

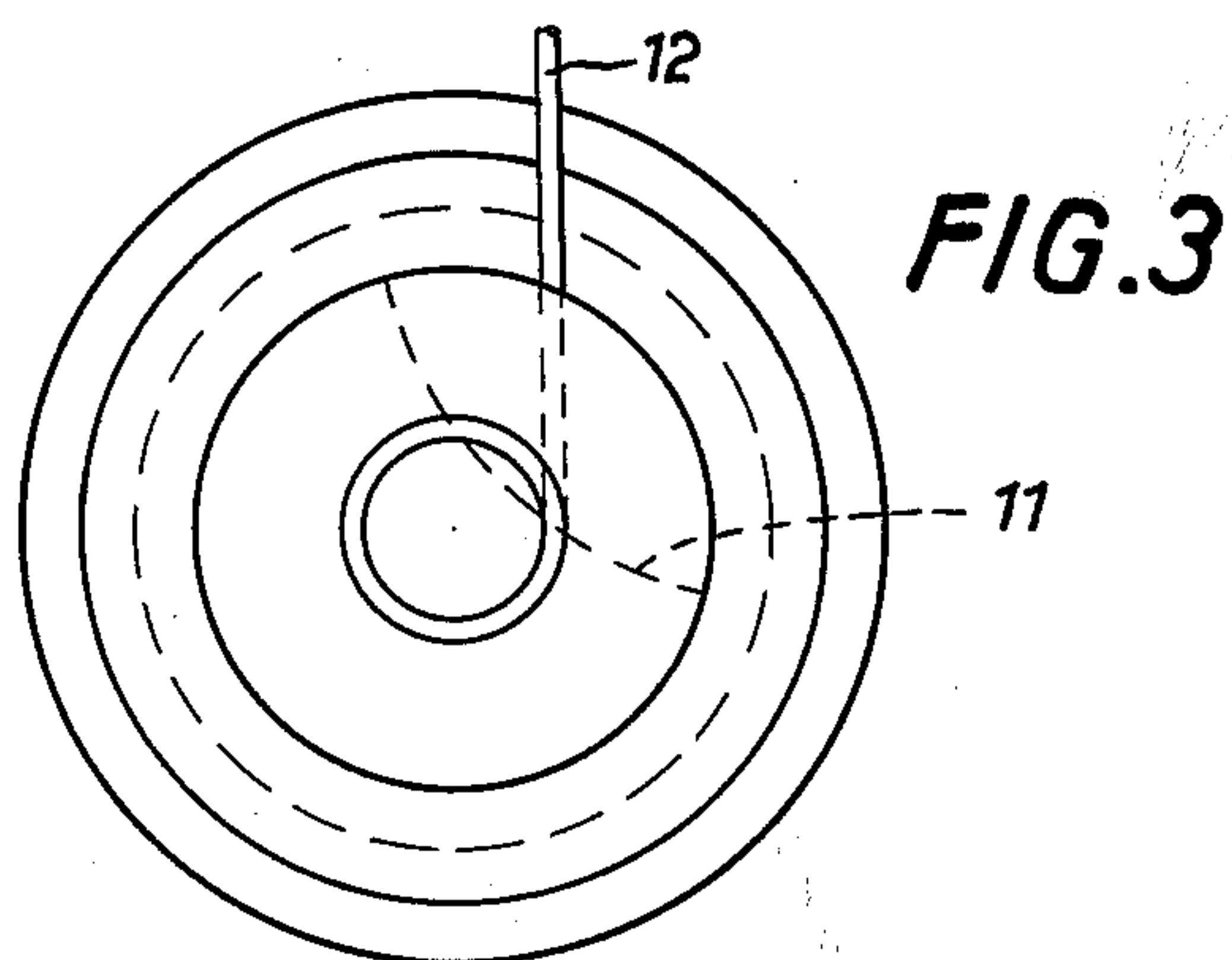
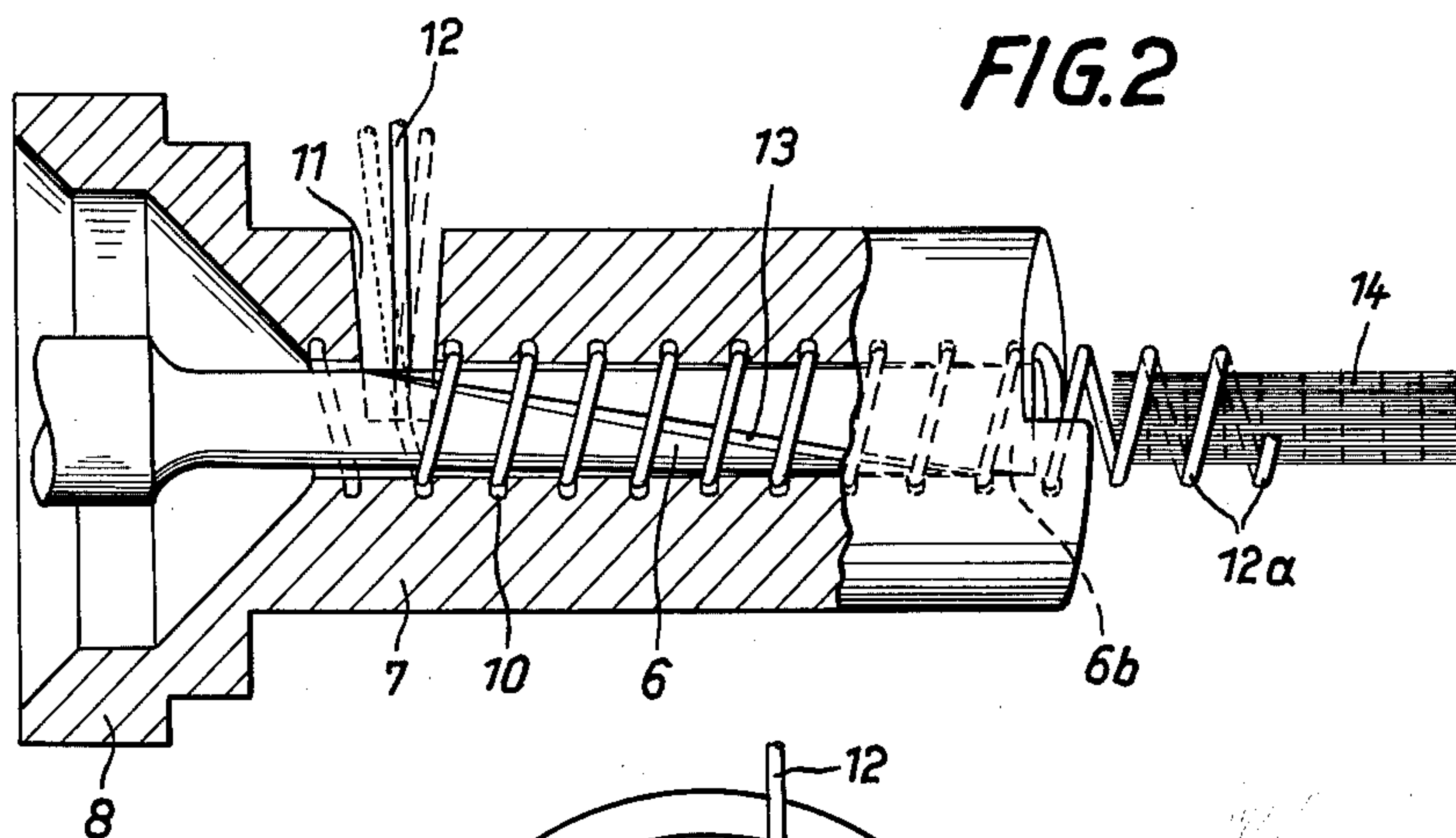
