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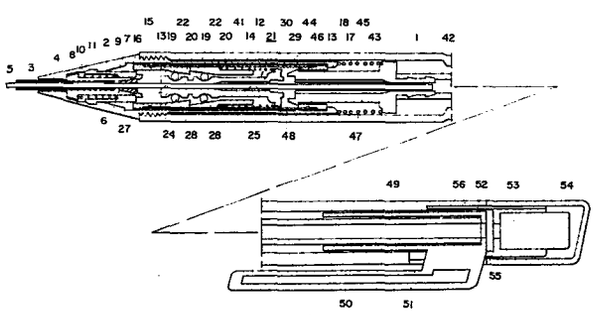
(54) Automatic mechanical pencil.

(57) Automatic mechanical pencil provided with a chuck which will grip a lead to allow the advance of the same, wherein the lead is kept prevented from retraction when it is pushed back by writing pressure, while the advance movement of the lead is allowed when it is to be advanced. The chuck is formed by the combination of two chuck elements, which will cooperate to grip the lead at their front ends. Intermediate portions of the chuck elements are swingably connected, so that when rear portions of the connection are pushed by a spring, front portions of chuck elements will be opened in the direction of mutual disconnection to release the lead.



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Background of the invention

1. Field of the invention:

This invention relates to a mechanical pencil, in particular to an automatic lead feed out mechanical pencil which is formed in such a manner that when the lead is consumed by the writing, the lead is automatically fed out by releasing the writing tip from paper surface.

2. Description of the prior art:

As a so-called automatic lead feed out mechanical pencil, those of various constructions have usually been proposed and marketed. However, due to complicated constructions, they could not be obtained economically. Particularly, the mechanism of shift control means of lead for preventing retract movement should be precisely made, and so it is difficult to make mechanical pencils having such construction with plastic material. Namely, in the chuck forming the shift control means, the tip of chuck itself is usually made to be always opened. For example, in case it is made of metallic pipe, a cylindrical chuck is provided with a slit at its tip portion to expand the tip outwardly. However, it is troublesome to form a chuck with plastic material. And, it is known to form the chuck with two independent chuck pieces, but even in this case, the tip of each chuck piece should be formed to expand outwardly. Therefore, it is not easy to make and assemble these pieces.

Summary of the invention

It is an object of this invention to obtain an automatic mechanical pencil provided with a simple shift control means capable of forming even with plastic material. Namely, the object

of this invention is that in an automatic mechanical pencil, the chuck forming the shift control means is not formed by bending itself so that its tip will always open outwardly, but it is formed so that its tip will open outwardly when the lead is fed out.

According to this invention, an automatic mechanical pencil is provided, wherein the shift control means controlling the shift of lead so as to allow only advance movement of the lead includes a chuck formed by the combination of plural chuck elements, which are swingably connected at their intermediate portion so that they grip the lead cooperating at their front ends and when their rear ends are pushed, the front ends will open in the direction of mutual release.

Other objects and features of this invention will become more apparent in the following detailed description taken in connection with the accompanying drawings:

Brief description of the drawing

Fig. 1 is a partly eliminated sectional view of an automatic mechanical pencil according to the present invention.

Fig. 2 is a perspective view of shift control means of the mechanical pencil of Fig. 1, in which a housing barrel is eliminated and an operating ring is sectioned.

Fig. 3 to Fig. 6 are front views, showing other examples of the operating ring.

Fig. 7 to Fig. 9 are partial side views, showing other examples of connecting portion of the chuck elements.

Figl 10 is a cross-sectional view, showing still other example of chuck elements.

Fig. 11 to Fig. 13 are automatic mechanical pencil according to the present invention, showing a partly eliminated other example.

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Fig. 11 shows a state when the lead is fully fed out.

Fig. 12 shows a state when the slider means is slightly pushed back by writing pressure.

Fig. 13 shows a state when the housing barrel is shifted to the retracted position by the slider means.

Fig. 14 is a front view of the chuck of mechanical pencil shown in Fig. 13.

Fig. 15 is a right side view of the chuck shown in Fig. 14.

Fig. 16 is a left side view of the chuck shown in Fig. 14.

Fig. 17 is a front view of a part of chuck elements forming the chuck shown in Fig. 14.

Fig. 18 is a rear elevation of chuck elements shown in Fig. 17.

Fig. 19 is a sectional view taken along A - A line of chuck elements shown in Fig. 17.

Description of the preferred embodiments

The automatic lead feed out mechanical pencil of the present invention comprises a main body (1), and a cap nozzle (2) screwed in the main body. Within the cap nozzle are disposed a slider means which elastically holds a writing lead by friction and is shiftable in axial direction and urged so as to project an end of the lead from the tip portion of the cap nozzle, and a shift control means which allows advance movement of the lead and prevents in its retraction.

In the mechanical pencil shown in the drawings, the slider means is constructed as follows. There is a lead guide sleeve (3) whose front end is protruded from the cap nozzle and the rear end is fixed to a lead engaging collet. This collet is fixed on its rear portion with an elastic ring (6) made of elastic material such as rubber, plastic and the like to hold a

writing lead (5) by frictional action, and is inserted shiftably in axial direction into a holding barrel (7) fixed to the cap nozzle. Between a flange (8) provided on the front portion of the collet and a shoulder (9) inward of the holding barrel, a spring (10) is provided to urge the collet to project the sleeve from the cap nozzle. When the front end of the sleeve is pushed rearward, the collet will retract along axial direction until the flange (8) hits on front end face (11) of the holding barrel (7). When the pressure pushing the front end of the sleeve is released, the collet will return to its advanced position by the spring. Accompanied therewith, the lead held by the elastic ring (6) will advance.

