

May 15, 1945.

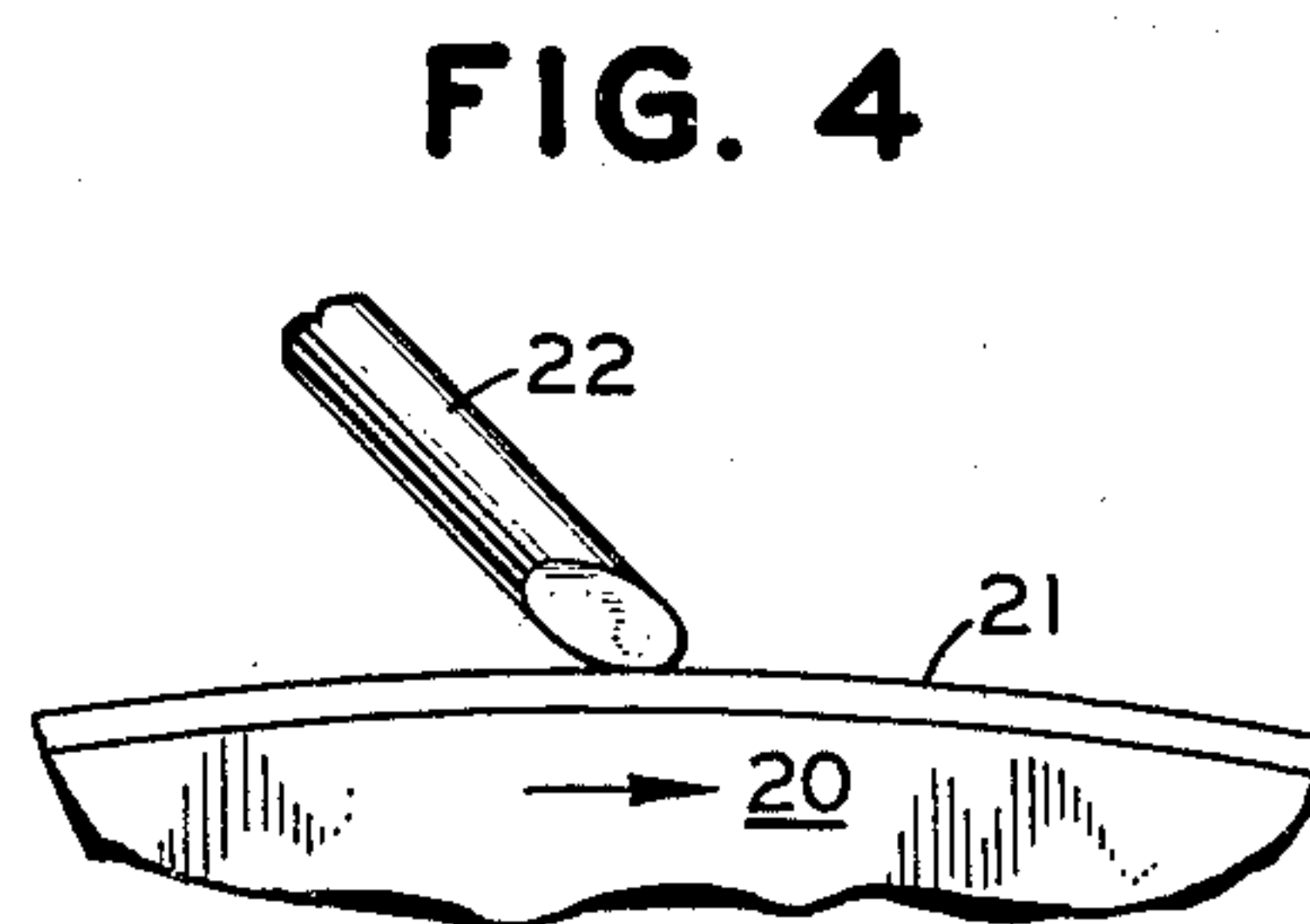
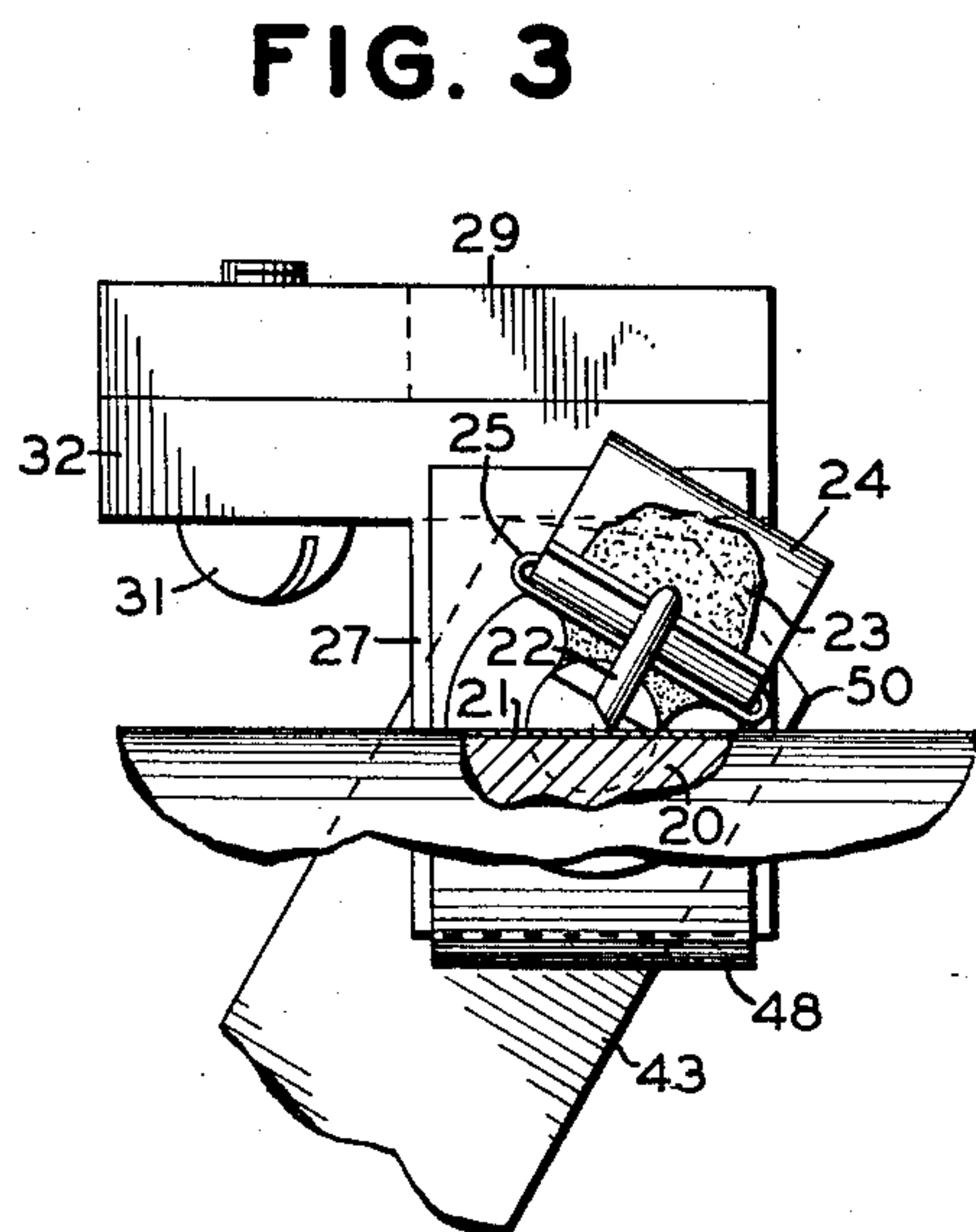