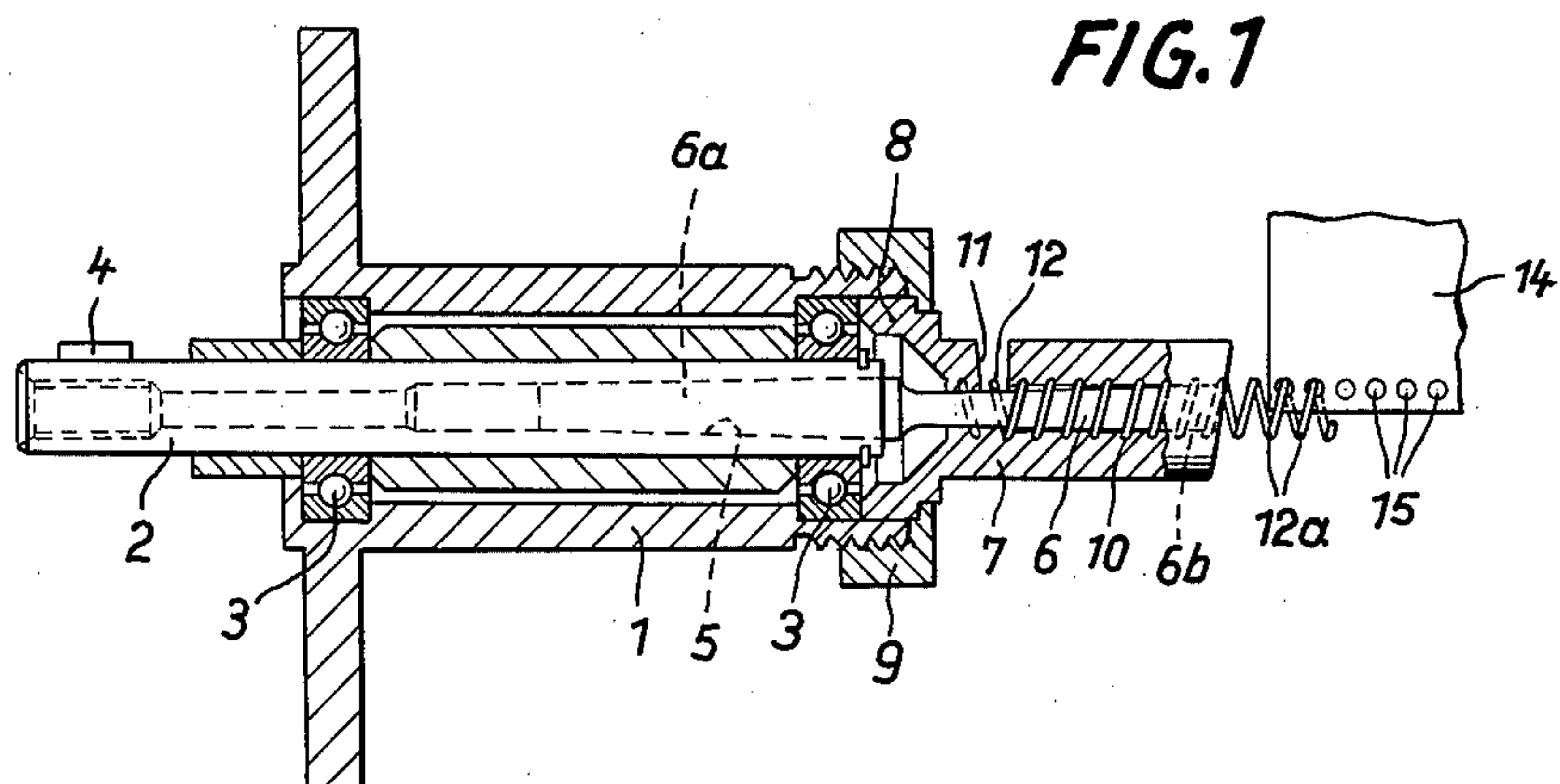
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APPARATUS FOR PRODUCING HELICAL COILS