The shift control means shown in Fig. 1 is constructed as follows. Within an inner barrel (12) extending rearward of the cap nozzle, a housing barrel (14) is inserted, of which both ends are fixed with retaining rings (13), (13), and the housing barrel is provided so that it can advance until its front end (15) hits against a shoulder (16) on the cap nozzle and it can retract until its rear end (17) hits against a projection (18) of the inner barrel. Inside the housing barrel, a cylindrical operating ring (20) is inserted, having a tapered face (19), whose inner face is slanting to be forwardly wide and rearwardly narrow. In the pencil shown in the drawing, the operating ring includes two rings, i.e., a front operating ring and a rear operating ring, but one or more than three operating rings may be provided. Within the operating ring, a cylindrical chuck (21) is inserted shiftably in axial direction and between outer face of the chuck and the tapered face, balls (22) are provided. And, to facilitate the rotation of balls, it is preferable to provide guide grooves (23) in the tapered face of the operating ring. In Fig. 3 to Fig. 6,

examples of guide grooves are shown, wherein V-shape (Fig. 3), semi-circular shape (Fig. 4), approximately U-shape (Fig. 5), approximately U-shape with V-shape in the deepest point (Fig. 6) and other suitable shapes are adopted to prevent balls from coming off guide grooves. The chuck (21) has a lead passing bore (24), whose rear portion (25) is formed with larger diameter to facilitate the passage of writing lead. Front portion of the lead passing bore may be formed with rough surface such as serration and the like, if required, to grip the lead surely by frictional action. The chuck is divided into plural chuck elements (27) by a slit (26) extending in longitudinal direction. In the drawing, chuck elements are provided into two pieces, but three pieces or more may be provided. On outer faces of chuck elements, there are concave grooves (28) for receiving balls and when balls correspond to relatively narrow portion of tapered face of the operating ring, chuck elements are pressed from their periphery to hold the lead by frictional action. When balls correspond to relatively wide portion of tapered face of the operating ring, chuck elements are released from their peripheral pressure to cease the holding of the lead, which will then become free. The rear portion of the chuck is provided with a spring seat (29), in front of which chuck elements are connected with their front ends being openable. In Fig. 1 and Fig. 2, the chuck is connected with a flexible thin plate (30) which is formed integral with chuck elements. However,it may be connected with a bent plate (31) which is bending arcuately, as shown in Fig. 7. The bent plate shown in the drawing is bent forward, but it may be bent rearward. And, chuck elements may be separately formed and connected by an engaging piece. As in Fig. 8, one chuck element is provided with an engaging piece (32) which is extending towards other chuck element, and the tip of the engaging

element is engaged in an engaging groove (33) of other chuck element. In Fig. 9, engaging pieces (34), (35) are extending from both chuck elements, and a projection (36) formed on the front portion of one of the engaging piece is engaged with a receiving groove (37) formed on the front portion of other engaging pieces. Chuck elements may be connected by means of other member than chuck elements, one example of which is shown in Fig. 10, wherein a locking ring (39) is formed, with its inner face (38) being arcuately formed; a part of inner face of the locking ring is provided with a short projection (40) projecting within the slit; and under the state that the projection is put in the slit, the ring is put on other periphery of chuck elements to connect the same. Between the spring seat (29) and the operating ring (20), there is a means for urging them in the direction of increasing their distance. In the drawing, the urging means is a spring (41), whose action is somewhat weaker than that of the spring (10) of the slider means. Since the spring seat is urged rearwardly by the action of the spring, chuck elements, whose front ends are openably connected at the front end of the spring seat, always tend to open their front portions. Since the shift control means of the present invention is formed as mentioned above, the spring seat (29) and the operating ring (20) are always urged in the direction of increasing their distance, balls (22) with rolling contact on outer periphery of the chuck, are urged in a state of facing narrow portion of tapered face of the operating ring (20). Therefore, since chuck elements are usually pressed from periphery, they grip the lead (5) and upon writing, even if the lead is pressed rearwardly, it is never retracted. On the other hand, when the lead is pulled forwardly, the chuck will advance, together with the lead, against a spring (41), and balls (22) will correspond to wide portion of

the tapered face. Since chuck elements tend to open at their front portion, the grip action on the lead is released, thus the lead can advance freely.

There is a pushing pipe (43), whose rear end is connected to a lead magazine (42) provided within the main body (1), and front end of the pushing pipe penetrates through the rearward retaining fing (13) provided on the housing barrel (14) and faces a rear end (44) of the chuck (21). Between the pushing pipe and the rear end of inner barrel (12) of the cap nozzle, there is a spring (45), which is rearwardly urging the pushing pipe. At the front end of the pushing pipe, there is a flange (46), which will abut against the retaining ring (13) provided on the housing barrel when the pushing pipe shifts rearwardly. The pushing pipe has a lead inserting and passing bore (47), whose front portion is formed with a space (48) which can receive the rear end (44) of the chuck. On the rear end of the lead magazine (42), a knocking clip (49) is inserted and a pinch clip (50) of the knocking clip projects outwardly from a slit (51), and when the knocking clip is axially pressed by finger tip, the lead magazine is shifted in axial direction. On the rear end of the main body (1), a cylindrical eraser holder (52) with an eraser (53) is inserted, whose outside is provided with a cover (54), which is detachably inserted in the rear end of the main body. The writing lead can be supplied to the lead magazine through penetrated bores (55), (56) provided on the holder and knocking clip, after detaching the cover and eraser. And, the lead magazine can be shifted by directly pressing the rear portion of the magazine with knocking piece and the like provided on the rear end of the main body (not shown).

