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(11) **CA 635949** (13) **A**

(40) **06.02.1962**

(12)

(21) Application number: **635949D**

(51) Int. Cl:

(22) Date of filing: ..

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(54) **CALCULATING MACHINE**

(57) **Abstract:**

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Calculating machines comprising a machine body which can preferably be embraced by hand, a central stepped roller, setting members and digit rollers arranged around said stepped roller, and a peripherally and axially movable round carriage serving preferably for decade shifting are known per se. In these calculating machines the operator must not only peripherally rotate the round carriage, which operation is mainly effected by the index finger and thumb, but must also lift and lower it, e.g., to effect the decade shifting mentioned hereinbefore. Depending on the dexterity of the operator this double movement involves greater or smaller difficulties. It is in any case disturbing in high-speed calculating work and causes the hand to be tired sooner; besides, the axial movement does not constitute an organic continuation of the peripheral movement so that it has previously been considered an inevitable nuisance.

The present invention is based on the recognition that the operator can be relieved from this additional operating movement. Whereas the movement itself is not to be eliminated as it is the simplest means for decade shifting, the operator should be relieved from the task of intentionally performing the same. In accordance therewith this invention relating to calculating machines comprising a machine body which can preferably be embraced by hand, a central stepped roller, setting members and digit rollers arranged around said stepped roller, and a peripherally and axially movable round carriage serving particularly for

decade shifting, is characterized in that means are provided for automatically converting of the exclusively peripheral movement of a setting ring serving for operating the round carriage into axial movements of the round carriage.

These means may be constructed in various forms. One of them is characterized by the connection of device which prevents peripheral movements of the counter body of the round carriage in the decade positions to cams and cam followers, preferably pressure rollers, in engagement therewith, which cams and followers are effective between the counter body and the setting ring of the round carriage to cause an axial displacement of the latter. The cams are preferably formed by the counter ring whereas the setting ring carries the roller forming the cam follower although this arrangement may be inverted. Another illustrative embodiment is characterized by the connection of a device which prevents peripheral movements of the counter body of the round carriage in the decade positions to pawls effective between the counter body and the setting ring of the round carriage to cause an axial displacement thereof. These pawls are preferably rotatably mounted in the setting ring and their ends engage the counter ring in their effective position. Again, the inverse arrangement is possible. The counter body, particularly a counter ring, forms preferably stops for the pawls, e.g., in the form of a radially toothed annulus.

The device for preventing peripheral movements

of the counter body of the round carriage in the decade positions may also be provided in various forms. A preferred embodiment is characterized in that it comprises a toothed annular rib or fixing ring, which is arranged on the machine body and with which a stop of the counter body is associated in such a manner that the teeth of the annular rib permit only axial adjusting movements of the counter body when the stop of the latter engages a gap between teeth whereas the stop rests on slide faces formed by the top faces of the teeth during peripheral movements of the round carriage between decade positions. The transitions between the teeth and gaps are preferably rounded so that the stop, which may consist of a fixing pin, slides downwardly along the inclined surfaces thus formed under the pressure of the spring and/or weight. If the setting ring is quickly moved the stop will shortly impinge on the opposite bevel so that the engagement is felt by the operating hand. In this case special detent springs and notches associated therewith to facilitate the finding of the decade positions can be eliminated.

Because the round carriage must be lifted against spring forces and forces of gravity acting thereon, the performance of the axial movement requires a substantial force to be exerted in the peripheral direction. In order to facilitate the rotary movements, which are generally performed only with one hand, the relatively rotatable parts, generally the casing lying in the palm of the hand and the setting ring moved with the fingers of the same hand, have been knurled

even in the previous constructions. Experience has shown that this construction of the operating means enabling a perfectly satisfactory operation of the known calculating machines because they did not require axial movements to be performed by a rotation of the setting ring is not sufficient in calculating machines in which the peripheral movement of the setting ring is automatically converted into axial movements of the round carriage to avoid a sliding of the fingertips over the knurled surface or a slipping of the machine in the palm of the hand because owing to the relatively small friction between the skin, which has always some skin fat and often moisture, and the machined, although knurled material of the setting ring and casing the pressure forces which are exerted by the fingers and the hand and which should be as small as possible are not sufficient to transmit the higher torque now required without sliding and slippage.