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**APPARATUS FOR PRODUCING HELICAL COILS**  
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The present invention relates to an apparatus for producing helical coils of wire or other suitable materials, and more particularly for producing the type of coils as are used for binding together the sheets of writing pads, pamphlets, books, and the like by winding such a coil through a row of perforations along one edge of the sheets.

It is an object of the present invention to provide a very simple and inexpensive apparatus of the above-mentioned type which is very easy to manipulate and permits different kinds of wire to be wound with an accurately adjustable pitch. This object is attained essentially by winding the wire on a mandrel and by making such a mandrel of a conically diverging shape at least near the free end thereof from which the wire coil emerges.

This as well as other objects, features, and advantages of the present invention will become further apparent from the following detailed description thereof, particularly when read with reference to the accompanying drawings, in which—

FIGURE 1 shows a top plan view of the apparatus according to the invention;

FIGURE 2 shows an enlarged vertical longitudinal section of a part of the apparatus shown in FIGURE 1; while

FIGURE 3 shows an end view as seen from the right side of FIGURE 2.

Referring to the drawings, the apparatus according to the invention consists of a stationary housing 1 in which a shaft 2 is mounted on ball bearings 3 and prevented by conventional means from shifting in its axial direction. Shaft 2 which may be driven through a key 4 by any suitable driving means, not shown, has a conical bore 5 into which the conical end 6a of a mandrel 6 may be inserted so as to be easily removable therefrom for a replacement by a mandrel of a different size.

Over the mandrel 6 a tubular jacket 7 is mounted which has at one end a flange 8 which is removably secured to housing 1 by a coupling nut 9. This jacket 7 has a central longitudinal bore of a diameter substantially in accordance with the respective mandrel 6 which is being used, and into the wall of this bore a helical groove 10 is cut, the pitch of which substantially corresponds to the desired pitch of the coil to be produced. Near the inner end of mandrel 6, jacket 7 is provided with a notch 11 which extends transverse to its axis and through which the wire 12 to be wound on mandrel 6 may be fed into groove 10 which is adapted to guide the wire on mandrel 6 during the coil winding operation.

Mandrel 6 has a longitudinal groove 13 cut into its outer surface. This groove 13 preferably turns about the axis of mandrel 6 in a direction opposite to the direction of groove 10 in jacket 7 and it serves for inserting therein the angularly bent front end of wire 12, provided that groove 10 does not already contain a wire.

Mandrel 6 is conically increased in thickness toward its outer end either along its entire length or at least along its outer end portion 6b. When the wire 12 is wound upon mandrel 6, a small amount of play in the radial direction remains at the outer end 6b of the mandrel between the wire and the bottom of groove 10. Jacket 7 extends beyond the outer end 6b of mandrel 6.

The operation of the apparatus is as follows: After the

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end of wire 12 has been inserted through notch 11 on jacket 7 into the longitudinal groove 13 of mandrel 6, the mandrel is turned by means of shaft 2. Wire 12 will then be wound upon mandrel 6 to form a coil 12a, and the wire is thereby drawn into the guide groove 10 of jacket 7 and slides therein toward the right end thereof. During this helical movement of the wire coil 12a along guide groove 10 of the stationary jacket 7, this coil also shifts along the rotating mandrel 6 toward the outer end thereof, and the angularly bent front end of wire 12 then slides along the longitudinal groove 13 of mandrel 6 until it emerges from the end of jacket 7 and may then be cut off. Since the longitudinal groove 13 of mandrel 6 turns in the direction opposite to the direction of the guide groove 10 in jacket 7, the front end of the wire coil 12a will be turned relative to mandrel 6 in a direction opposite to the direction of rotation of the coil itself. This results in a slight increase in the diameter of coil 12a which facilitates the longitudinal movement of the coil along mandrel 6 since it prevents the coil from tightening and binding on mandrel 6. During this procedure, wire coil 12a engages with the rear side wall of guide groove 10 in jacket 7 and, while passing along the guide groove, it is being pushed thereby toward the outer end of jacket 7.