And, when the pencil is in use, the writing lead (5) supplied to the lead magazine stops, at first, with its tip reached to the

rear portion (25) of larger diameter of the lead passing bore (24) of the chuck (21).

Now, the knocking clip (49) is knocked to shift the lead magazine forward along axial direction, then the pushing pipe (43) hits against the rear end of the chuck to push the chuck forward. However, since the housing barrel (14), which is housing the chuck, the operating ring (20) and the like, is under free state, the housing barrel will advance until it hits against the shoulder (16) of the cap nozzle. Thus, the chuck remains under the closed state. By successive pressing, the chuck will advance while rolling balls (22). When balls correspond to wide portion of the tapered face (19), the lead passing bore (24) will widen and the lead will advance with its own weight until it stops upon hitting against the elastic ring (6) of the slider means, since the chuck always tends to open its front portion. Thereupon, the pressing is ceased, then the pushing pipe (43) and the lead magazine (42) will return to the original position (retracted position) by the action of the spring (45). The housing barrel will be pulled by the flange (46) and returned to the original position (retracted position) when the pushing pipe returns to the original position. Also the chuck returns to the original position (retracted position) by the action of the spring (41). When the chuck returns to retracted position, the lead is gripped by the inner face of the lead passing bore closed by the action of balls and the tapered face, but its tip remtains abutting on the elastic ring as mentioned above.

When above mentioned operation is repeated by knocking again, as the housing barrel advances, the lead will advance while being gripped by the chuck and its tip will advance over the elastic ring, and soon the tip will project forward from the

sleeve (3), thus to enable to write.

When the tip of lead becomes short by the writing, the lead guide sleeve (3) will hit on paper surface, and by continuing the writing, the guide sleeve will be gradually pressed rearwardly. By the shift of the guide sleeve, the elastic ring (6) will retract while sliding on the outer face of the lead together with the lead engaging collet (4). When the flange (8) of the collet hits on the front end face (11), the shift of the collet stops.

When the flange and the front end face of the holding barrel abut, or before the abutting/writing is ceased and the tip of the lead is released from paper surface, the elastic ring (6) and the guide sleeve (3) will advance to the advanced position by the action of the spring (10) together with the collet. By the frictional action of the elastic ring, the lead is also pulled forward, and the chuck (21) also advances against the spring (41) together with the lead, and when balls correspond to wide portion of the tapered face of the operating ring, the tip of the chuck widens to release the grip action on the lead and to allow forward movement of the lead. Thereby, the tip of lead together with the guide sleeve again projects forward direction of the cap nozzle, to enable the writing.

When it is desired to retract the tip of lead, as in the case of usual knocking type mechanical pencil, the tip of lead may be pushed rearward under the state of the knocking clip being knocked.

An embodiment of other automatic lead feed out mechanical pencil having shift control means according to the present invention is shown in Fig. 11 to Fig. 19. Similar to the above mentioned embodiment, this embodiment is also provided with a main body (101), a slider means screwed within a cap nozzle (102) and a

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shift control means. This slider means is of nearly the same construction as that of the above mentioned embodiment.

Namely, there is a lead guide sleeve (103), whose rear end is fixed to a lead engaging collet (104). The collet is fixed on its rear portion with an elastic ring (106) made of elastic material, such as rubber, plastic and the like to hold a writing leand (105) by frictional action, and is inserted shiftably in axial direction into a holding barrel (107) fixed to the cap nozzle. Between a flange (108) provided on the front portion of the collet and a shoulder (109) inward of the holding barrel, a spring (110) is provided to urge the collet to project the sleeve from the cap nozzle. When the front end of the guide sleeve is pushed forwardly, the collet retract along axial direction until the flange (108) hits on front end face (111) of the holding barrel (107). When the pressure pushing the front end of the guide sleeve is released, the collet will return to its advance position by the spring. Accompanied therewith, the lead held by the elastic ring (106) will advance.

The shift control means is constructed as follows. Within an inner barrel (112) extending rearward of the cap nozzle, a housing barrel (114) [illegible], whose both ends are fixed with retaining rings (113), (113), is inserted in contact with the inner barrel so as to make a sliding friction. The housing barrel is provided so that it can advance until its front end (115) hits against a shoulder (116) on the cap nozzle. Between its rear end (117) and the base end of a pushing pipe to be under mentioned, a spring (118) is provided and forwardly urged. Inside of the housing barrel, a cylindrical operating ring (120) is inserted, having a tapered face (119), whose inner face is slanting to be fowardly wide and rearwardly narrow. Within the operating ring, a cylindrical