It is a further feature of the invention to improve the construction of the calculating machine proposed hereinbefore in this respect and thus to ensure a reliable operation. In order to solve this problem, calculating machines comprising a machine body which can be embraced by the hand are characterized in a development of the invention in that knurled operating rings of resiliently expandable material, which rings are known per se, are provided on the parts which are relatively rotatable by hand.

The operating rings are preferably formed in such a manner that they tightly embrace the parts to be

relatively rotated or that they are arranged in annular grooves of the parts to be rotated. It is suitable to provide one operating ring on the setting ring and one on the casing base which during operation is always in engagement with the ball of the thumb.

Independently of the manner in which the operating rings are affixed to the machine body and to the setting ring the calculating machine according to the invention has the essential advantage that the frictional adhesion occurring during the performance of the rotary movements between the fingertips and the operating ring arranged on the setting ring and between the palm of the hand and the operating ring arranged on the casing base is much greater than is possible where metal operating rings are employed. Another important advantage resides in that fixing elements and functional parts such as screws, levers and the like are covered by the operating rings and that the fixing means for the rings are not visible. Finally, knurled operating rings of resiliently expandable material have the advantage that the calculating machines have a much more pleasing feel, particularly in the cold, than machines which have only metallic outside surfaces.

The fixation of the operating rings is required only if the rings are not smaller in diameter than the body to be embraced thereby. The rings are suitably polymerized or stuck onto the metal parts or are connected thereto by other methods known per se. It is simpler, however, to provide rings which tightly embrace under initial stress the parts to be relatively rotated

so that an additional fixation can be eliminated because in this case the frictional adhesion between the operating rings and the parts on which said rings are arranged is sufficient to preclude relative movements between the operating rings and the parts to be embraced by them. The frictional adhesion is increased by the pressure exerted by the fingertips or the palm of the hand or the ball of the thumb during the operation of the machine.

Further details and advantages of the invention will be explained with reference to two illustrative embodiments which are shown in the drawing and will be described hereinafter.

Fig. 1 is a general view of the calculating machine which comprises round carriage actuating means proposed according to the invention. The stepped roller, zero buffer disc, tens shifting body and five-prong shafts are only indicated with broken lines. For greater clarity the tens shifters are not shown.

Fig. 2 is a somewhat enlarged view of the part which is broken away and shown in section in Fig. 1.

Fig. 3 is partly a vertical sectional view taken on line III-III of Fig. 2 and partly a side view of Fig. 2.

Fig. 4 is a view similar to Fig. 3 consisting of an elevation and partly of a sectional view taken on line IV-IV of

Fig. 5, which is a sectional view similar to Fig. 2 and represents a vertical longitudinal sectional view of an external part of the round carriage.

Fig. 6 is a side view showing a calculating machine having operating rings of resiliently expandable material. To simplify the drawing this calculating machine is not in accordance with Figs. 1 to 5 but has the simplified setting ring partly shown in section in Fig. 7.

Fig. 7 shows the setting ring of the calculating machine partly in elevation and partly in section.

In the first respect it is apparent from Figs. 1 to 3 that a calculating machine is concerned which has a machine body which can be embraced by hand, a central stepped roller, shifting members and digit rollers arranged around said stepped roller and a peripherally and axially movable round carriage which serves for decade shifting. Figs. 1 and 2 indicate the machine body at 1. As is apparent particularly from Fig. 2, the round carriage 2 consists of the counter body 3, the counter cap 4, the counter shafts 5 and the counter ring 6. The parts 3, 4 and 6 form a rigid unit, which is rotatably mounted and axially displaceable relative to the main body 1. The collar 8, which serves for mounting the setting ring 9, is firmly connected to the main body 1 by means of the screws 7. The setting ring 9 extends over the extension 10 of the counter ring 6, which extension has the form of an annular flange. The counter ring 9 has forced into it two pins 11, which are spaced from each other by 180° and on which the pressure rollers 12 are rotatably mounted. Fig. 3 indicates that the annular flange 10 of the counter ring 6 is formed as a cam by the provision of

the inclined planes indicated at 13. The main body 1 has also connected thereto the fixing ring 14, which is closed by the annular ring 15. As is particularly indicated with broken lines in Fig. 3, the annular rib 15 is toothed so that each tooth 16 is followed by a gap 17. The transitions between the gaps and teeth are well rounded, as is indicated at 18, so that gradual transitions are provided. The toothed annular rib 15 has associated therewith a stop 19, which is fixedly arranged in the counter body 3 and which consists, e.g., of a pin which is an exact fit in the gaps 17.

