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STYLUS ASSEMBLY

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2 Sheets-Sheet 1

FIG. 1

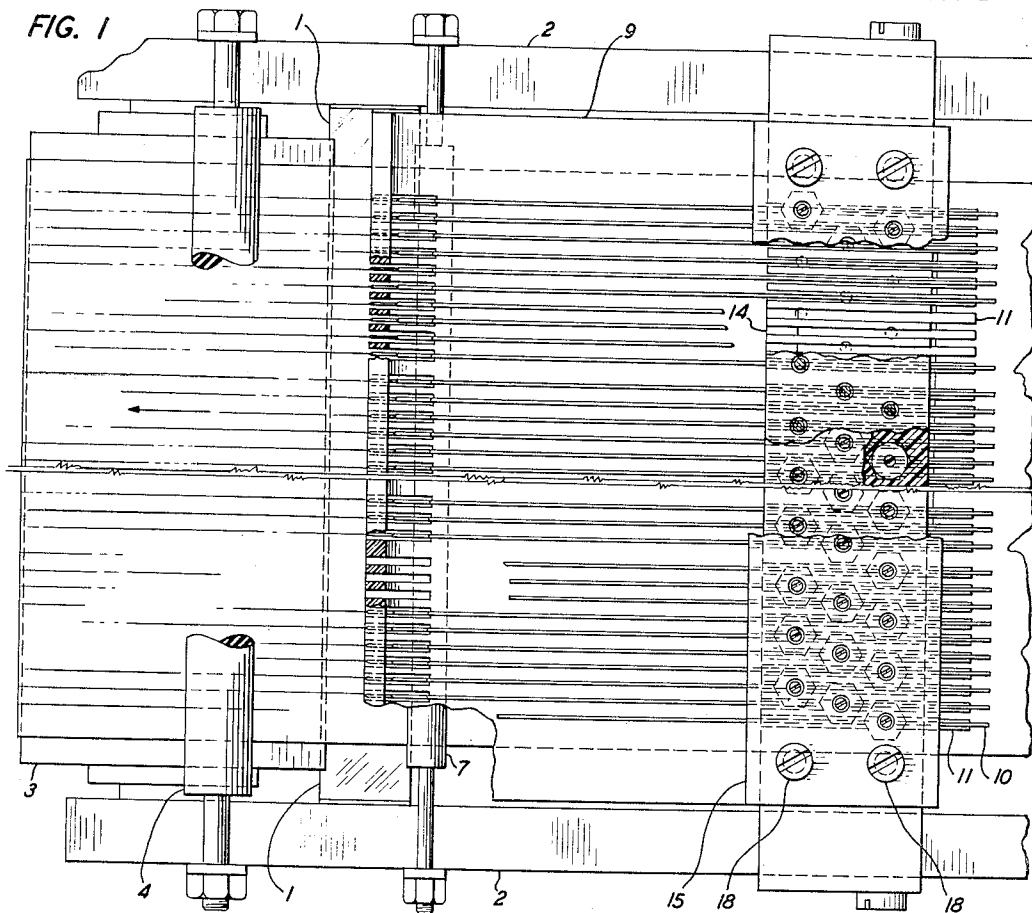
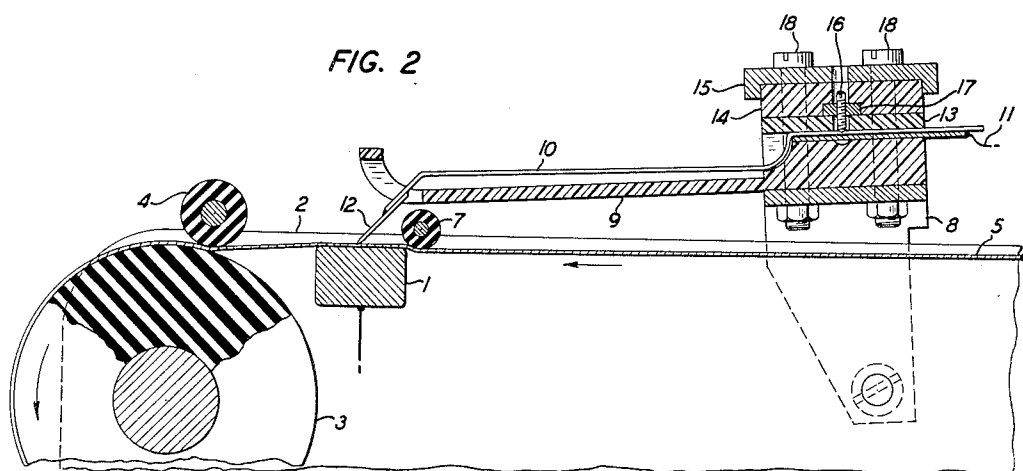