chuck (121) is inserted shiftably in axial direction and between outer face of the chuck and the tapered face, balls (122) are provided. The chuck (121) has a lead passing bore (124), whose front inner face provided with serration (123) and its rear portion (125) is formed with larger diameter to facilitate passage of the lead. By means of the serration (123) of the front portion of the lead passing bore, the lead will be surely gripped by the frictional action. The chuck is formed with plural chuck elements (127) to form a longitudinally extending slit (126) (Fig. 14). In this drawing, two pieces of chuck elements are provided. On outer faces of chuck elements, there are concave grooves (128) for receiving balls and when these balls correspond to relatively narrow portion of tapered face of the operating ring, chuck elements are pressed from their periphery to hold the lead by frictional action. When balls correspond to relatively wide point of tapered face of the operating ring, chuck elements are released from their peripheral pressure to cease the holding of the lead, which will then become free. The rear of the chuck is provided with a spring seat (129), in front of which chuck elements are connected with their front ends being openable. As shown in Fig. 14 to Fig. 19, the chuck element has on its one side of lead passing bore (124) a projection (130) with its tip being formed round, and has on its other side a receiving groove (131) with its bottom being formed round. And, two chuck elements (127), (127) are made in the same shape, which are combined facing with each other, and projection (130) on one side is engaged with receiving groove (131) on other side. And as mentioned above, the height of the projection (130) is made slightly higher than the depth of receiving groove (131) so that a slit (126) is always formed ranging from front end to rear end

between chuck elements (127), (127). By engaging as mentioned above, when rear end of the chuck is pressed in the direction that chuck elements will come nearer, front end will shift in the direction that chuck elements will come farther so that the front end of the chuck will be opened. Between the spring seat (129) and the operating ring (120), there is a spring (132) urging in the direction to separate them, and the action of the spring is slightly weaker than that of the spring (110) of the slider means. Since the spring seat is urged rearwardly by the action of the spring, the chuck element, whose front end is openably connected in front of the spring seat, is always tending to open its front portion. Since the shift control means of the present invention is formed as mentioned above, the spring seat (129) and the operating ring (120) are always urged in the direction of increasing their distance, balls (122) with rolling contact on outer periphery of the chuck, are urged in a state of facing narrow portion of tapered face of the operating ring (120). Since chuck elements are usually pressed from periphery, they grip the lead (105) and upon writing even though the lead is pressed rearwardly, it is never retracted. On the other hand, when the lead is pulled forwardly, the chuck will advance, together with the lead, against the spring (132), and balls (122) will correspond to wide portion of the tapered face. Since chuck elements tend to open at their front portion, the grip action on the lead is released, thus the lead can advance freely.

On the rear end of the inner barrel (112), there is a pushing pipe (134) provided with a passing bore (133) for lead (105), and front end of the pushing pipe penetrates through the rearward retaining ring (113) provided on the housing barrel (114) and faces a top cut conical projection (135) on rear end of the chuck (121).

Between the pushing pipe and the rear end of the housing barrel (114), there is a spring (118), At the front end of the pushing pipe, there is a flange (136) and within a space (137) formed by the flange, a part of projection (135) of the rear end of the chuck will thrust in.

And, as shown in Fig. 11, when the pencil is used under a state of projected lead and the tip of lead becomes short by the writing, a lead guide sleeve (103) hits on the paper surface and by continuing the writing, the lead guide sleeve will be gradually pressed in rearwardly (Fig. 12). By the shift of the sleeve, the elastic ring (106) will retract while sliding on the outer face of the lead together with the collet (104). When the flange (108) of the collet hits on the front end face (111) of the holding barrel (107), the shift of the ring is stopped (Fig. 13).

As shown in Fig. 12, when the writing is ceased prior to the abutment of the flange and the front end face of the holding barrel and the tip of the lead is released from paper surface, the elastic ring (106) and the sleeve (103) will advance to the advanced position by the action of the spring (110) together with the collet (104). By the frictional action of the elastic ring, the lead is also pulled forwardly, and the chuck (121) also advances against the spring (132) together with the lead, and when balls correspond to wide portion of the tapered face of the operating ring, the tip of the chuck widens to release the grip action on the lead and to allow forward movement of the lead. Thereby, the tip of lead together with the sleeve again projects forwardly the cap nozzle to enable the writing.

As shown in Fig. 13, when the writing is continued until the flange (108) of the collet (104) and the front end face (111) of the holding barrel (107) abut, or the lead guide sleeve is

pushed into that position, the housing barrel (114) will be pushed into retracted position under a state that the rear end (138) of the collet (104) abuts on the front end (115) of the housing barrel (104). Before the collet reaches the retracted position, slant side face of the projection (135) of rear end of the chuck (121) is hit by the edge of the flange (136) at the front end of the pushing pipe (134). Thereby, since the shift of the chuck will be stopped under an abutted state of the projection (135) and the flange (136), when the housing barrel (114) arrives at the rear end position, the chuck (121) is under an advanced relation against the spring (132) relative to the housing barrel (114). Thus, under this state, the tip of the chuck widens and releases the grip action for the lead to allow the forward movement of the lead, and when the lead guide sleeve (103) is released from the paper surface, the lead is pulled to the projected position together with the lead guide sleeve accompanied by the shift to the advanced position of the collet (104). When the rear end (138) of the collet (104) leaves from the front end (115) of the housing barrel (114), the housing barrel (114) will advance due to the action of the spring (118). At that time, the housing barrel (114) will shift with lower speed than the shift speed to the advanced position of the collet (104) due to slide resistance caused between the housing barrel (114) and the inner barrel (112). Thereby, after the collet arrives at the advanced position, the housing barrel will advance until the front end (115) of the housing barrel hits on the shoulder (116) of the cap nozzle under a state that the housing retracts to a state, under which the chuck will grip the lead by the action of the spring (132). Thus, the lead (105) will project just a little more than the tip of the lead guide sleeve (103) (Fig. 11). At that time,

elastic ring and the like may be fitted on the outer periphery of the housing barrel, which is slidingly contacted with the inner barrel to delay the shift of the housing barrel.