The mode of operation of the calculating machine according to Figs. 1 to 3 is as follows:

When the setting ring 9 is rotated and the pin 19 is just in a gap 17, i.e., in a certain decade position, this will lock the counter body 3 with the parts 4, 5, 6, 10 and the surfaces 13 against peripheral movements. Only an axial adjustment of said parts is possible. This will result because the assumed peripheral rotation of the setting ring 9 will urge the roller 12 against one of the inclined planes 13 to produce an axially directed adjusting force component whereby the parts 3, 4, 5, 6, 10 are urged upwardly. This will disengage the pin 19 from the gap 17' in which it is just disposed and a peripheral rotation of the entire round carriage, including the setting ring 9, results. During this movement the end face of the pin 19 slides over the top face 20 of a tooth 16. A spring, not shown, and/or the weight of the round carriage 2 ensure that the pin 19 will automatically fall into the next gap 17

unless the peripheral movement of the setting ring 9 is continued. Otherwise the inclined surfaces or planes 13 against which the roller 12 is urged will again become effective to cause a shifting by a further decade. The pins 21 provide for a firm connection of the fixing ring 14 to the main body 1.

In the embodiment of the invention shown in Figs. 4 and 5, parts having the same reference characters correspond to those of Figs. 1 to 3. Being modified compared to the counter ring 6, the counter ring is now designated 22. It receives in a groove 23 a knurled annulus 24, which is preferably formed with radially extending teeth. The setting ring 25 is also differently formed. It contains four riveted pivot pins 26, which are spaced 90° apart and serve for mounting the pawls 27, two opposite ones of which are arranged to lock in the right-hand direction whereas two other ones are arranged to lock in the left-hand direction. A spring 28 urges the pawl 27 in its inoperative connection downwardly against the pin 29 forced in the setting ring 25. As a result, the pawl cannot engage the knurled annular rib 24. The uptilting springs 30 are disposed in the path of the pawl 27. As soon as a pawl 27 engages an uptilting spring 30, the pawl will be turned about the pin 26 and engage the knurled surface 24 with its effective tip 31. The knurled rib 24 and the counter ring 22, however, cannot rotate because the fixing ring 14 and the locking pin 19 are provided in accordance with the embodiment of Figs. 1 to 3 and prevent a rotation of parts 3, 4, 5, 22, 24. For this

reason the pawl 27 will be effected in the sense of an axial displacement of the round carriage if the setting ring 25 is peripherally moved. A peripheral rotation of parts 3, 4, 5, 22, 24, 25 will not be possible until the locking pin 19 has left the gap 17 or 17' in which it is just disposed. The end face of the locking pin 19 then slides again on the top faces 20 of the teeth 16 until the pin falls into the next gap between teeth unless the peripheral rotation of the setting ring 25 is continued. In the second embodiment the transitions between the gaps and teeth are not rounded as at 18 in Fig. 3. Instead of these rounded transitions, detent springs 33 are affixed by means of screws 32 to the collar 8 and can fall into notches 34 formed on the setting ring 25. Because the pawls 27 have been rendered effective with the aid of the uptilting springs 30, the peripheral operation of the setting ring 25 will cause a pressure to be generated in the direction opposite so that of the operation. This indicates to the operator that the setting ring must be moved to its middle position. This middle position will be reached when the detent spring 33 has snapped into the notch 34. The detent spring 33 is disposed between two pawls 27 spaced 90° apart so that the same amount of movement is required in both directions of rotation.

In Figs. 6 and 7, 35 is the casing of the calculating machine. The setting ring 36 is arranged in known manner on said casing and carries a knurled operating ring 37 consisting of resiliently expandable material, e.g., of soft rubber and tightly embracing the

shifting ring 36. The base 38 of the casing of the machine is also provided with a knurled operating ring 39. Fig. 7 indicates that the setting ring 36 is formed with an annular groove 40, which receives the operating ring 37. During the operating of the calculating machine the base 38 of the casing lies with the operating ring 39 in the palm of the hand whereas the thumb and index finger or the thumb and middle finger of the same hand are used for rotating the shifting ring.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A calculating machine adapted to be embraced with one hand, comprising, in combination, a machine body, a central stepped roller, setting members arranged around said stepped roller, digit rollers, a round carriage suitable for decade shifting, said round carriage comprising a counter body, a counter cap, counter shafts, a counter ring, said round carriage being arranged on said machine body and being moveable axially and peripherally on said machine body, said calculating machine comprising further a setting ring, said setting ring being rotatably arranged on said machine body and adapted to be rotated relative to said round carriage, means adapted to transform rotary movements of the setting ring automatically into axial movements of the round carriage.