FIG. 2



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FIG. 3

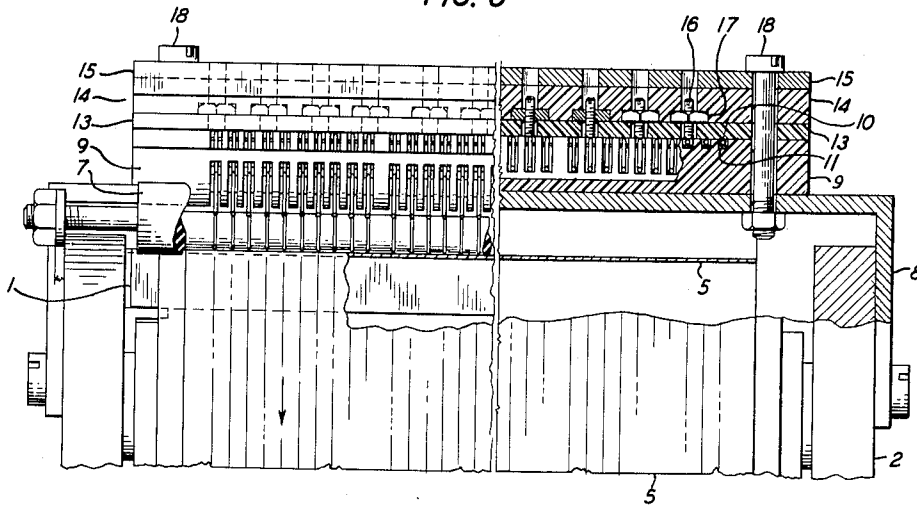
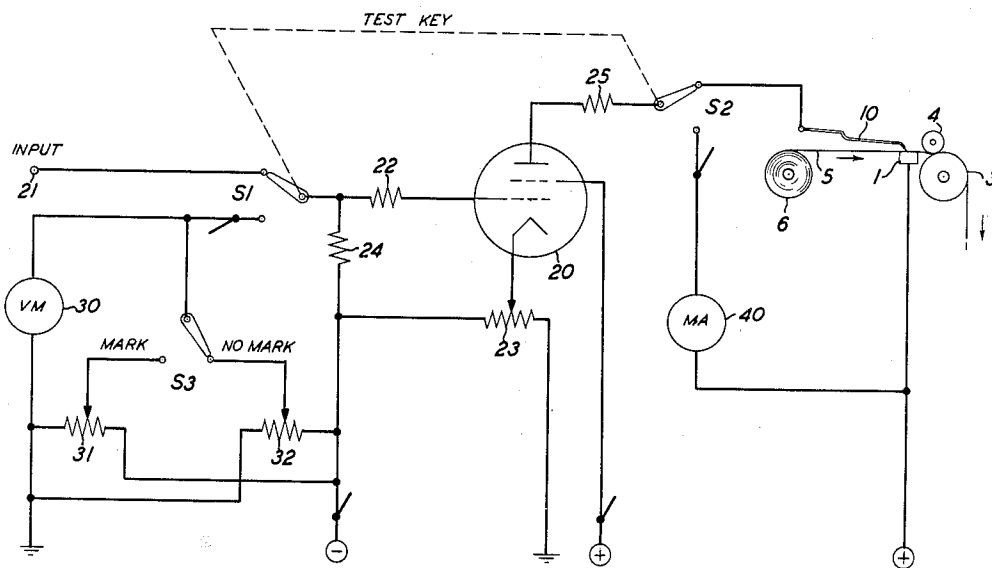


FIG. 4



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STYLUS ASSEMBLY

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8 Claims. (Cl. 346—139)

This invention relates to a stylus assembly for producing records on a sensitive medium.

The object of the invention is an assembly of a plurality of styli for simultaneously producing a plurality of records on a medium by means of electrical discharges.

A feature of the invention is a stylus comprising a fairly heavy wire, made of some springy material, such as piano wire, to which is affixed a long wearing tip of small area, preferably made of nickel plated, thoriated tungsten wire.

Another feature of the invention is a stylus guide which supports a plurality of styli so that their tips may be in constant contact with a moving recording medium. The guide restrains axial rotation of the styli and further restrains them from movement laterally to the recording medium, while at the same time permitting free movement of the styli tips in a direction perpendicular to the recording medium so as to prevent snagging of the tips and maintain even tip pressure against the medium regardless of imperfections and variations in the thickness of the medium. The guide is so constructed that individual styli may be conveniently replaced or realigned.