And, when at first the lead is supplied to the chuck and the like, it is preferable to supply the lead under a state that the lead guide sleeve is pressed on the paper surface as shown in Fig. 13, Namely, since in the state shown in Fig. 13, the tip of the chuck is under opened state, by dropping lead (105) into the passing bore (133) of the pushing pipe, the lead (105) will advance by its own weight until a position where it hits against the elastic ring (106). Whereupon, the lead guide sleeve is released from the paper surface to advance the collet, as mentioned above, after the collet arrives at the advanced position, the chuck will further advance under a state of gripping the lead (105), so that the tip of the lead will enter into the elastic ring (106). Thereafter, the lead guide sleeve is pressed on the paper surface and the operation is repeated, then the lead will advance little by little and will project from the tip of the sleeve under such a state as shown in Fig. 11.

Since the present invention is formed as mentioned above and is simply constructed, almost all parts thereof may be made by plastic material and may be economically obtained, except the lead guide sleeve, the housing barrel, balls, springs and the like. And it is to be understood that the housing barrel and other parts may be made with plastic material, and other parts may be formed with metallic material and the like.

It is to be understood that the present invention is not limited to the above mentioned embodiment thereof, but may be otherwise variously modified within the scope of the following claims.

What is claimed is:

1. An automatic mechhanical pencil, comprising an axially shiftable slider means, wherein a writing lead is elastically held by frictional action and is urged so as to project the tip of the writing lead from front portion of a main body of the pencil, and a shift control means for allowing advance movement of the writing lead and for preventing retractive movement of the same, characterised in that said shift control means including an operating ring provided with a tapered inner surface, a tubular chuck which grips the writing lead shiftably inserted in axial direction within said operating ring, balls provided between outer face of said chuck and said operating ring, and a spring arranged between said operating ring and a spring seat provided on rear portion of said chuck so as to rearwardly urge said chuck; said chuck being formed by the combination of plural chuck elements extending longitudinally; said chuck elements being swingably connected in front of said spring seat provided rearwardly so that the front end of said chuck element opens.

2. An automatic mechanical pencil according to claim 1, wherein connecting portion of said chuck elements is flexible thin plate, by means of which plural chuck elements are integrally formed.

3. An automatic mechanical pencil according to claim 1, wherein said chuck is formed by the combination of two independent chuck elements.

4. An automatic mechanical pencil according to claim 3, wherein said chuck elements have, on confronting faces to be combined, a projection whose tip is rounded and a receiving groove whose bottom portion is rounded, so that when two chuck elements are

combined, said projection of one chuck element will swingably engage with said receiving groove of another chuck element.

5. An automatic mechanical pencil according to claim 1, wherein said shift control means is housed in a housing barrel shiftably provided in axial direction, said housing barrel being made so as to begin its advance later than the advance movement of said slider means.

FIG. 1

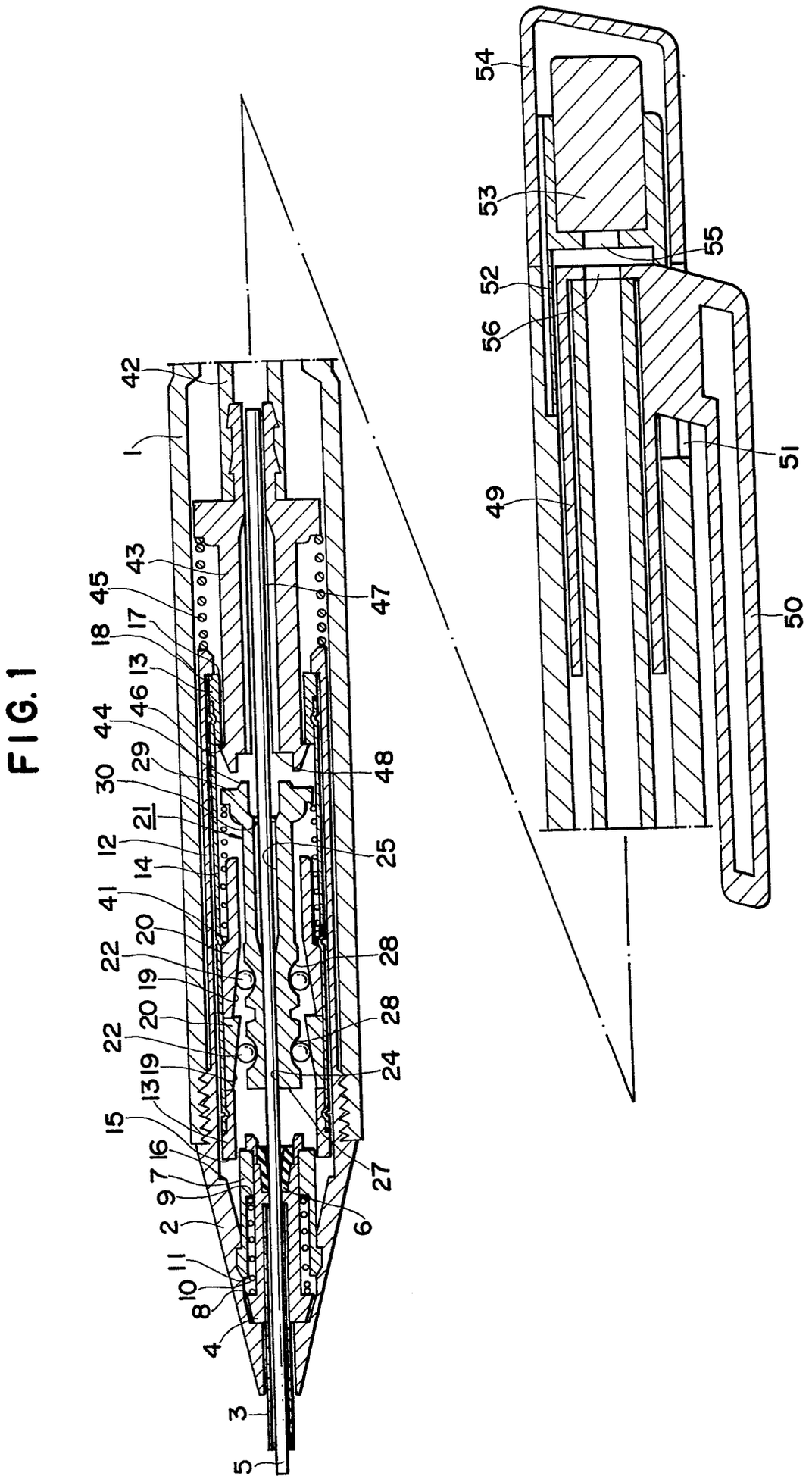
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FIG. 2

