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(19)



(54) DRAWING INSTRUMENT

(71) We, ROTRING-WERKE RIEPE KG., a body corporate organised under the laws of the German Federal Republic, of Kieler Strasse 301—303, 2000 Hamburg 54, German Federal Republic, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to a drawing instrument of the kind comprising at least one tubular or tube point pen mounted in a drawing head so as to be lowerable out of a raised rest position in which the front or writing end of its writing tube is located above the drawing substrate, into a drawing position in which the front end of its writing tube is in contact with the drawing substrate.

Drawing instruments of this kind have already been proposed and it is possible to employ more than one tubular pen in such a drawing instrument, in order to make it possible to draw different line widths without exchanging tubular pens. For this purpose it is only necessary, where a plurality of tubular pens is present in the drawing instrument, to lower selectively one of the tubular pens into the drawing position whilst the remaining tubular pens remain in their rest position.

Both with drawing instruments of the above-mentioned kind with a single tubular pen, and with drawing instruments which comprise a plurality of tubular pens, there is the risk of the ink becoming dry in the writing tube of a tubular pen when the latter is maintained in the rest position for a long time during an interruption of drawing operations, or whilst using another tubular pen. Such drying has the result that, when the tubular pen is lowered into the drawing position, it does not immediately draw with the full line width, whereby the operation of the drawing instrument is impaired.

According to the present invention there is provided a drawing instrument, wherein

the instrument comprises at least one tubular pen mounted in a drawing head so as to be lowerable out of a raised rest position in which the front or writing end of its writing tube is located above a drawing substrate into a drawing position in which the front end of its writing tube is in contact with the drawing substrate, and wherein for the or each pen, a movable seal element is provided and is mounted so as to be movable into a sealing position in which it fluid-tightly seals the front end of the writing tube of the pen when the pen is in said rest position, and out of said sealing position to permit the front end of the writing tube to assume said drawing position.

With the present drawing instrument drying of the ink in the writing tube can thus be substantially prevented or minimised.

This seal element is preferably pivotable laterally with reference to the writing tube, so that when the pen is in the drawing position the drawing operation is not impaired.

In the present drawing instrument, the writing tube of the or each pen is sealed when the pen is in its raised rest position, and this sealing is equivalent to the sealing which is effected by placing conventional hand-held tubular pens in socket stands or by putting cover caps on them, although socket stands and cover caps cannot be used to seal tubular pens in automatic drawing instruments. The seal element ensures that the tubular pen is always ready for drawing even after a long time in the rest position, so that no impairment of the automatic operation of the drawing instrument occurs.

In an automatic drawing instrument in which the tubular pen is maintained in the rest position by spring pressure and is urged into the drawing position by a controllable lift magnet provided in the drawing head, the seal element is preferably coupled pivotally to the lift magnet. For this coupling, the seal element may be fixed to a lever connected to the drawing head, and the lever

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may be in contact with a transverse pin connected to the lift magnet, so that, upon a downward movement of the lift magnet, the transverse pin is also moved downwards and thus pivots the lever, and with it the seal element, outwardly when the tubular pen is lowered into the drawing position by the lift magnet.

In a preferred embodiment, the sealing material consists of an elastic material and has the form of a section of a sphere, the spherical surface of which can be brought into contact with the front end of the writing tube. The elastic material preferably has a low wettability and may be, for example, a silicone rubber.

This construction of the seal element enables reliable sealing of the writing tube to be achieved, because as the seal element is elastically deformed when it is in contact with the front end of the writing tube, any dried ink which may adhere to the elastic material is flaked off and broken by the return of the spherical section into its original shape on moving away from the writing tube, so that the seal element does not become dirty or inoperative due to the deposition thereon of dried ink residues.

However, with the drawing instrument just described, there may, in certain circumstances, be the risk of damage to the seal element, and possibly even damage to the writing tube if it is for drawing very fine lines when the seal element which contacts the writing tube is pivoted laterally in order to unseal the writing tube and to clear the tubular pen for a downward movement into the drawing position, since in that case the front end of the writing tube is in contact with the seal element during the first part of the pivoting movement of the latter.