A further feature of the invention is a pair of snuffer rollers contacting the medium to snuff out any fires produced by the recording process.

In the drawings:

Fig. 1 is a top view of an assembly embodying the invention;

Fig. 2 is a side view in part section of the assembly;

Fig. 3 is a front view in part section of the assembly; and

Fig. 4 is a test and operating circuit associated with the styli.

The anode bar 1 is supported by the framework 2, but is insulated therefrom, and extends across the whole width of the recording surface. The drive platen 3 is journaled in the framework 2 and is driven at constant speed by any suitable drive mechanism (not shown). The front snuffer roller 4 is rotatably supported by the framework 2 in yielding contact with the drive platen 3. The sensitized recording medium 5, which may be the product commercially available under the trade name "Teledeltos" paper, is threaded from the feed reel 6, over the anode bar 1, and between the platen 3 and the roller 4; and, during recording is driven forward by the platen 3 to some suitable receptacle (not shown). The rear snuffer roller 7 is rotatably supported by the framework 2 and firmly, yet yieldingly presses the medium 5 upon the bar 1. The rollers 4, 7, also snuff out any small fires which may be produced in the medium during the recording process.

The yoke 8 is pivotably secured to the framework 2, so that the stylus assembly may be rotated for easy replacement or alignment of one of the styli and for threading the recording medium through the recorder.

The stylus guide 9 is made of insulating material and has an abutment supported by the yoke 8, a forwardly

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extending web, and a curved surface transition section joining the abutment to the web, said web terminating in an upturned end portion which is milled to provide a slot for each stylus. Each slot is longitudinally much larger than the diameter of stylus 10, as shown in Fig. 2, but is laterally only slightly larger than the diameter of stylus 10, as shown in Figs. 1 and 3. The upper surface of the abutment is grooved to receive the straight end of the stylus 10; the curved surface of the transition section between the abutment and the web is milled to provide a curvilinear groove for each stylus. The linear grooves in the surface of the abutment, the curvilinear grooves in the curved surface of the transition section, and the slots in the upturned end portion of guide 9 are all aligned to correspond with each other, whereby a common vertical plane passes through the centerlines of those grooves and slots which correspond. The circuit connections may be soldered, brazed, or otherwise connected directly to the end of the stylus 10; or, the groove in the abutment of the guide 9 may be lined with some conducting material in contact with the stylus 10, and in contact with a soldering terminal. Or, as shown, the grooves in the abutment of the stylus guide 9 may be made slightly larger than the stylus 10; a soft copper strip 11 may be forced into each groove and soldered to the circuit connection; and the stylus 10 forced into close contact with the strip 11.

The stylus 10 is formed of a springy electrically conductive material such as piano wire. Preferably, it is of relatively large cross-sectional area compared to the area of its tip, so as to provide low electrical resistance. A stylus diameter of .024 inch has been found convenient. A short rigid tip 12, which serves as the actual recording pen, is affixed to the end of the stylus 10 by soldering, welding, brazing, or otherwise. Tip 12 should be of relatively small cross-sectional area to produce clearly defined marks in the recording medium 5. Its small diameter and the fact that, as described below, current must pass to the tip through medium 5 from anode bar 1, may result in relatively high current density in tip 12. This may cause erosion and pitting of the tip, with consequent erratic marking of medium 5. Such behavior has been characteristic of recording pens of the type described constructed in the manners heretofore known.

By making tip 12 of .008-inch diameter nickel plated, thoriated tungsten wire, then when utilized as described in the stylus assembly specified herein, erosion and pitting of tip 12 are reduced to such a degree that the life of the tip is enormously increased and the possibility of erratic marking of medium 5 is practically eliminated. This is therefore the preferred construction of tip 12.

Of course, the invention is not limited to the specific preferred sizes and materials given above for stylus 10 and tip 12, as it is obvious that many changes may be made therein without departing from the scope of the invention.