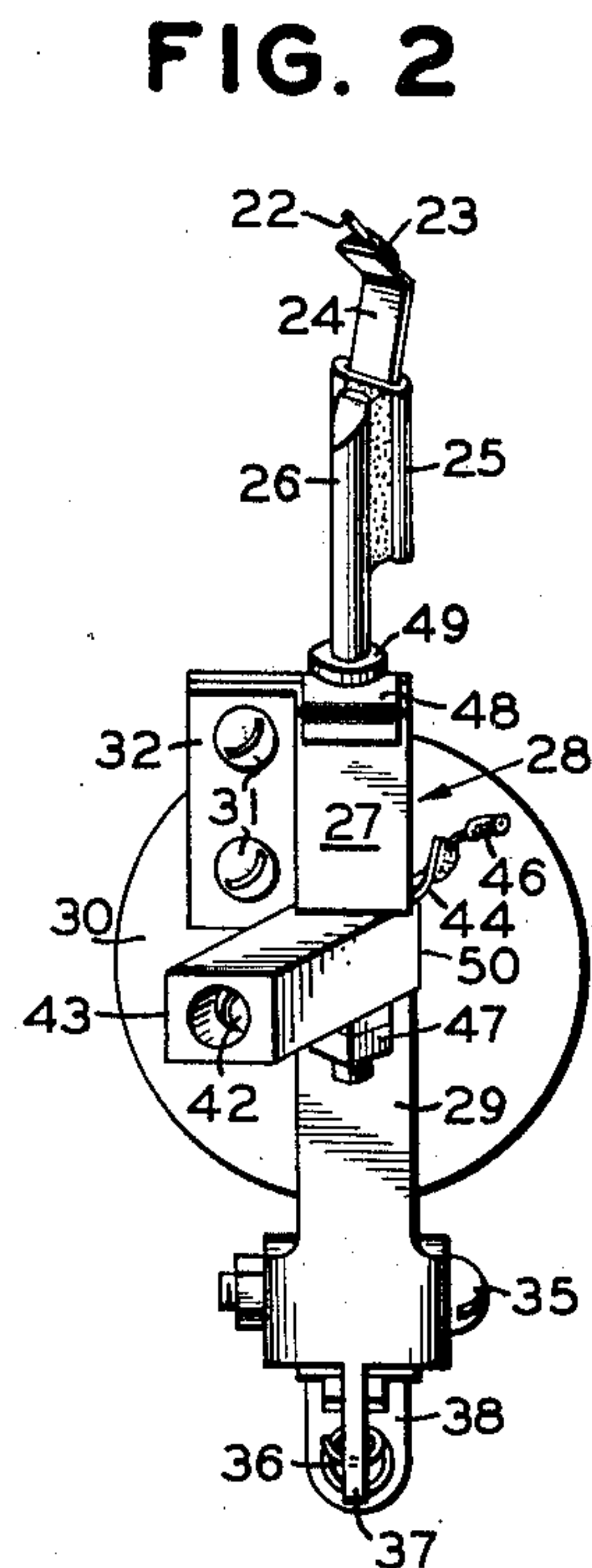
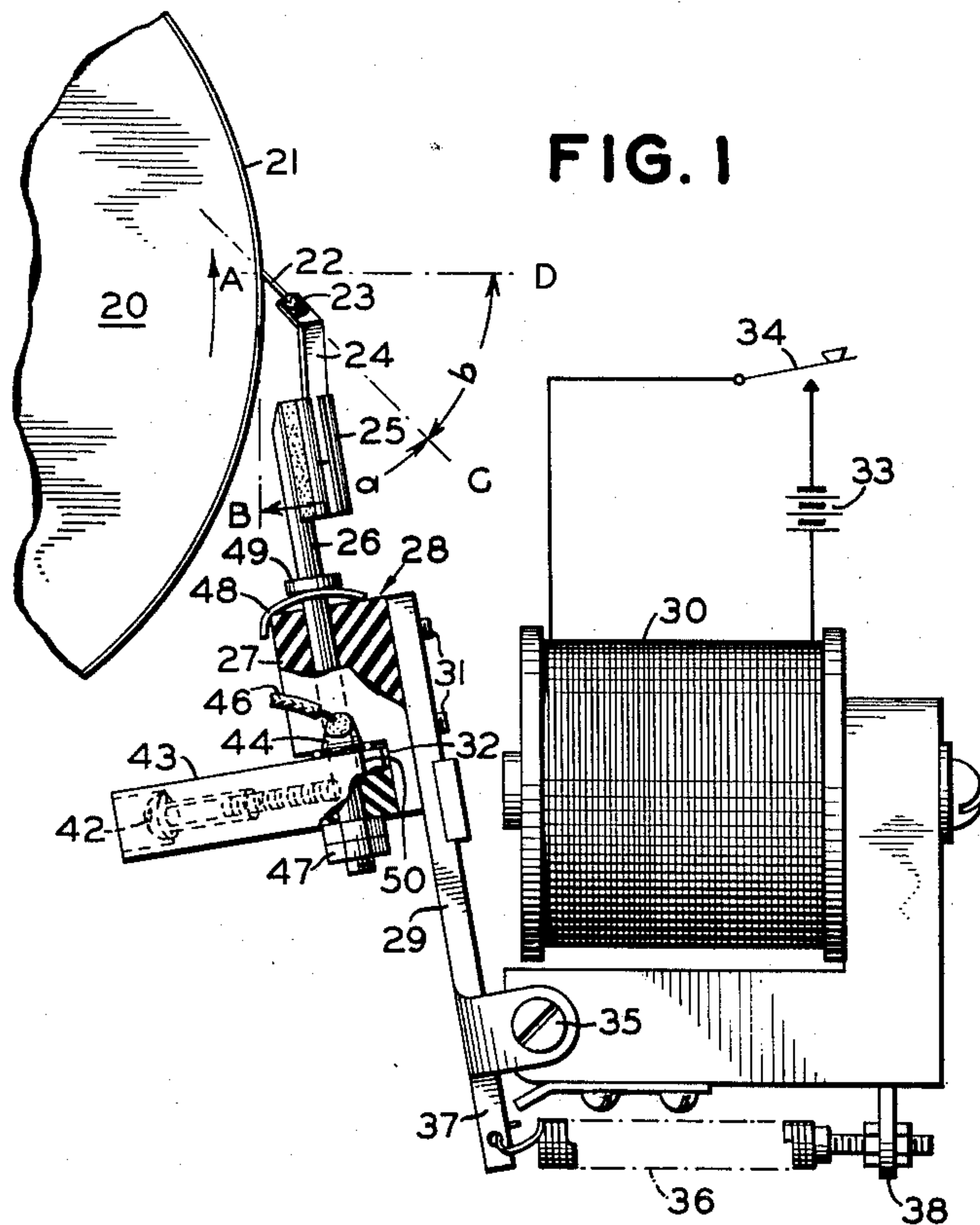
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2,375,820