In order to eliminate these difficulties, the drawing instrument may be provided with a locking device which can be brought into engagement with the tubular pen in order to retain the tubular pen in its rest position until the seal element is pivoted completely out of the descending region of the tubular pen—i.e., the locking device makes it possible to pivot the seal element out of the sealing position without the front end of the writing tube being in contact with the seal element during this pivoting movement and at the same time exerts upon the seal element a force corresponding to the weight of the tubular pen and of any springs which may be present.

In the present drawing instrument having the locking device and a lift magnet for moving the tubular pen between the rest position and the lowered position, the seal element being attached to a lever connected to the drawing head and being pivotable by means of the lift magnet, the locking device may be constituted by an auxiliary lever arranged adjacent to the lever carrying the

seal element. The auxiliary lever comes into contact with or engages the tubular pen so as to retain it substantially in its rest position after the seal element has moved clear of the front end of the writing tube. After the lever has pivoted through a prescribed distance it comes into engagement with the auxiliary lever which is thereby brought out of engagement with the tubular pen.

If at least part of the tubular pen is made of ferromagnetic material, it is possible to provide magnetic means for holding the tubular pen in its rest position until the seal element has been moved completely out of the path of movement of the tubular pen.

In the present drawing instrument, at each descent of the tubular pen there occurs a pivoting of the seal element out of the region of the writing tube and upon the raising of the tubular pen a corresponding pivoting back in order to seal the writing tube. These movements occur even if the tubular pen is lifted merely in order to produce an interruption in a line to be drawn and then to be immediately lowered back on to the drawing substrate, for instance when drawing a dash line. In the case of such a drawing cycle, however, it is not necessary to seal the writing tube, since, during the extremely short period of time for which the tubular pen is returned into its rest position, there is no danger of the ink drying.

The drawing instrument can therefore be constructed so that the seal element is lockable in the laterally pivoted position, whereby the tubular pen can be moved to and fro between drawing position and rest position without a sealing of the writing tube occurring in each rest position.

In order to lock the seal element, a slide may be provided which is formed with a perforation or cavity for the lever and which is slidable at right-angles to the longitudinal direction of the lever and at right-angles to the direction of the pivotal movement of the lever, the lever in the sealing position being in contact with the bottom surface of the perforation or cavity and in the pivoted limit position resting upon a shoulder or a projection which lies at a distance from the bottom surface in the direction of the pivoting movement of the lever.

With this construction, therefore, the lever can be moved by the lateral pivoting into its limit position and a corresponding displacement of the slide to rest upon the shoulder or the projection, whereby the seal element is locked in its laterally pivoted position. This locking can be cancelled again by a corresponding movement of the slide and return of the lever to rest upon the bottom surface of the perforation or cavity.

The movement of the slide may be performed manually by the operator. It is however also possible to connect the slide, for example,

to a lift magnet, in order to have the slide movement performed thereby correspondingly to the desired operating cycle. In this case a time control means may be provided which, after a predetermined period of time, moves the slide so that the seal element returns into its sealing position and seals the writing tube, whilst the period of time is chosen so that this sealing is performed when the tubular pen has not been lowered into the drawing position for a certain time, so that it can be assumed that the tubular pen was not raised in order to obtain an interruption in the line stroke. This period of time is, for example, in the range of from 15 seconds to 30 seconds.

In order to determine the period of time and for the subsequent tripping of the lift magnet, a mechanical or electrical time element of known construction, for example, may be used. It is also possible that in case the drawing instrument is controlled by means of a programme, for instance a programme stored on punched tape, the corresponding control of the lift magnet after the elapse of a time period is allowed for in the programme.

In order to cause the slide to move when the lever is pivoted, whereby a simultaneous separate actuation of the slide manually or by means of the lift magnet is avoided, the surface extending between the bottom surface and the shoulder or projection may be so inclined with reference to the direction of the pivoting movement, and the lever can be guidable when the seal element pivots in contact with the inclined surface, so that the lever moves the slide by engagement with the inclined surface in the prescribed manner, and the slide needs only to be returned through a corresponding distance when the lever is present in the region of the shoulder or of the projection in order to lock the lever.