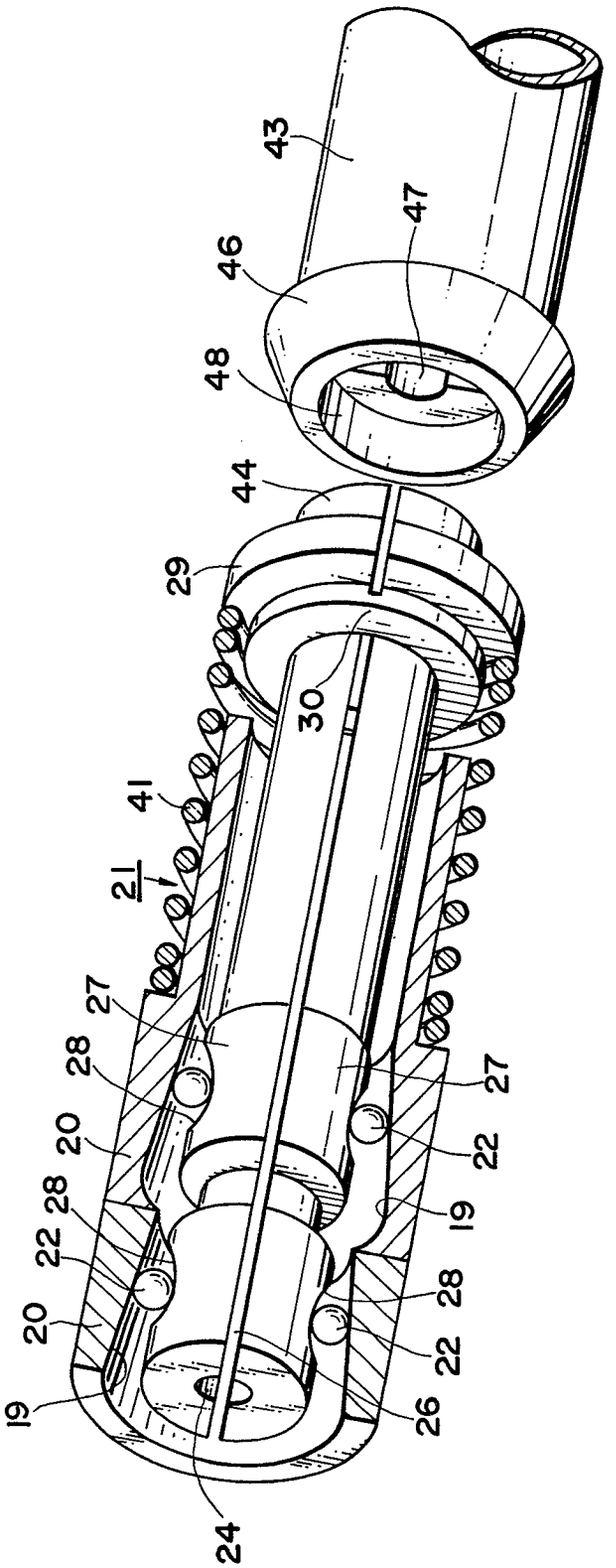

FIG. 6

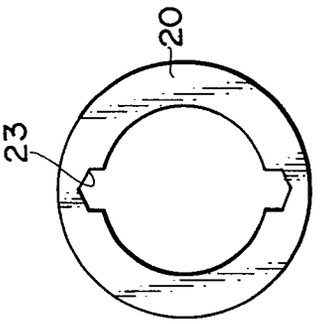

FIG. 5

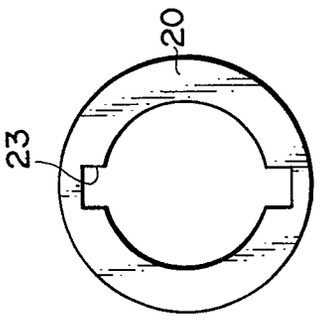

FIG. 4

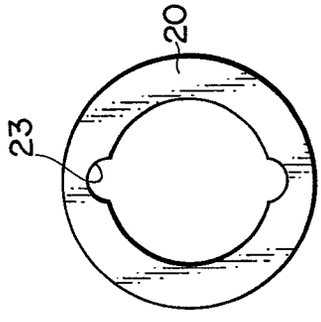

FIG. 3

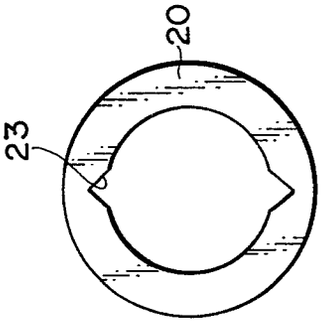

FIG. 10

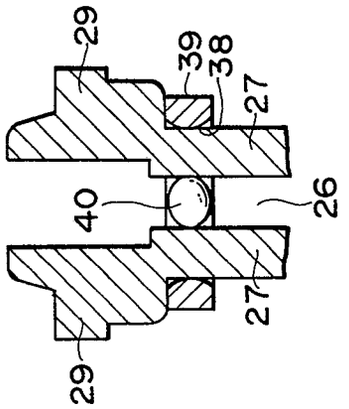