ADJUSTABLE STYLUS FOR FACSIMILE RECORDERS

Filed Feb. 11, 1942

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 5

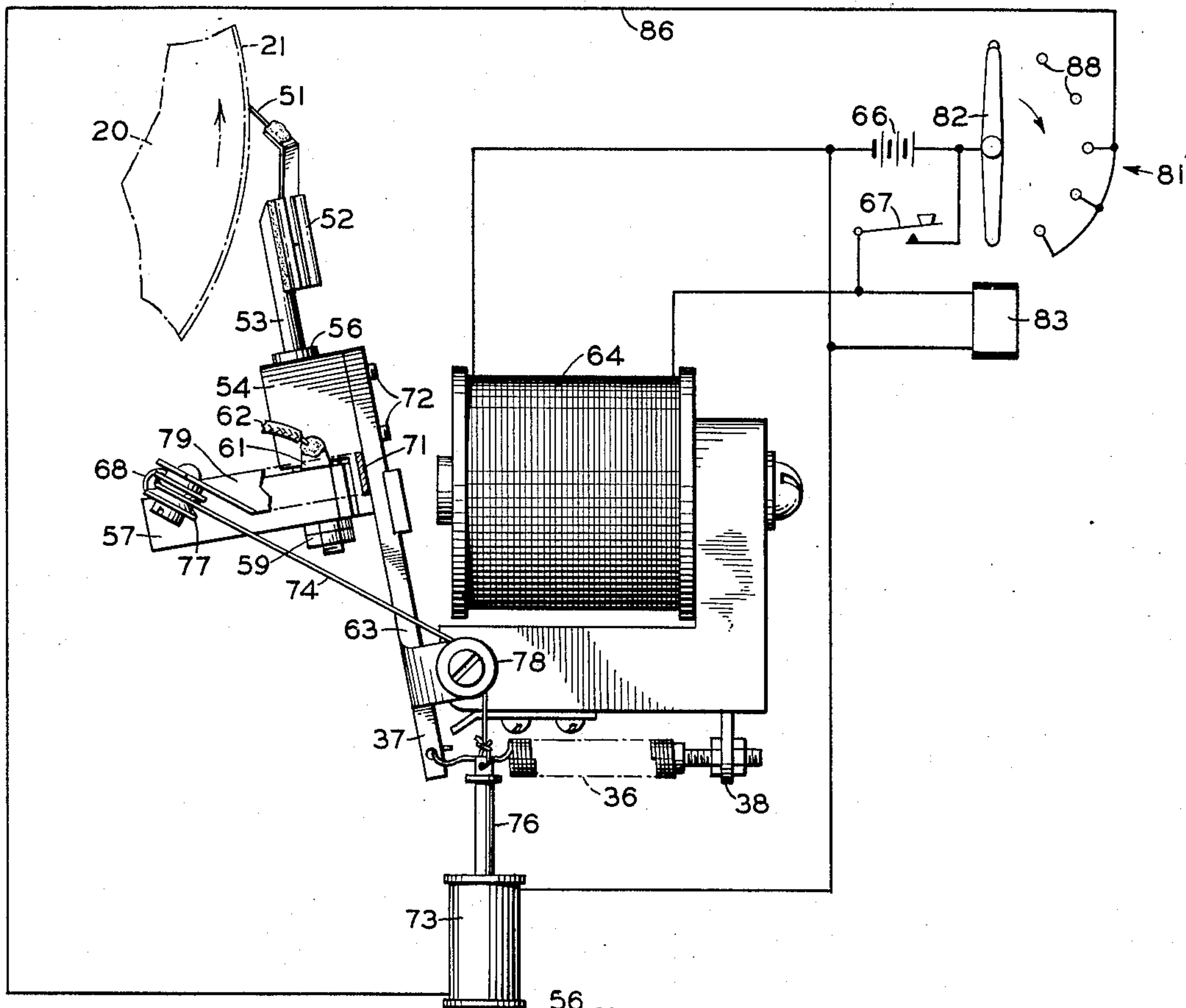
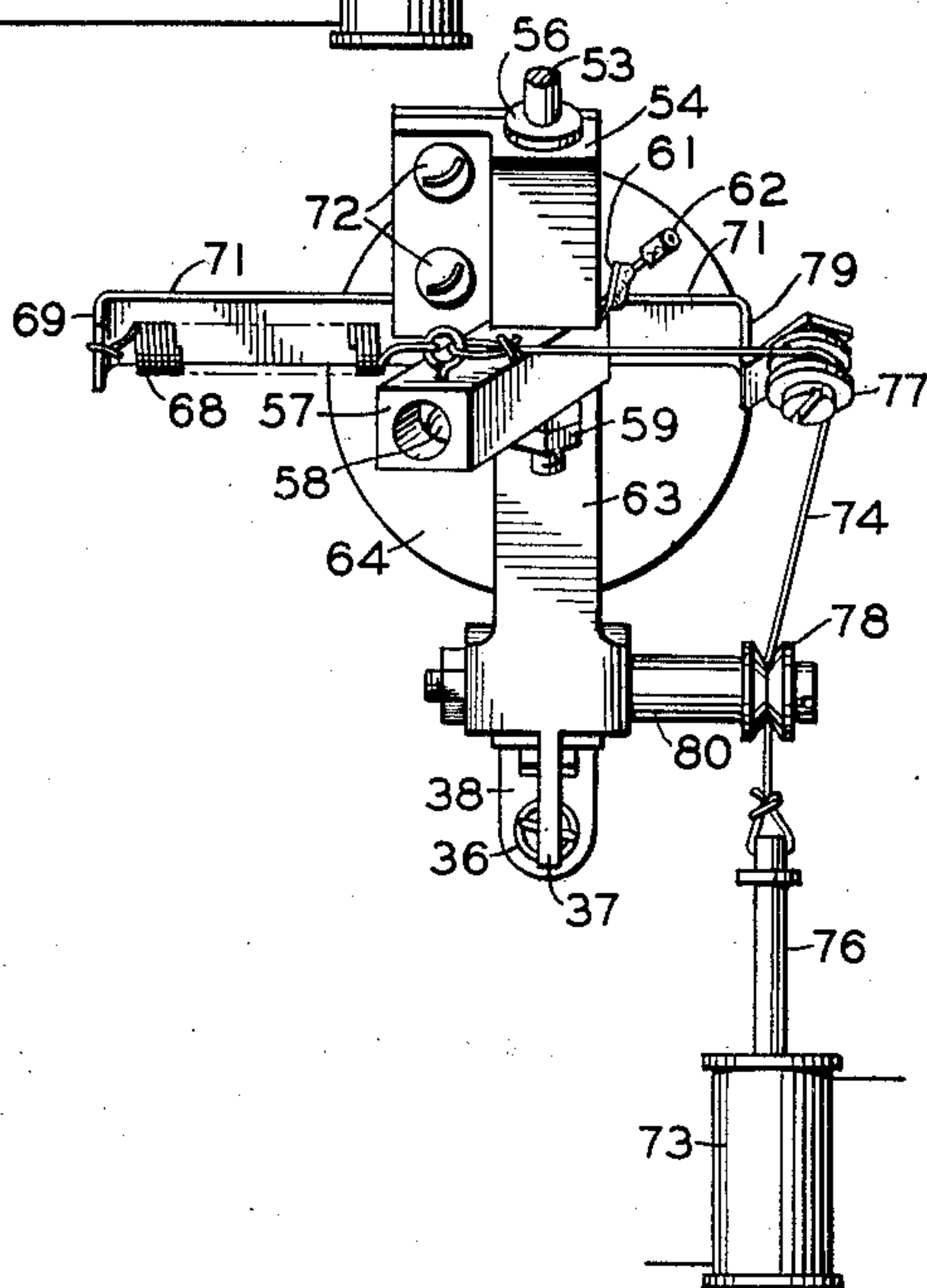