The movement of the slide out of its initial position preferably occurs against the action of a spring so that the locking of the lever by means of the shoulder or of the projection occurs automatically in the corresponding position of the lever.

If desired, a slide may be provided in the case of a drawing head which has a plurality of tubular pens and seal elements associated with them. In this case a perforation or cavity to receive a respective lever is formed in the slide for each of the tubular pens.

In order to enable the invention to be more readily understood, reference will now be made to the accompanying drawings, which illustrate diagrammatically and by way of example some embodiments thereof, and in which:—

Fig. 1 is a section through a drawing head of a drawing instrument,

Fig. 2 is a schematic side elevation of another drawing head,

Figs. 3a to 3e show schematically a slide

for a drawing head with three tubular pens,

Figs. 4a and 4b show in perspective, in a partial view obliquely from beneath, two tubular pens arranged in the drawing head according to Figs. 3a to 3e.

Referring now to Fig. 1 there is shown, in simplified form, a drawing head 5 of a drawing instrument, the remainder of which is not shown. A tubular or tube point pen 1 with a writing tube 2 arranged in its front or writing end is mounted in the drawing head. At the rear end of the tubular pen, there is provided a plate 3, so that a spring 4 surrounding the pen and bearing between the plate 3 and an internal flange of the drawing head urges the tubular pen 1 upwards into the rest position illustrated in the drawing. In the upper end of the drawing head 5 is mounted a lift magnet 6 which has a controllable actuating piston 7, which can be urged into a raised position by a spring 8 when the lift magnet is unenergised.

Where it is required to move the tubular pen into the drawing position, the lift magnet 6 is energised and the piston 7 moves downwards to engage the plate 3, whereby the tubular pen is urged downwards against the action of the spring 4 until the front end of the writing tube 2 is in contact with the drawing substrate and the drawing operation can be performed.

As soon as the lift magnet 6 is de-energised again, the tubular pen moves back into the rest position illustrated under the action of the spring 4.

Secured to the drawing head at 5 by means of a screw 12 is a sprung lever 11 which carries at its lower end a seal element 10 made of an elastic material, which has the form of a section of a sphere. As indicated, the lever 11 is bent so that it has a part extending laterally beneath the lower part of the drawing head 5.

A transverse pin 9 is also provided on the piston 7 of the lift magnet 6 and contacts the lever 11 in the illustrated raised or rest position of the piston 7. Therefore when the lift magnet 6 is energised and the piston 7 is moved downwards, the transverse pin 9 urges the obliquely oriented elastically deformable lever 11 outwards, so that the seal element 10 moves out of the region of the writing tube 2, which can then be lowered onto the drawing substrate without obstruction.

As soon as the lift magnet 6 is de-energised again, causing the piston 7 to be raised due to the action of the spring 8, then the pen returns into its raised position and, moreover, the lever 11 moves back into the position shown in the drawing, in which the seal element 10 fluid-tightly closes the lower end of the writing tube 2. In this way, therefore, drying of the ink in the writing tube is prevented in the raised rest position of the tubular pen.

The elastic sealing material from which the seal element 10 is made preferably has low wettability, in order to prevent ink from adhering to its surface, and silicone rubber, for example, is a suitable material.

However, if ink should nevertheless dry on the surface of the seal element 10 whilst the latter occupies the position illustrated, then this dried ink is removed when the lever 11 is pivoted laterally by the transverse pin 9, because the seal element is then no longer in contact with the writing tube 2 which was deforming the seal element elastically in order to achieve sealing, but the seal element reverts elastically into its original spherical sectional form. Due to this movement, the dried ink residues break away from the surface of the seal element 10 and the seal element can be used for the next sealing operation without impairment.

