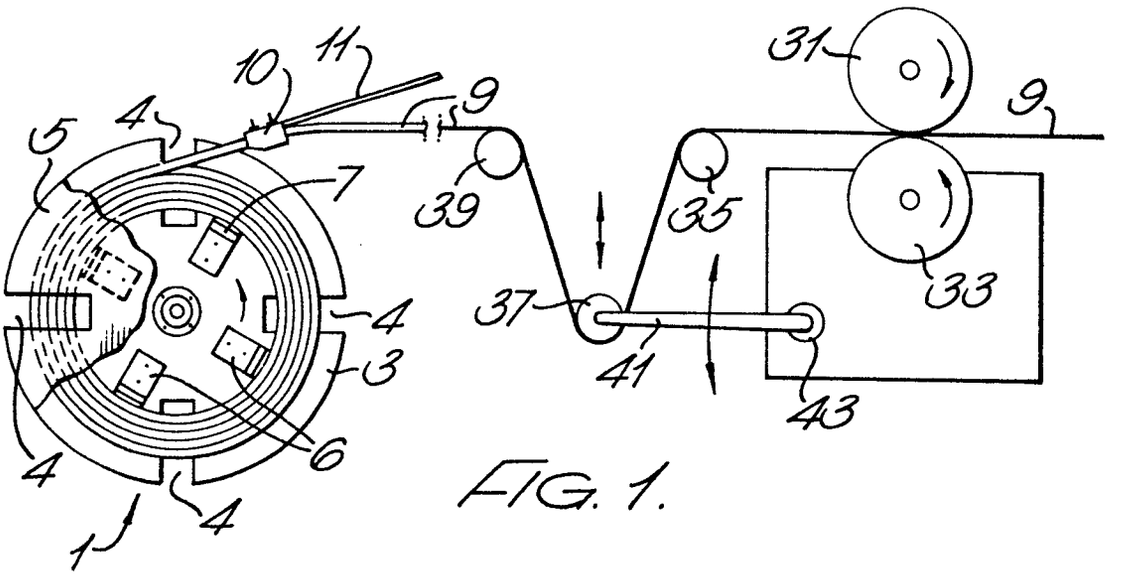

FIG. 1.

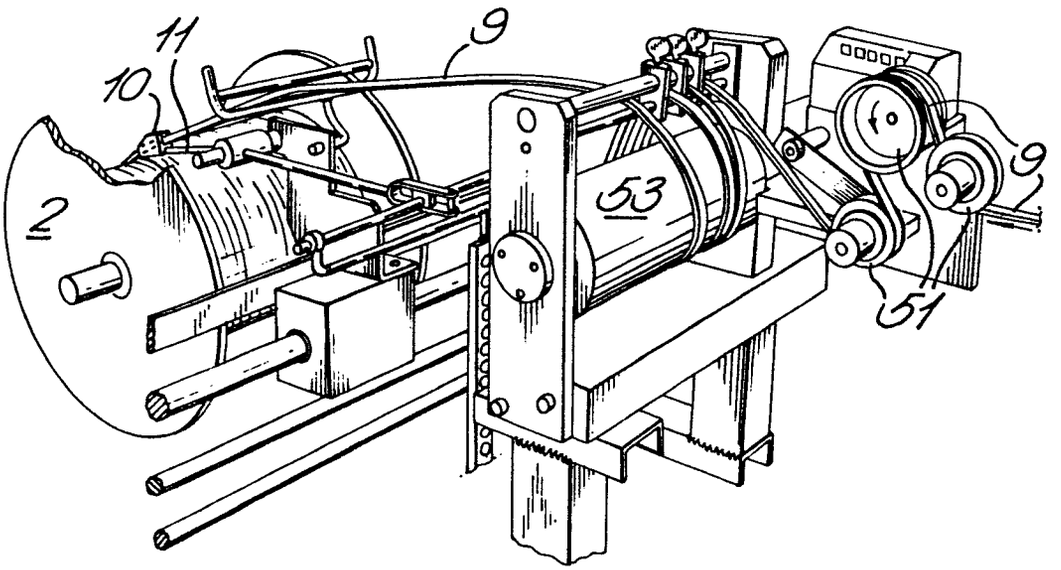

FIG. 2.