FIG. 6



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## UNITED STATES PATENT OFFICE

2,375,820

ADJUSTABLE STYLUS FOR FACSIMILE  
RECORDERS

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3 Claims. (Cl. 234—70)

The present invention relates to recording telegraph systems of the type employing an electrical recording stylus for applying electrical energy to a recording medium to produce a record thereon.

Systems of this type usually include an electrically conductive supporting surface for a recording blank, such, for example, as a recording cylinder around which the recording blank is wrapped, although a support which remains stationary or other types of movable supports for the recording blank can be used. Relative movement between the blank and the stylus is obtained by various means to produce scanning of the blank by the stylus for recording purposes. Such movement produces friction so that the end of the stylus is worn flat with the result that the recorded marking on the blank becomes blurred and loses the desired sharp definition. Where the stylus rests on the surface of the blank at a trailing angle, an arrangement which is desirable for mechanical reasons, the flattened end of the stylus becomes elliptical in outline and exaggerates the blurring and, therefore, further reduces the sharpness of definition. In practising the present invention, the effect of wear on the stylus and the possible increase of this effect because of the desired inclination of the stylus with respect to the blank is entirely overcome.

An object of this invention, therefore, is to provide a stylus mechanism for a recording telegraph, constructed and arranged to compensate for the flattening discussed above, by presenting a fresh stylus bearing surface of relatively small area and minimum width to the recording blank, either periodically or after operation for any desired length of time.