Referring now to Fig. 2 there is shown part of another drawing head, in which is mounted a tubular pen 21 with a writing tube 22. The pen is movable in the vertical plane between a raised rest position illustrated in the drawing and a lowered drawing position by means of a lift magnet 6 which is provided at the side of the tubular pen and which has a piston 27 which is moved downwards against the action of a spring 28 when the lift magnet is energised. This piston has a transverse pin 29 upon which, as shown, a shoulder of the tubular pen 21 rests so that a spring 24 braced against a stationary point of the drawing head and in engagement with the tubular pen 21 cannot press the tubular pen downwards so long as the lift magnet 26 is not energised.

Also fixed to the drawing head, by means of a screw 32, is an elastically deformable lever 31 extending obliquely to the front end of the tubular pen 21 and carrying at its lower end a seal element 30 consisting of elastic material which seals the writing tube 22 of the tubular pen 21 in the rest position. Also secured to the drawing head by means of the screw 32 is an elastically deformable auxiliary lever 34, the inclination of which to the vertical is less than that of the lever 31 and the front terminal region 35 of which, extending approximately horizontal, passes through an aperture, not shown, in the lever 31 and extends into the region of a ring shoulder or an offset of the tubular pen 21.

If the tubular pen 21 is required to be moved into its drawing position, then the lift magnet 26 is energised and its actuating piston 27 moves downwards, whereby a roller 33 attached to the free end of the transverse pin 9 pivots the lever 31 outwards so that the seal element 30 moves out of the region of the writing tube 22. Although the transverse pin 29 moves downwards, the spring 24 cannot at first move the tubular pen 21 out of its rest position, because the front end region 35 of the auxiliary lever 34 retains the tubular pen

by engagement with the ring shoulder of the pen.

Only after the lever 31 has pivoted through a certain angle due to the downward movement of the transverse pin 29 does the lever 31 come into contact with the auxiliary lever 34, so that the latter is then pivoted outwards conjointly with the lever 31 upon further downward movement of the actuating piston 27 and hence of the roller 33, whereby the lower end region 35 of the auxiliary lever 34 releases the tubular pen. At the time of this release the seal element 30 is already outside the region of the writing tube 22, and the tubular pen 21 can now move downwards into the drawing position under the action of gravity and the spring 24.

When the lift magnet 26 is de-energised, the tubular pen is returned by the force of the spring 28 back into its rest position in which the seal element 30 seals the writing tube 22.

Figures 3a to 3d and 4a and 4b illustrate a slide for locking the lever carrying the seal element in the laterally pivoted position, so that it is possible to lift the tubular pen out of the drawing position without the seal element coming into sealing engagement with the writing tube of the tubular pen, this arrangement being for a writing head with three tubular pens each of which has a lever 51, 52 or 53 respectively for supporting the seal element.

As will be seen in Figs. 3a to 3e the levers 51, 52 and 53 are only shown in section, and are arranged to be displaced by a slide 40 having cavities 43, 47 and 48 in a direction extending at right-angles to the longitudinal direction of the levers and at right-angles to the direction of the pivoting movement of these levers, namely from left to right and *vice versa* in the drawing.

Fig. 3a shows the position when the tubular pen associated with the lever 51 is in operation. In this position, the lever 51 is lifted from the bottom surface 44 of the cavity 43 and rests upon a projection 45, between which and the bottom surface 44 an inclined surface 46 extends. The cavities 47 and 48 have the same shape as the cavity 43 and are therefore not further described in detail. The levers 52 and 53 in the cavities 47 and 48 rest upon the bottom surface of these cavities, so that the relevant tubular pens are sealed.

If it is now required to bring the pen associated with the lever 52 into use instead of the tubular pen associated with the lever 51, then the tubular pen associated with the lever 51 is raised into its rest position and the lever 52 is pivoted in the manner previously described so that it slides along the inclined surface of the cavity 47 and thereby moves the slide 40 to the left against the action of a spring 41 through the distance indicated between the Figs. 3a and 3b. This

displacement is sufficient to make the lever 51 move clear of the projection 45 so that, due to its elasticity, it is pivoted back to the bottom surface 44 and brings the seal element attached to it into sealing engagement with the writing tube of its tubular pen. Since furthermore the lever 52 is raised into the region of the projection of the cavity 47, the slide 40 can return by spring action into its initial position and the position shown in Fig. 3c is obtained, in which the lever 52 is locked so that the tubular pen associated with it is movable between the drawing position and the rest position without movement of the seal element.