Either lateral movement or axial rotation of stylus 10 would cause the stylus tip 12 to be displaced from its preset position transversely of recording medium 5. With many closely spaced styli and tips, such displacement would make it difficult to ascertain which of adjacent styli produced a particular mark on medium 5, and would permit misalignment and possible contact of adjacent tips. The invention prevents this by forcing the straight portion of the stylus 10 into the linear groove in the abutment of the guide 9. This restrains the stylus 10 from lateral movement, while the curve in the stylus 10 which fits into the curved groove milled into the face of this abutment restrains the stylus 10 from axial rotation of the straight portion of stylus 10 in the linear grooves. In forming the stylus 10 the forwardly extending straight

portion which extends above the web of guide 9 may be formed at a small downward angle to the rear straight portion, so that the stylus tip 12 will exert a downward pressure on the medium 5. The curve of the stylus 10 preferably ends a slight distance above the web of the guide 9 so that the stylus 10 will have free vertical motion. Even if the curved portion of stylus 10 ends just at the web of guide 9, the curved portion of stylus 10 freely rests in the curvilinear groove in the curved surface of the transition section between the abutment and the web of guide 9. Accordingly, stylus 10 can easily flex in an upward vertical direction about its curved portion as the flexural arc. Consequently, stylus tip 12 is free to move in a direction perpendicular to the recording medium 5, which direction can also be characterized as approximately perpendicular to the surface of the abutment of guide 9. This freedom of motion in the perpendicular direction effectively prevents snagging of tip 12 due to any irregularities in the recording medium 5, and maintains substantially uniform pressure of the tip against the medium even though the thickness of the medium may vary along its length. The end of stylus 10 to which tip 12 is attached is freely suspended through the upturned slotted end portion of guide 9, the slot serving to limit any even momentary lateral displacement of tip 12.

The grooves in the abutment of the guide 9 preferably are in equal groups of equally spaced grooves, with wider spaces between the groups, so that the record traces may be easily identified.

The cover plate 14 is drilled, in staggered rows, for the set screws 16. As the cover plate is made of insulating material which will not retain a thread, the holes are counterbored for the nuts 17, which are pressed into the counterbores and secured by a suitable cement. The spacer 13 is also made of insulating material and is correspondingly drilled; and the drilling is continued to produce a small depression in the top of the abutment of the guide 9, so that, when the screw 16 is tightened, the stylus 10 will be slightly deformed and will react elastically to lock the screw 16 in the nut 17. Screw 16 serves to secure stylus 10 in its groove in the surface of the abutment of guide 9.

The top plate 15 extends over the cover plate 14 and is secured by screws 18 to the yoke 8.

In Fig. 4, the input voltage is supplied through terminal 21, upper contact and blade of switch S1, resistor 22, to the control electrode of electronic tube 20. The cathode of tube 20 is connected to the brush of potentiometer 23, having a winding connected across the biasing battery; and the control electrode and cathode circuits are connected by resistor 24. The screen grid of tube 20 is connected to a suitable supply; while the anode of tube 20 is connected through resistor 25, blade and upper contact of switch S2 to the stylus 10. This portion of the circuit is duplicated for each of the 100, or more, styli in the complete assembly. The common anode bar 1 is connected directly to the positive high tension supply. The tube 20 preferably should have high input resistance and high sensitivity, and may conveniently be a tube of the type known commercially as the 6AK5 pentode. Accordingly, when tube 20 is used for recording, its plate current traverses the path from the positive high tension supply, to anode bar 1, through recording medium 5 to stylus 10, upper contact of switch S2, resistor 25, anode of tube 20, cathode of tube 20, brush and winding of potentiometer 23, to ground. In this condition, the assembly may be used to record the engaged times of circuits, such as communication circuits; the operate and release times of mechanisms, such as the switches and dials used in machine switching; and the presence or absence of any voltage of sufficient magnitude to mark the recording medium.

The lower contacts of switches S1, S2, are connected to the similar contacts of the switches of a number, or all,

of the circuits in a system. The lower contact of switch S1 is connected to ground through voltmeter 30; while the lower contact of switch S2 is connected through milliammeter 40 to the positive supply. Potentiometers 31, 32, have windings connected across the bias battery, and brushes respectively connected to the contacts of switch S3, which has a blade connected to the lower contact of switch S1. With switch S3 on the right, or no mark, contact, the brush of potentiometer 32 is adjusted till meter 30 indicates a desired voltage, then switches S1, S2, of one of the circuits are moved to lower contacts, and potentiometer 23 of that circuit is adjusted till meter 40 reads a small current, too small to produce a record in the medium. Switch S3 is moved to the left, or mark, contact and the brush of potentiometer 31 adjusted till meter 40 reads a current large enough to produce a satisfactory record in the medium. The no-mark voltage of the next circuit should be set slightly above the voltage indicated on meter 30. With sensitive tubes, two or three-volts change in the applied voltage will change the anode current from cut-off to the value necessary for a satisfactory record. Thus, with a bias source of say -48 volts, 15 or 20 circuits may be adjusted to cover this range. The input circuits of all the adjusted circuits may then be connected to a source of fluctuating voltage, all the switches S1, S2, moved to the upper contacts, and the circuits will then record the durations of voltages in the applied wave exceeding the voltage levels respectively set into the circuits. An assembly of this character is adapted to record the durations of voltages exceeding predetermined levels in the fluctuating waves from telephone channels, and other circuits such as object location circuits, seismic prospecting circuits, etc.