FIG. 9

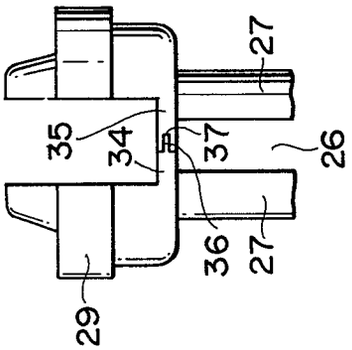

FIG. 8

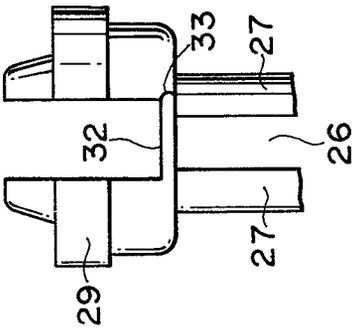

FIG. 7

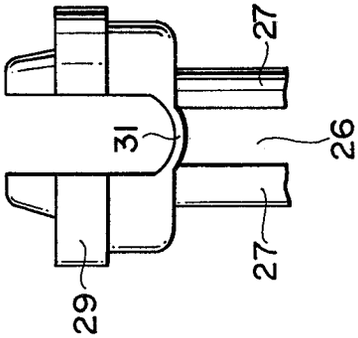

FIG. 11

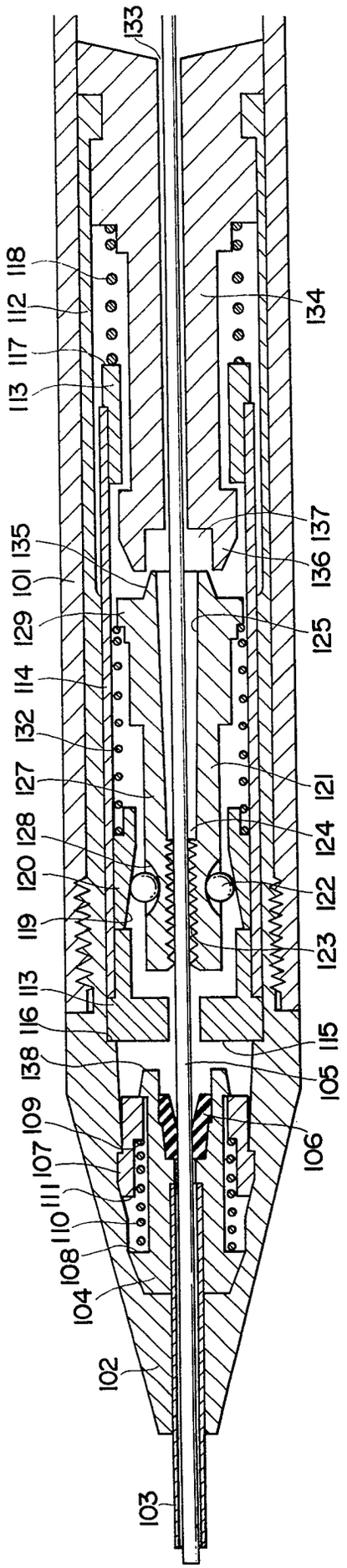
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FIG. 12