If all the tubular pens have been brought into the rest position and if they are all required to be sealed there, then it is only necessary to move the slide 40 manually to the left out of the position shown in Fig. 3c by pressure upon a knob 42, whereby the lever 52 then moves clear of the projection of the cavity 47 and due to its elasticity comes into contact with the bottom surface of this cavity, whereupon the slide 40 then returns into its initial position due to the action of the spring 41 and the position shown in Fig. 3e is obtained, i.e., all the tubular pens of the writing head are sealed by means of seal elements.

If desired, the displacement of the slide 40 in order to seal all the tubular pens may also be performed by means of a lift magnet, and in particular this movement may be tripped when none of the tubular pens have been lowered into the drawing position during a predetermined period of time. For this purpose it is only necessary to determine the required period of time by means of a mechanical or electrical time element, so that after the expiry of this period of time without the lowering of a tubular pen into the drawing position, the slide movement is tripped, possibly by energising a corresponding lift magnet which attacks the slide directly or indirectly.

Further details of the locking arrangement are illustrated in Figs. 4a and 4b, in which only the levers 51 and 52 visible in Figs. 3a to 3e are shown with their associated tubular pens and auxiliary levers.

As will be seen, the levers 51 and 52, which carry seal elements 70 and 71 for the tubular pens 61 and 62, are attached by means of screws 72 and 73 respectively to the drawing head, and the auxiliary levers 54 and 55 are also attached to the drawing head by means of these screws. The lower terminal regions of these auxiliary levers extend through apertures 56 and 57 in the levers 51 and 52 and in the unpivoted position of the levers 51 and 52 they are in engagement with the respective tubular pen 61 and 62 as is indicated by the broken away region in Fig. 4a and was also described in conjunction with Fig. 2 for the auxiliary lever 34.

As already shown in Figs. 3a to 3e, the

lever 51 extends through the cavity 43 and the lever 52 through the cavity 47 of the slide 40, while the position of the levers shown in Fig. 4a corresponds to the position of the levers shown in Fig. 3e, and the position of the levers shown in Fig. 4b corresponds to the position of the levers shown in Fig. 3a i.e., in Fig. 4b the lever 51 is locked by resting upon the projection 45 of the cavity 43 so that the tubular pen 61 is movable to and fro between the drawing position and the rest position without the sealing of its writing tube by means of the seal element 70 taking place.

WHAT WE CLAIM IS:—

1. A drawing instrument, wherein the instrument comprises at least one tubular pen mounted in a drawing head so as to be lowerable out of a raised rest position in which the front or writing end of its writing tube is located above a drawing substrate into a drawing position in which the front end of its writing tube is in contact with the drawing substrate, and wherein for the or each pen, a movable seal element is provided and is mounted so as to be movable into a sealing position in which it fluid-tightly seals the front end of the writing tube of the pen when the pen is in said rest position, and out of said sealing position to permit the front end of the writing tube to assume said drawing position.

2. A drawing instrument as claimed in Claim 1, wherein the seal element is pivotable laterally with reference to the writing tube.

3. A drawing instrument as claimed in Claim 1 or 2, wherein a spring is provided to maintain the tubular pen in its rest position, and a controllable lift magnet is provided in the drawing head to move the pen into its drawing position, and wherein the seal element is pivotally coupled to the lift magnet.

4. A drawing instrument as claimed in Claim 3, wherein the seal element is fixed to a lever connected to the drawing head and wherein a transverse pin connected to the lift magnet contacts said lever and is arranged to pivot the lever outwards upon downward movement of the lift magnet.