A further object is to provide a novel method of controlling the stylus in machines of the type set forth so as to provide sharp definition of the recorded subject matter throughout the life of the stylus.

A still further object of the present invention is to provide an improved construction of stylus holder for a recording telegraph system or the like.

Still another object of the present invention is to provide for automatically changing the angle which the worn portion of the stylus makes with the recording surface between a recording operation or series of operations.

These and other objects, which will be apparent to those skilled in the art, are accomplished by the present invention, several illustrative embodiments of which are shown in the accompanying drawings, in which:

Fig. 1 is a view, in side elevation, of a stylus mechanism constructed in accordance with one embodiment of the invention and forming part of a recording telegraph having a metallic recording cylinder, a part of which is shown;

Fig. 2 is an elevational view of the stylus mechanism taken from the left of Fig. 1;

Fig. 3 is a fragmentary view on an enlarged scale, partially in section, showing the angular relationships which the stylus may assume with respect to the recording surface to overcome the effect of stylus wear;

Fig. 4 is a fragmentary partial section, showing the effect of wear on the stylus and the manner in which the mechanism of this invention functions to overcome such effect;

Fig. 5 is a view similar to Fig. 1 of a modified form of stylus mechanism; and

Fig. 6 is an elevational view of the stylus mechanism of Fig. 5 taken from the left.

In the embodiment of the invention illustrated by Figs. 1 and 2 of the drawings, the stylus holder is constructed to yieldingly press the end of the stylus into engagement with the surface of a suitable recording medium, such as a recording paper, capable of being marked by the passage of a recording electric current to the paper from the stylus. Such a recording paper is disclosed in Patent No. 2,251,742, dated August 5, 1941.

As disclosed in Patent No. 2,346,675, dated April 18, 1944, the best definition is obtained when the end of the stylus in contact with the recording paper assumes a crater-like formation, this crater producing a concentration of marking current at the central portion of the stylus so that the trace produced by the stylus is of considerably less width than the width of the end surface of the stylus in contact with the recording surface. The formation of this crater occurs rapidly when a new stylus is applied to the paper and current is passed therethrough to the paper, providing the end of the stylus makes limited contact only with the paper so as to provide a point of high current density. As long as the marking current flows through the stylus to the paper, the desired crater-like formation is retained, but during no-current periods, as between the lines of a telegraph message, the frictional engagement of the stylus with the paper tends to wear the stylus flat. If the no-current periods sufficiently predominate over the intervals of applied current, the stylus will eventually wear to the contour of the paper surrounding the drum. As this condition is approached, the current is distributed over a larger area of the stylus and the current



density at no point is sufficient to cause the crater to re-form. This difficulty is overcome in accordance with the present invention by changing the angle of contact of the stylus with respect to the paper so as again to provide a sufficiently small area of contact of the stylus with the paper to permit re-formation of the crater. This may be accomplished by tilting the stylus so as to lift the worn contacting surface of the stylus from the recording surface of the paper, thereby leaving only an edge in contact with the paper. Means for conveniently making such an adjustment of the stylus point is shown in the drawings.

The stylus mechanism of the invention is shown in connection with a rotary recording drum 20 having a sheet of recording paper 21 mounted on the surface thereof. A stylus 22 is secured at 23, as by soldering or welding, to a yieldable member in the form of a flat spring 24. A stylus mounting member 25 detachably receives the spring 24 in the manner set forth and claimed in applicants' copending application, Serial No. 406,214, filed August 9, 1941. The mounting member 25 is secured in any suitable manner to a shaft 26 which is rotatably mounted in the upstanding portion 27 of an insulating piece 28. The point of intersection of the axis of the stylus with the surface of the recording paper preferably coincides with the axis of the shaft 26 as shown in Fig. 1 of the drawings. The insulating piece 28 is secured on the armature 29 of an electromagnet 30 by screws 31 or other desired fastening means engaging a laterally extending portion 32 of the insulating piece 28. The electromagnet is energized by current from any desired source 33 controlled by a suitable switch 34 or the like. It will be understood that in telegraph or facsimile recorders, the electromagnet 30 will usually be automatically controlled for the purpose of positioning the stylus in operative or inoperative position. The armature 29 is pivotally supported on a pin 35 and a spring 36 connects an extension 37 of the armature to a bracket arm 38 normally to press the end of the stylus into engagement with the surface of the recording paper in a yielding manner. When the electromagnet 30 is energized, the armature 29 is moved against the tension of the spring 36 to remove the stylus 22 from engagement with the recording paper.