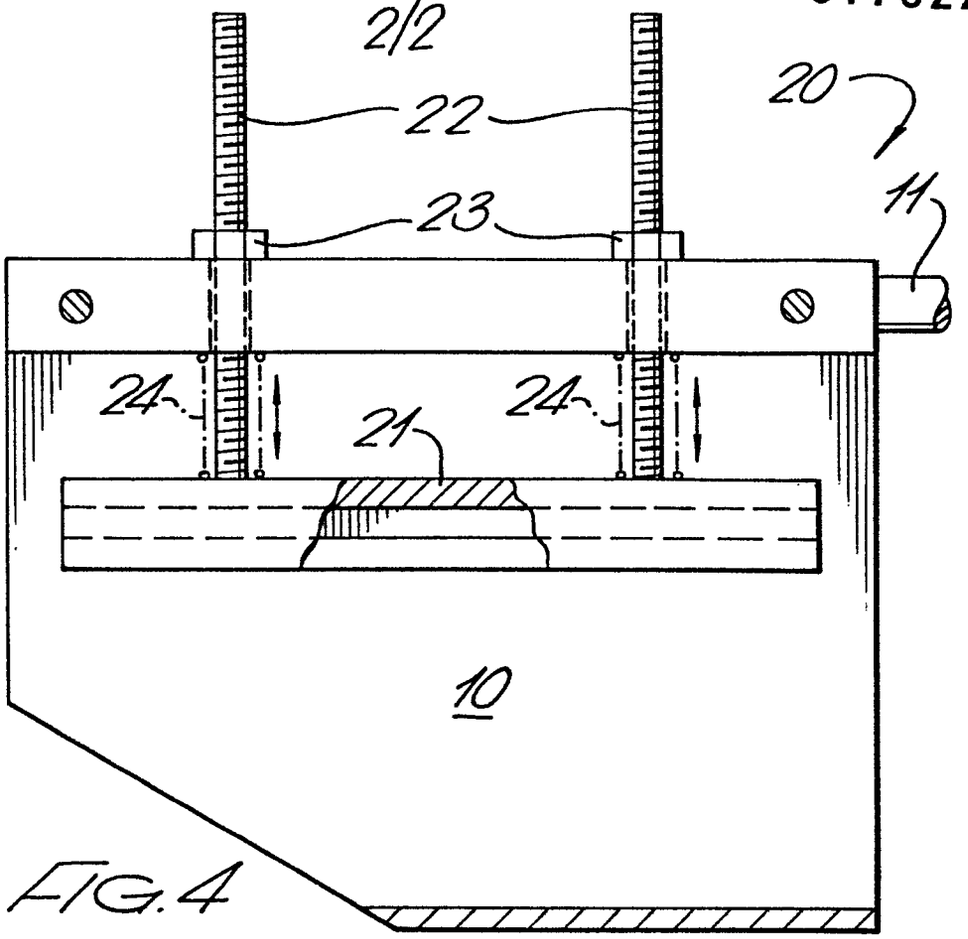

FIG. 4

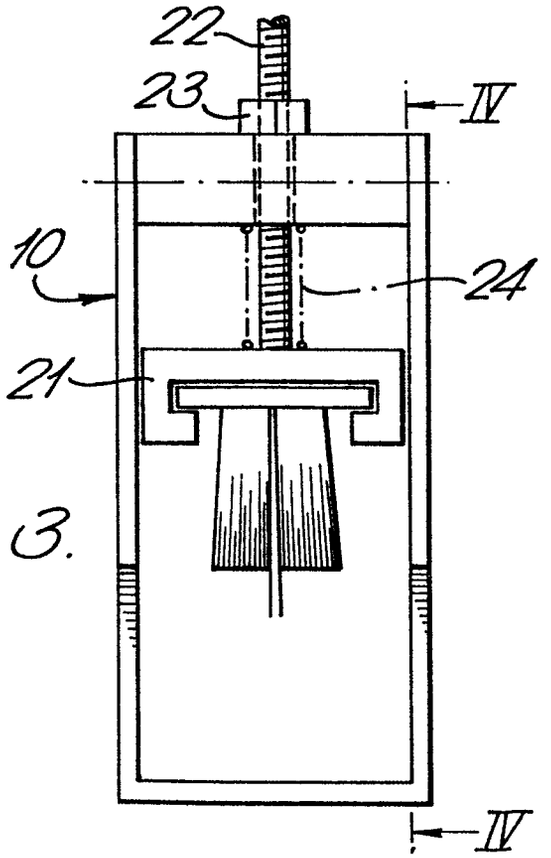

FIG. 3