5. A drawing instrument as claimed in any one of Claims 1 to 4, wherein the or each tubular pen has associated with it a locking device which can be brought into engagement with the tubular pen to maintain the tubular pen in its rest position until the seal element has been moved completely out of the path of movement of the tubular pen.

6. A drawing instrument as claimed in Claims 4 and 5, wherein the locking device is constituted by an auxiliary lever arranged adjacent to the lever carrying the seal element, the auxiliary lever engaging or being arranged to engage the front end of the tubular pen so as to maintain it substantially in its rest position after the seal element has moved

clear of the writing tube, and wherein the lever carrying the seal element is arranged to engage the auxiliary lever after it has pivoted through a prescribed distance thereby to move the auxiliary lever out of engagement with the tubular pen.

7. A drawing instrument as claimed in Claim 5 or 6, wherein means are provided for locking the seal element in its laterally pivoted position.

8. A drawing instrument as claimed in Claim 7 wherein said locking means is a slide which is formed with a perforation or cavity for the reception of the lever carrying the seal element and which is slidable at right-angles to the longitudinal direction of the lever and at right-angles to the direction of its pivoting movement, and wherein the lever is, in the sealing position, in contact with the bottom surface of the perforation or cavity and in its pivoted limit position rests upon a shoulder or a projection which is located at a distance from the bottom surface in the direction of the pivoting movement of the lever.

9. A drawing instrument as claimed in Claim 8 wherein the surface extending between the bottom surface and the shoulder or projection of the side is inclined with respect to the direction of the pivoting movement and wherein the lever is guidable in contact with the inclined surface during pivoting of the seal element.

10. A drawing instrument as claimed in Claim 8 or 9, wherein the slide is movable out of its initial position against the action of a spring.

11. A drawing instrument as claimed in any

one of Claims 8 to 10, wherein the instrument has a plurality of tubular pens mounted in the writing head and a seal element associated with each pen, and wherein the slide has a perforation or cavity for the reception of the respective lever of each tubular pen.

12. A drawing instrument as claimed in any one of Claims 1 to 4, wherein at least part of the tubular pen is made of ferromagnetic material, and wherein magnetic means are provided for holding the tubular pen in its rest position until the seal element has been moved completely out of the path of movement of the tubular pen.

13. A drawing instrument as claimed in any one of Claims 1 to 12, wherein the seal element consists of an elastic material and has the shape of a section of a sphere the spherical surface of which can be brought into contact with the front end of the writing tube.

14. A drawing instrument as claimed in Claim 13, wherein the elastic material is a silicone rubber.

15. A drawing instrument substantially as hereinbefore described with reference to Fig. 1, or Fig. 2, or Figs. 3 and 4 of the accompanying drawings.