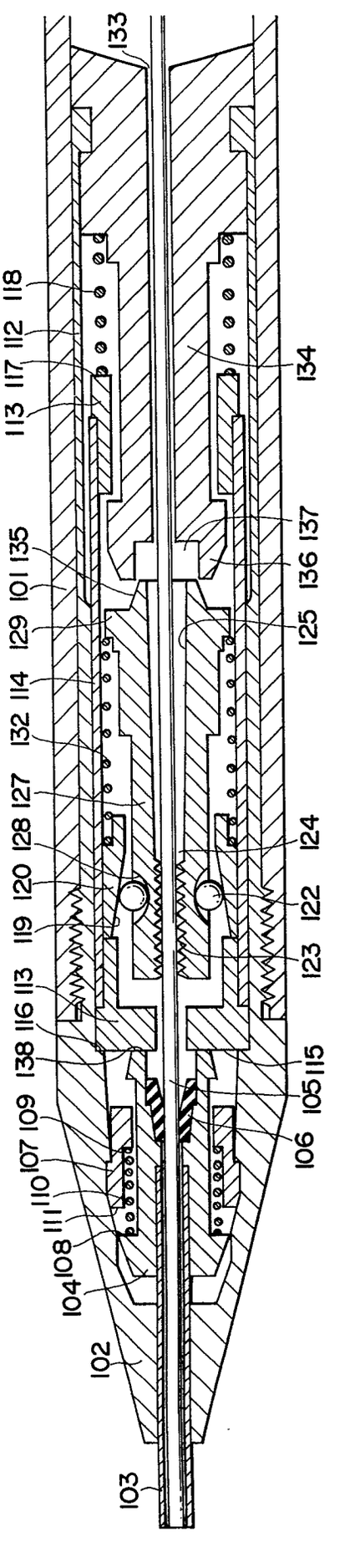
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FIG. 13

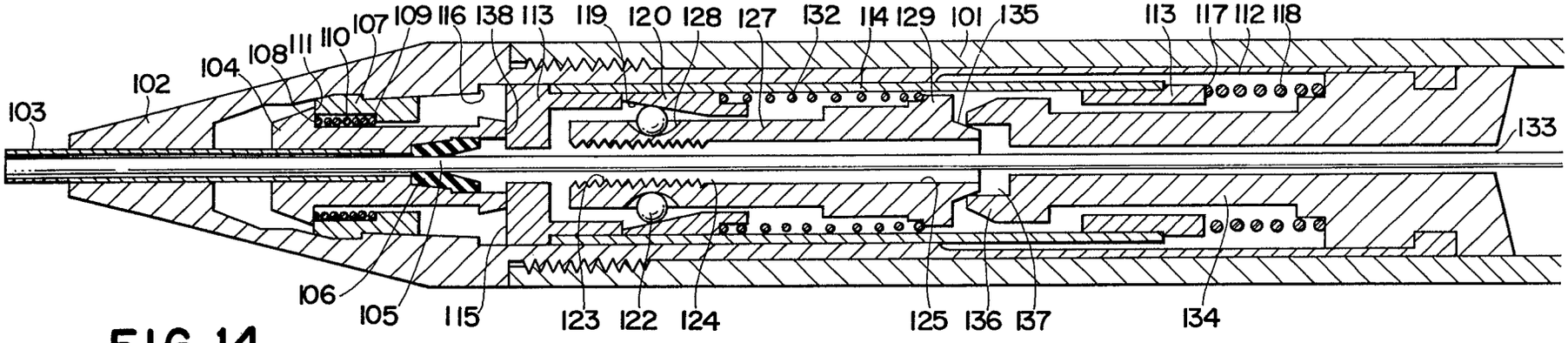


FIG. 14

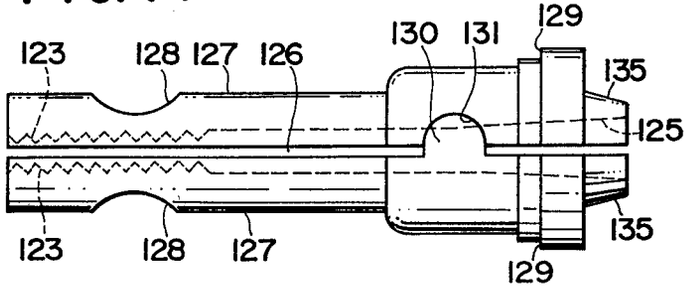


FIG. 15

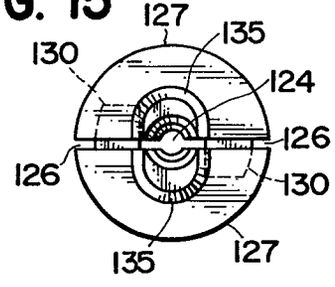


FIG. 16

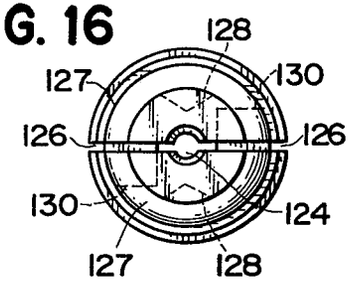


FIG. 19

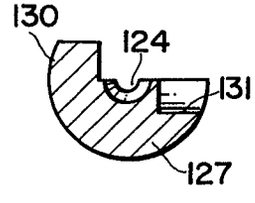


FIG. 17

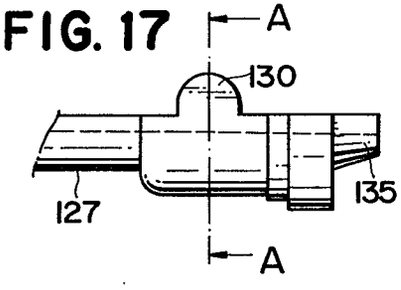
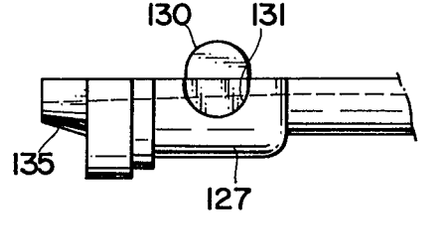


FIG. 18



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