After due to the rotation of mandrel 6 the wire coil 12a has been formed along the mandrel to the outer end thereof and the bent front end of wire 12 then slides out of the front end of the longitudinal groove 13 of the mandrel, the wire coil will no longer be taken along due to the fact that the outer end portion 6b of mandrel 6 is conically enlarged. The wire coil 12a thereby engages along this outer end portion 6b of mandrel 6 for such a distance and under such a tension that the friction produced thereby will be greater than the other forces occurring, especially those of feeding the wire to the apparatus, the resistance of the wire against its deformation into a wire coil, the friction of the wire coil along the guide groove 10 and along mandrel 6, and those forces which are required during the subsequent use of the wire coil, for example, for binding together the sheets of a writing pad, pamphlet, or book.

For determining the degree of taper of the conical enlargement of mandrel 6, it must be considered that, when the wire coil 12a is no longer rotated, for example, when the apparatus is stopped, it will recoil to a certain extent and thereby increase in diameter. In order to restart the apparatus without difficulty after the coil winding operation has been interrupted, it is advisable to increase the diameter of the outer end 6b of mandrel 6 relative to the diameter of the inner end adjacent to the feed slot 11 so as to exceed the diameter of wire coil 12a when it is in the recoiled position.

The apparatus according to the invention is especially adapted for binding together the sheets of writing pads, pamphlets, books, or the like so as to permit them to be easily turned. FIGURE 2 illustrates, for example, a stack of sheets which are provided along one edge with a row of perforations 15. The rotating wire coil 12a emerging from jacket 7 will wind directly through the perforations 15, although suitable guide means, not shown, may be provided to insure the penetration of the front end of the wire into the successive perforations 15.

For guiding the emerging wire coil 12a, it is also possible to extend the length of jacket 7 beyond the outer end 6b of mandrel 6.

In order to compensate for inaccuracies and deviations in the resilient properties of wire 12 which may affect the pitch of the wire coil when it recoils and expands after emerging from the apparatus, the invention further provides the feeding angle at which wire 12 is inserted



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relative to the axis of the wire coil to be adjustable. In FIGURE 2, the normal feeding direction of wire 12 into the apparatus is illustrated in solid lines, while for changing the pitch of wire coil 12a, the feeding direction may be changed toward one side or the other, as indicated in dotted lines and dash lines, respectively, by means of any suitable kind of guiding means, not shown.

If during the insertion of wire coil 12a into the perforations 15 of the stack of sheets 14 an interference occurs in that, for example, the front end of the wire hits upon an obstruction, it is desirable to interrupt the further feeding movement of the wire coil immediately so as to prevent the occurrence of any damages due to a wrongly guided wire coil. For this purpose, the invention further provides that the guide groove 10 in jacket 7 affords a small amount of radial play of wire coil 12a which during the normal operation engages firmly with mandrel 6.

If the front end of the wire coil then hits against an obstruction, the coil will slightly recoil and thereby increase in diameter and separate from mandrel 6 so that the latter will no longer take along the wire even though it continues to rotate.

Although my invention has been illustrated and described with reference to the preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiment, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. An apparatus for forming a helical wire coil of metal or other suitable material and feeding the coil into a series of punches on the border of a pack of sheets, a mandrel having a circular cross section and a rear and a front end, means for connecting said rear end to driving means for rotating said mandrel so as to wind a wire thereon from a feeding point near said rear end, means for preventing longitudinal shifting of said mandrel, and a stationary tubular jacket enclosing said mandrel and having a helical groove therein for guiding the wire coil while being wound on said mandrel from said feeding point toward said front end, said mandrel having an uninterrupted surface for longitudinal sliding movement of the wire coil thereon and being formed slightly conically, widening from said feeding point to said front end to an extent which exceeds the resiliency of said wire coil, a longitudinal slot being provided in said mandrel for feeding the front end of said wire from said feeding point into said helical groove and guiding it to said front end of said mandrel during the rotation of the latter, said jacket having a recess for introducing the wire into said helical groove, said groove having sufficient depth to permit the coil slightly to recoil and thus to increase in diameter and thereby to be released from said mandrel for interrupting the winding-up movement of the wire on the rotating mandrel in the event that the wire coil hits an obstruction during its introduction into said series of punches.