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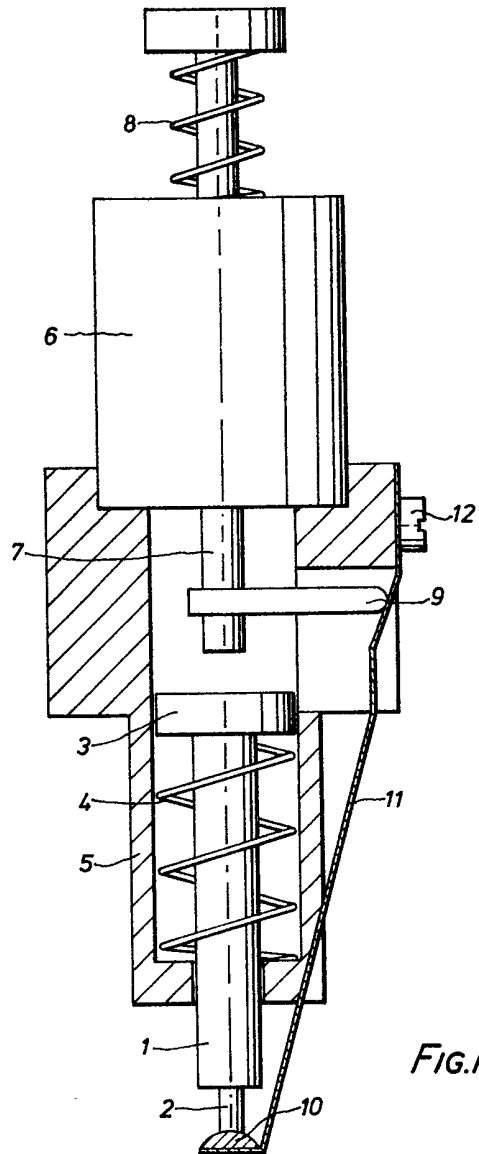
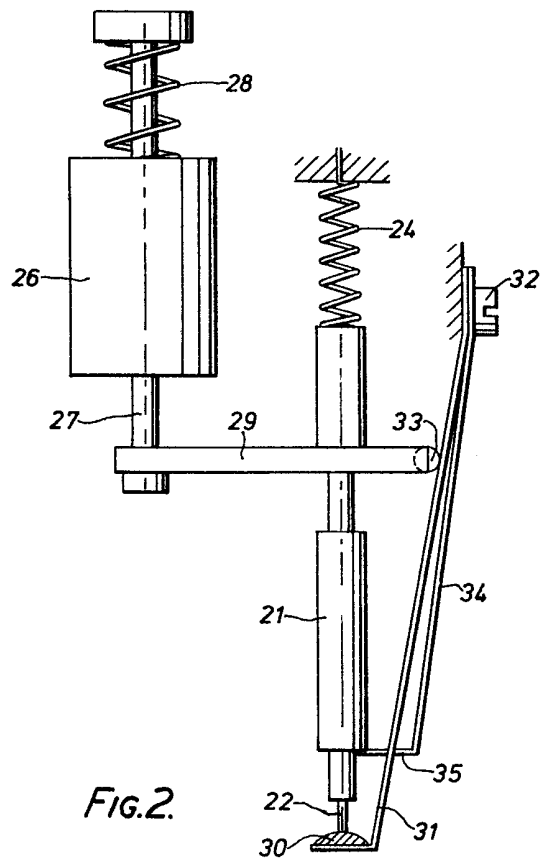


FIG. 1.



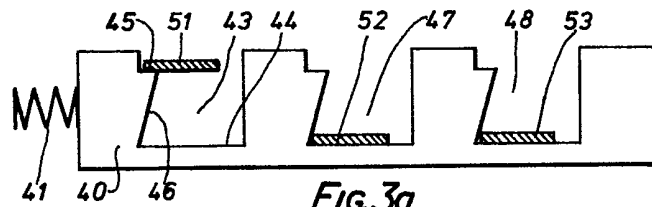


Fig. 3a.

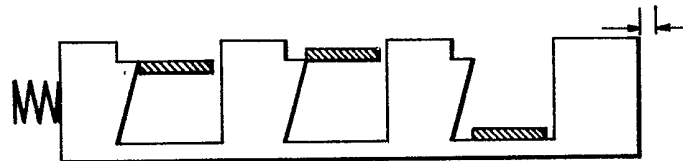


Fig. 3b.

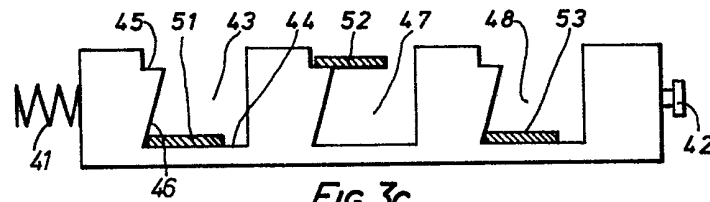


Fig. 3c.

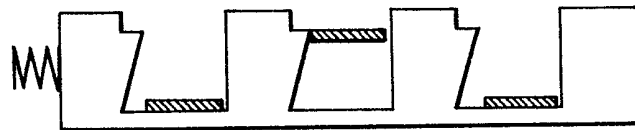


Fig. 3d.



Fig. 3e.