A set screw 42 extends longitudinally of a handle member 43 and secures it to the shaft 26. A terminal lug 44 in electrical contact with the shaft 26 provides a connection for the conductor 46 over which electrical recording impulses are conveyed to the stylus 22. A nut and check nut combination 47 engages the threaded end of the shaft 26 to assist in maintaining the parts in assembled relationship. Frictional engagement of the shaft 26 with the insulating piece 28, whereby the stylus is maintained in its position of adjustment, is provided by a spring member 48 which is seated on the insulating piece 28 and frictionally presses against a collar 49 formed on the shaft 26. The end of the handle member 43, adjacent the laterally extending portion 32 of the insulating piece 28, is given a slight V-shape, as shown in Fig. 3, whereby each edge 50 thereof is spaced from the portion 32 that swinging movement of the handle member is limited to approximately 20° each way from the vertical position with respect to the portion 32 or a total range of movement of approximately 40°. It is obvious that any other convenient means may be employed to limit swinging movement of the handle

member 43. Fig. 3 shows the position of the parts after the handle 43 has been moved angularly through approximately 40° following a period of stylus wear.

With the drum 20 rotating in the direction of the arrow on Fig. 1 of the drawings, the stylus 22 trails on the surface of the recording paper 21, since it lies in a plane which is inclined with respect to the recording surface. As indicated in Fig. 1, line A—C lies in the plane of the stylus, this plane forming an angle  $b$  with respect to a plane normal to the recording surface and also an acute angle  $a$  in the direction of marking, which in the illustrative example is opposite to the direction of movement of the surface of the cylinder. The stylus is preferably additionally tilted laterally with respect to the linear elements of the cylinder, in the plane of inclination thereof as shown in Fig. 3 of the drawings. The angle of tilt shown by Fig. 3 of the drawings is adjustable from one side of the normal to the other by moving the handle member 43 to rotate the shaft 26. In the embodiment of Fig. 1, when the drum and the recording blank are rotated in the direction of the arrow to produce the desired relative movement between the recording paper and the adjacent end of the stylus, the resulting friction ultimately flattens the end of the stylus by wear, as shown in Figs. 3 and 4 of the drawings, with the result that the marking produced on the blank loses the desired sharp definition. When this occurs, it is only necessary to move the handle member 43 from one end of its range of movement to the other. This tilts the stylus in the plane of inclination from the position shown in Fig. 3 to a position on the opposite side of the normal to the cylinder, or vice versa, with the result that a fresh bearing surface of relatively small area formed by the edge of the flattened face is brought into contact with the recording paper thus restoring the sharp definition of the marking produced on the blank. It will be noted that the worn and flattened face is of relatively large area, since it is in the form of an ellipse, the major axis of which is longer than the diameter of the stylus. Upon tilting the stylus by moving the handle member 43 to the opposite end of its range of movement, the edge of this elliptical surface bears against the recording surface and as recording proceeds, the area in contact with the recording surface increases. In the event that the subject matter to be recorded presents a substantially uninterrupted flow of recording current, it will be sufficient to operate the stylus without moving the handle member 43 until quite a lengthy piece of subject matter has been entirely recorded, since the crater formed initially will be effectively maintained, as pointed out previously.

Another, and in some respects less desirable, mode of operation of the stylus adjusting mechanism to correct for stylus wear is to set the handle member 43 at some point between the extreme positions of its range of movement after the recorder has been operated until the stylus is only partially worn to elliptical form. This will bring the edge formed by the intersection of two worn surfaces at the end of the stylus into engagement with the recording surface. Following operation of the recorder for a recording period approximately equal to the recording period preceding previous adjustment of the handle 43, the handle may again be set to either of its extreme positions of adjustment, thereby obtaining a portion of the stylus for contact with



the recording surface which is less in width than the diameter of the stylus and less in area than the total area of the worn end of the stylus. Further operation then may be obtained by again setting the handle member at some point between the extreme positions of its range of movement. The initial step of the mode of operation just described may be employed when operation is to be resumed with a partly worn stylus which presents an area of contact with the recording surface sufficiently great to prevent formation of the crater referred to previously.

By employing either method of operation, the stylus may be used for recording until substantially the entire projecting end of the stylus has been used up. Waste resulting from clipping the stylus to sharpen it is eliminated, and when a new stylus is needed, it can be quickly and easily substituted in the manner described above.

Figs. 5 and 6 of the drawings disclose a modification in which the stylus is tilted automatically between recordings or between a selectable number of recordings. The stylus mechanism is shown as cooperating with a rotary recording drum in the manner of Fig. 1. However, it will be understood that any of the previously mentioned variants may be employed. The stylus 51 and the stylus holder 52 may be the same as disclosed in connection with Figs. 1 to 3 of the drawings. The stylus holder 52 is secured, as previously described, to a rotatably mounted shaft 53 which is journaled in an insulating piece 54, shown as being similar to the insulating piece 28 of Figs. 1 to 3 of the drawings. The shaft 53 is provided with a collar 56 which rests against the insulating piece 54 to locate the shaft longitudinally in the insulating piece. An operating member 57, which may be similar in structure to the handle member 43 of Fig. 1, is secured to the shaft 53 by means of a set screw 58, and a nut and check nut combination 59 assists in maintaining the parts in assembled relationship. Swinging movement of the operating member 57 is limited in the manner described in connection with the handle member 43 shown in Figs. 1 to 3 of the drawings. A terminal member 61 provides a convenient connection for the conductor 62 which conveys potential differences to the recording stylus 51. The insulating piece 54 is carried on the armature 63 of an electromagnet 64 which may be similar to the electromagnet 30 shown in Fig. 1 of the drawings. The electromagnet 64 is energized by current from any desired source 66 controlled by a suitable switch 67 or the like.