2. An apparatus for forming a helical wire coil of metal or other suitable material and feeding the coil into a series of punches on the border of a pack of sheets, a mandrel having a circular cross section and a rear and a front end, means for connecting said rear end to driving means for rotating said mandrel so as to wind a wire thereon from a feeding point near said rear end, means for preventing longitudinal shifting of said mandrel, and a stationary tubular jacket enclosing said mandrel and having a helical groove therein for guiding the wire coil while being wound on said mandrel from said feeding point toward said front end, said mandrel having an uninterrupted surface for longitudinal sliding movement of the wire coil thereon and being formed slightly conically, widening from said feeding point to said front end to an extent which exceeds the resiliency of said wire coil, a longitudinal slot being provided in said mandrel for feed-

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ing the front end of said wire from said feeding point into said helical groove and guiding it to said front end of said mandrel during rotation of the latter, said jacket having a recess for introducing the wire into said helical groove and said jacket further projecting beyond said front end of said mandrel, said groove having sufficient depth to permit the coil slightly to recoil and thus to increase in diameter and thereby to be released from said mandrel for interrupting the winding-up movement of the wire on the rotating mandrel in the event that the wire coil hits an obstruction during its introduction into said series of punches.

3. An apparatus for forming a helical wire coil of metal or other suitable material and feeding the coil into a series of punches on the border of a pack of sheets, a mandrel having a circular cross section and a rear and a front end, means for connecting said rear end to driving means for rotating said mandrel so as to wind a wire thereon from a feeding point near said rear end, means for preventing longitudinal shifting of said mandrel, and a stationary tubular jacket enclosing said mandrel and having a helical groove therein for guiding the wire coil while being wound on said mandrel from said feeding point toward said front end, said mandrel having an uninterrupted surface for longitudinal sliding movement of the wire coil thereon and being formed slightly conically, widening from said feeding point to said front end to an extent which exceeds the resiliency of said wire coil, a longitudinal slot being provided in said mandrel for feeding the front end of said wire from said feeding point into said helical groove and guiding it to said front end of said mandrel during rotation of the latter, said longitudinal slot having a slight twist opposite to the twist of said helical groove in said jacket, said jacket having a recess for introducing the wire into said helical groove and said jacket further projecting beyond said front end of said mandrel, said groove having sufficient depth to permit the coil slightly to recoil and thus to increase in diameter and thereby to be released from said mandrel for interrupting the winding-up movement of the wire on the rotating mandrel in the event that the wire coil hits an obstruction during its introduction into said series of punches.

4. An apparatus for forming a helical wire coil of metal or other suitable material and feeding the coil into a series of punches on the border of a pack of sheets, a mandrel having a circular cross section and a rear and a front end, means for connecting said rear end to driving means for rotating said mandrel so as to wind a wire thereon from a feeding point near said rear end, means for preventing longitudinal shifting of said mandrel, and a stationary tubular jacket enclosing said mandrel and having a helical groove therein for guiding the wire coil while being wound on said mandrel from said feeding point toward said front end, said mandrel having an uninterrupted surface for longitudinal sliding movement of the wire coil thereon and being formed slightly conically, widening from said feeding point to said front end to an extent which exceeds the resiliency of said wire coil, a longitudinal slot being provided in said mandrel for feeding the front end of said wire from said feeding point into said helical groove and guiding it to said front end of said mandrel during the rotation of the latter, and said jacket having a recess for introducing the wire into said helical groove.

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