2. A calculating machine adapted to be embraced with one hand, comprising, in combination, a machine body, a central stepped roller, setting members arranged around said stepped roller, digit rollers, a round carriage suitable for decade shifting, said round carriage comprising a counter body, a counter cap, counter shafts, a counter ring, said round carriage being arranged on said machine body and being moveable axially and peripherally on said machine body, a pawl and ratchet gear arranged between said machine body and said round carriage, said pawl and ratchet gear being adapted to prevent peripheral movements of the round carriage in the decade positions, said calculating machine comprising further a setting ring, said setting ring being rotatably

arranged on said machine body and adapted to be rotated relative to said round carriage, means adapted to transform rotary movements of the setting ring automatically into axial movements of the round carriage.

3. A calculating machine as set forth in claim 2, cam faces and pressure rollers engaging said cam faces being provided between said counter body of the round carriage and said setting ring, said cam faces and pressure rollers being moveable relatively peripherally and adapted axially to displace said round carriage to disengage said pawl and ratchet gear between said machine body and said round carriage.

4. A calculating machine as set forth in claim 2, cam faces and pressure rollers engaging said cam faces being provided between said counter body of the round carriage and said setting ring, said cam faces and pressure rollers being moveable relatively peripherally and adapted axially to displace said round carriage to disengage said pawl and ratchet gear between said machine body and said round carriage said counter ring of said round carriage forming said cam faces, said setting ring comprising pins, said pressure rollers rotatably mounted on said pins.

5. A calculating machine as set forth in claim 1, said means for transforming rotary movements of the setting ring into axial movements of the round carriage being formed as pawls, said pawls being arranged between said counter body of the round carriage and said setting ring and adapted axially to displace said round carriage to disengage said pawl

and ratchet gear between said machine body and said round carriage.

6. A calculating machine as set forth in claim 1, said means for transforming rotary movements of the setting ring into axial movements of the round carriage being formed as pawls, said pawls being arranged between said counter body of the round carriage and said setting ring, said setting ring comprising bearing bolts, said pawls being rotatably mounted on said bearing bolts and adapted axially to displace said round carriage to disengage said pawl and ratchet gear between said machine body and said round carriage.

7. A calculating machine as set forth in claim 1, said means for transforming rotary movements of the setting ring into axial movements of the round carriage being formed as pawls, said pawls being arranged between said counter body of the round carriage and said setting ring, said setting ring comprising bearing bolts, said pawls being rotatably mounted on said bearing bolts said counter ring comprising a radially toothed annular rib, said toothed annular rib forming a surface which is engageable by the ends of said pawls, said pawls being adapted axially to displace said round carriage to disengage said pawl and ratchet gear between said machine body and said round carriage.

8. A calculating machine as set forth in claim 2, said pawl and ratchet gear comprising a toothed annular rib arranged on said machine body, said pawl and ratchet gear further comprising pins arranged on

said counter body and adapted to enter into spaces between two adjacent teeth of said annular rib, said teeth having top faces, engageable by said pins during peripheral movements of said round carriage.

9. A calculating machine as set forth in claim 2, said pawl and ratchet gear comprising a toothed annular rib arranged on said machine body, said pawl and ratchet gear further comprising pins arranged on said counter body and adapted to enter into spaces between two adjacent teeth of said annular rib, said teeth having top faces, engageable by said pins during peripheral movements of said round carriage, said teeth having rounded portions between sides and top faces of said teeth.

10. A calculating machine as set forth in claim 1, said machine body comprising a collar adapted to form a bearing surface for said setting ring.

11. A calculating machine as set forth in claim 1, said machine body comprising detent springs, said setting ring comprising notches, said detent spring being adapted to spring into said notches, said notches and detent springs being adapted to facilitate the finding of the middle position of the setting ring.

12. A calculating machine as set forth in claim 1, said calculating machine being provided with knurled operating rings consisting of extensible material, said operating rings being adapted to embrace relatively rotatable parts.