What is claimed is:

1. In an apparatus comprising a plurality of flexible styli having tips, said styli adapted to bear said tips in constant physical contact with a moving recording medium, a stylus assembly comprising a supporting yoke, said stylus assembly further comprising a stylus guide, said stylus guide having an abutment, said abutment rigidly supported on said yoke, said abutment formed with linear grooves in its surface, said stylus guide also having a curved surface transition section, said transition section formed with curvilinear grooves in its curved surface, said transition section joined to said abutment so that the centerlines of said curvilinear grooves respectively lie in common planes with the centerlines of said linear grooves, each of said styli having a linear portion fitting in one of said linear grooves, each of said styli also having a curved portion fitting in one of said curvilinear grooves, a cover plate on said abutment surface, a plurality of retaining devices in said cover plate respectively securing said styli in said linear grooves, a top plate covering said cover plate, and means securing said top plate to said yoke.

2. The combination in claim 1 with conductive linings in said linear grooves respectively in contact with said styli and adapted to be connected to operating circuits.

3. A stylus assembly comprising a support, a stylus guide having an abutment rigidly mounted on said support, said stylus guide also having a forwardly extending web, said stylus guide further having a curved surface transition section joining said web and said abutment, said web terminating in an upturned end portion formed with a plurality of slots therein, said abutment formed with linear grooves in its surface, said curved surface transition section formed with curvilinear grooves in its surface, said linear and curvilinear grooves and said slots respectively so corresponding with each other that the centerline of corresponding linear and curvilinear grooves and slots lie in common parallel planes, a plurality of flexible styli, each of said styli having a straight portion fitting in one of said linear grooves whereby lateral motion of said styli is prevented, each of said styli further having a

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curved portion fitting in said corresponding one of said curvilinear grooves whereby axial rotation of said styli is prevented and said styli are free to move in a direction generally perpendicular to the surface of said abutment, each of said styli further having a stylus end portion freely suspended in said corresponding one of said slots, a tip affixed to said stylus end portion, a cover plate on said abutment surface retaining said styli in said linear grooves, and means for securing said cover plate to said support.

4. The combination in claim 3 with conductive linings in said linear grooves in contact with said styli adapted to be connected to operating circuits.

5. The combination in claim 3 in which said support is rotatably mounted whereby said assembly may be rotated to adjust or replace any of said styli.

6. In an apparatus comprising a plurality of flexible styli having tips, said styli adapted to bear said tips in constant physical contact with a moving recording medium, a stylus assembly comprising a stylus guide, said stylus guide comprising a portion formed with a plurality of linear grooves and a second portion formed with a plurality of curvilinear grooves, each of said styli having a linear portion and a curved portion, said linear portion and said curved portion of said styli respectively in said linear grooves and said curvilinear grooves of said stylus guide, said styli formed of spring wire of large diameter relative to the diameter of said tips, and said tips formed of nickel plated thoriated tungsten wire of the order of .008-inch diameter.

7. The combination in claim 3 in which said styli are formed of piano wire of the order of .024-inch diameter.

8. In an apparatus comprising a plurality of flexible styli each of which has a tip affixed to its end portion, said styli adapted to bear said tips in constant physical contact with a moving recording medium, a stylus assembly comprising a supporting yoke, said stylus assem-

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bly further comprising a stylus guide, said stylus guide having an abutment, said abutment rigidly supported on said yoke, said abutment formed with linear grooves in its surface, said stylus guide also having a curved surface transition section, said transition section formed with curvilinear grooves in its curved surface, said stylus guide also having a forwardly extending web, said transition section joining said web and said abutment, said web terminating in an upturned end portion formed with a plurality of slots therein, said linear and curvilinear grooves and said slots respectively so corresponding with each other that the centerlines of corresponding linear and curvilinear grooves and slots lie in common parallel planes, each of said styli having a straight portion fitting in one of said linear grooves, each of said styli also having a curved portion fitting in said corresponding one of said curvilinear grooves, each of said styli also having a stylus end portion freely suspended in said corresponding one of said slots, said styli formed of spring wire of large diameter relative to the diameter of said tips, said tips formed of nickel plated thoriated tungsten wire of the order of .008-inch diameter, a cover plate on said abutment, a plurality of retaining devices in said cover plate respectively securing said styli in said linear grooves, a top plate covering said cover plate, and means securing said top plate to said yoke.

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