In order that the stylus may be adjusted automatically at predetermined intervals of time, or between recordings or a selectable number of recordings, the previously described operating member 57 is spring-biased to one of its extreme angular positions by means of spring 68 which is secured at one end to an upstanding arm 69 of a bracket member 71 which is clamped between the insulating piece 54 and the armature 63 by means of screws 72. The operating member 57 is moved against the action of the spring 68 to its other extreme position of adjustment by an electromagnet 73 which may be secured to any convenient stationary portion of the supporting structure for the scanning apparatus. A cord or strand 74 is secured at one end to the core 76 of the electromagnet 73 and passes over the pulleys 77 and 78 and is connected at its other end to the operating member 57. The pulley 77 is rotatably carried on a second upstanding arm 79

of the bracket member 71. The pulley 78 is located on the mounting pin 80 which pivotally supports the armature 63 of the electromagnet 64. By locating the pulley 78 at or near the point of pivotal connection of the armature 63, the effect of movement of the armature upon the adjustment of the stylus 51 will be substantially eliminated. When the electromagnet 73 is de-energized, the operating member 57 will occupy the position shown in Fig. 6 and to obtain adjustment of the position of the stylus to compensate for wear it is only necessary to energize the electromagnet 73. One way of accomplishing this in a convenient manner is by providing a stepping switch 81 of the multicontact type, as illustrated diagrammatically in Fig. 5 of the drawings. The switch 81 may be of any type having a contact arm 82 which is stepped to the next succeeding contact upon energization of the stepping switch magnet 83. In the arrangement shown the stepping switch magnet 83 is arranged to be controlled by the switch 67 so that for every operation of the switch 67 the contact arm 82 will be stepped to the next succeeding contact. In some instances it may be desirable to change the stylus adjustment following three successive recordings and to accomplish this a conductor 86 which provides operating current for the electromagnet 73 from the source 66 is connected to three successive contacts 88 of the stepping switch, the remaining three contacts being idle. If desired, the conductor 86 may be connected to alternate contacts 88 of the stepping switch 81, thereby providing for stylus adjustment between each recording. In a similar manner the conductor 86 may be connected to any desired combination of contacts 88 thereby obtaining adjustments of the stylus 51 at any time with respect to recording operations.

With any desired connection of the contacts 88 and the stepping switch magnet 83, depending on the circumstances of use of the scanning apparatus, the modification just described will automatically provide sharp clean-cut recordings throughout the life of the stylus.

From the foregoing it will be seen that this invention provides a ready means for adjusting a recording stylus so that the useful part of the stylus may be used up without changing the stylus or resorting to difficult resharpening or reconditioning operations.

While the invention has been described and shown in connection with two illustrative embodiments thereof, it will be understood that many modifications and changes may be made in the structures shown without departing from the essential attributes of the invention and all such changes are contemplated as coming within the scope of the appended claims.

What is claimed is:

1. The combination in a mechanism for marking a record receiving medium including a recording stylus for producing a recording thereon, of means for holding said stylus in contact with said medium in a predetermined angular relationship thereto for relative movement across the surface thereof, means for varying the angular position of the body of said stylus with respect to the surface of said medium to decrease the area of contact of the stylus and said medium, means for raising said stylus from operative contact with said medium, and electrically controlled means operable during the operation of said last named means to cause operation of said second mentioned means.



2. In a recorder, a record receiving medium, a recording stylus, a holder for said stylus capable of angularly adjusting the inclination of the body of said stylus with respect to the surface of said medium, electromagnetic means for raising said stylus from operative contact with said medium, additional electromagnetic means in circuit with said first electromagnetic means, and means controlled by said last mentioned electromagnet for operating said holder to modify the angle of inclination of the body of said stylus relative to the recording surface.

3. In a mechanism for marking a record receiving medium, the combination of a recording stylus for producing a record thereon, means for

5 holding said stylus in contact with the surface of said medium in a given angular relationship thereto, for relative movement across the surface thereof, and electrically operated means for changing the angle of inclination of the body of said stylus relative to the surface of said medium following one or more recording operations to compensate for the flattening effect of such movement on said stylus and to present a fresh bearing surface which is substantially a line of contact between said stylus and said recording surface in the direction of a scanning line.

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