13. A calculating machine as set forth in claim 1, said calculating machine being provided with knurled operating rings consisting of extensible material, said operating rings being arranged on the base of the casing and on the setting ring.

14. A calculating machine as set forth in claim 1, said calculating machine being provided with knurled operating rings consisting of extensible material, said operating rings being adapted to embrace relatively rotatable parts, said relatively rotatable parts comprising annular grooves adapted to receive said operating rings.

15. A calculating machine as set forth in claim 1, said calculating machine being provided with knurled operating rings consisting of extensible material, said operating rings being adapted to embrace relatively rotatable parts, functional elements such as screws, levers or the like arranged between said operating rings and said embraced parts and covered by said operating ring.

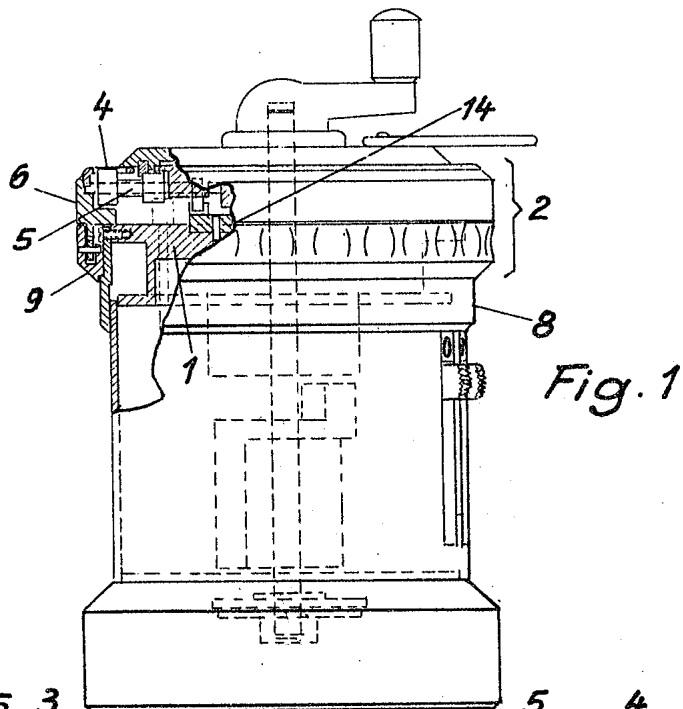


Fig. 1

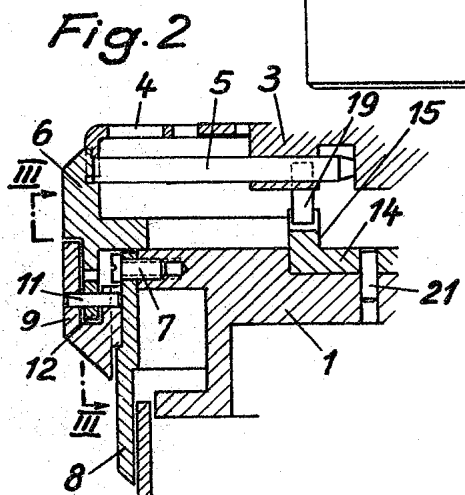


Fig. 2

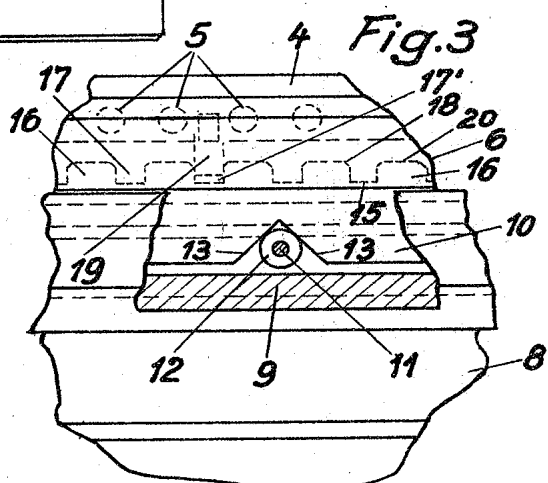


Fig. 3

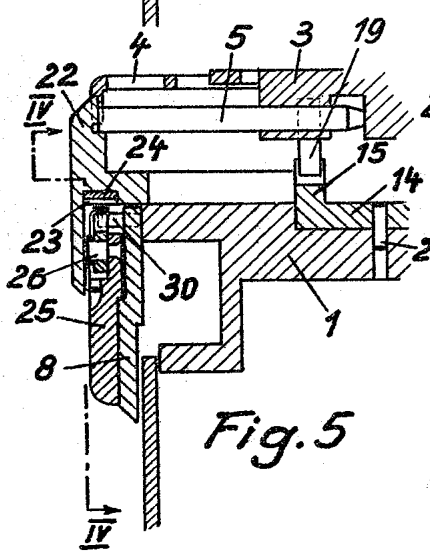


Fig. 5

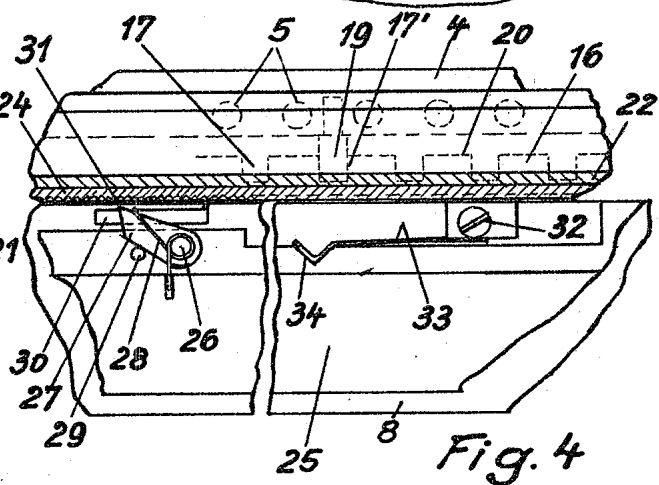


Fig. 4

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Fig. 6

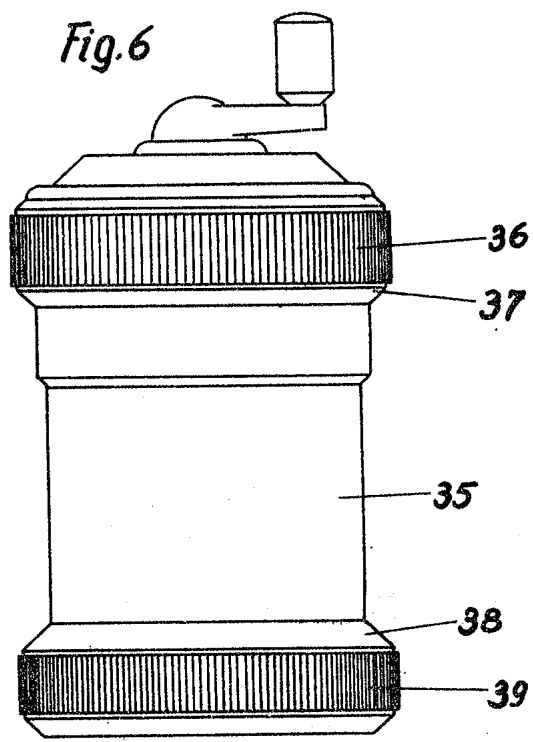
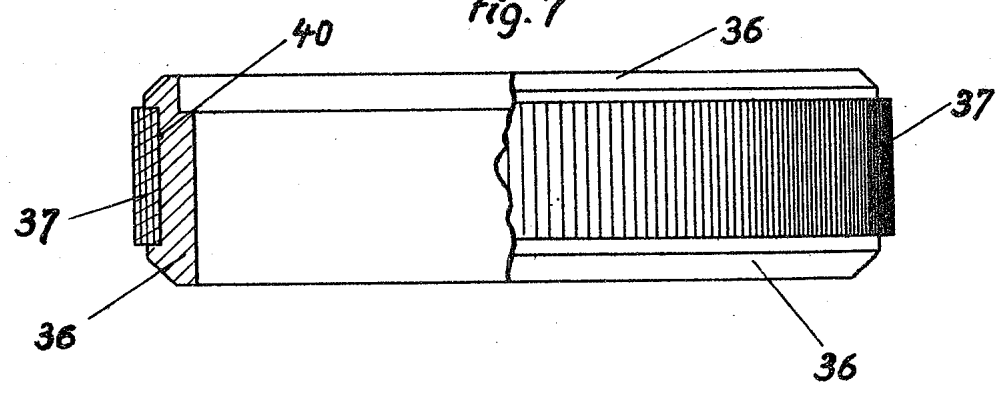


Fig. 7



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