April 20, 1943. W. B. WAIT 2,316,906

TAPE MARKER

Filed July 11, 1940 2 Sheets-Sheet 1

Fig. 1.

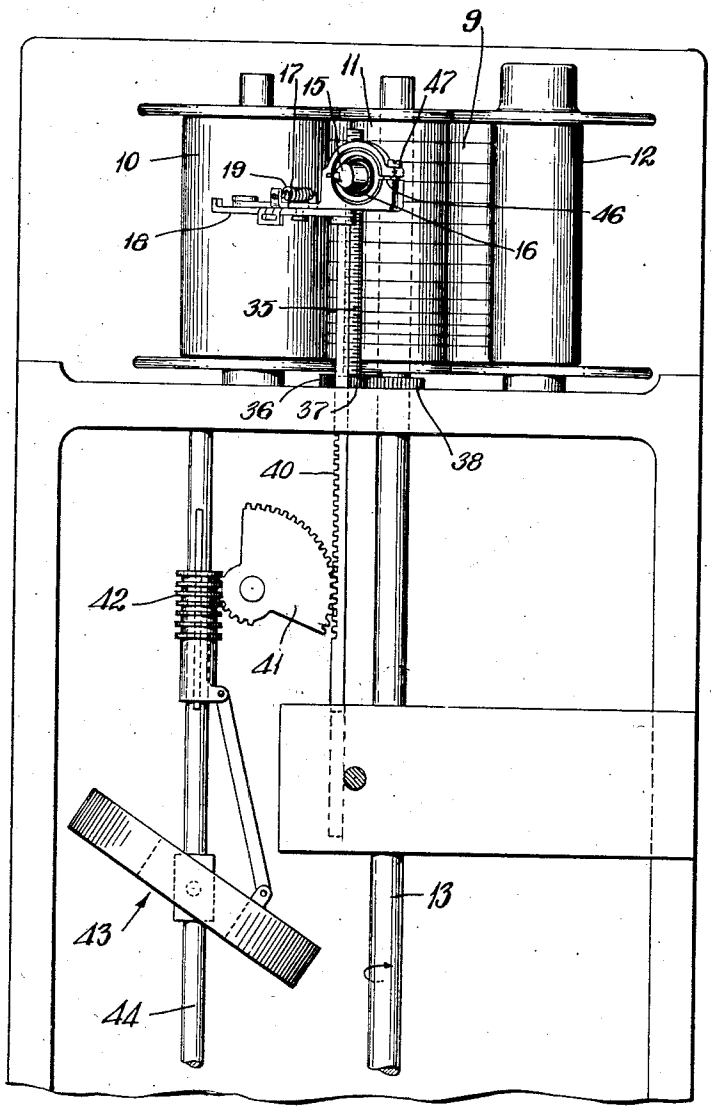

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Fig. 2.

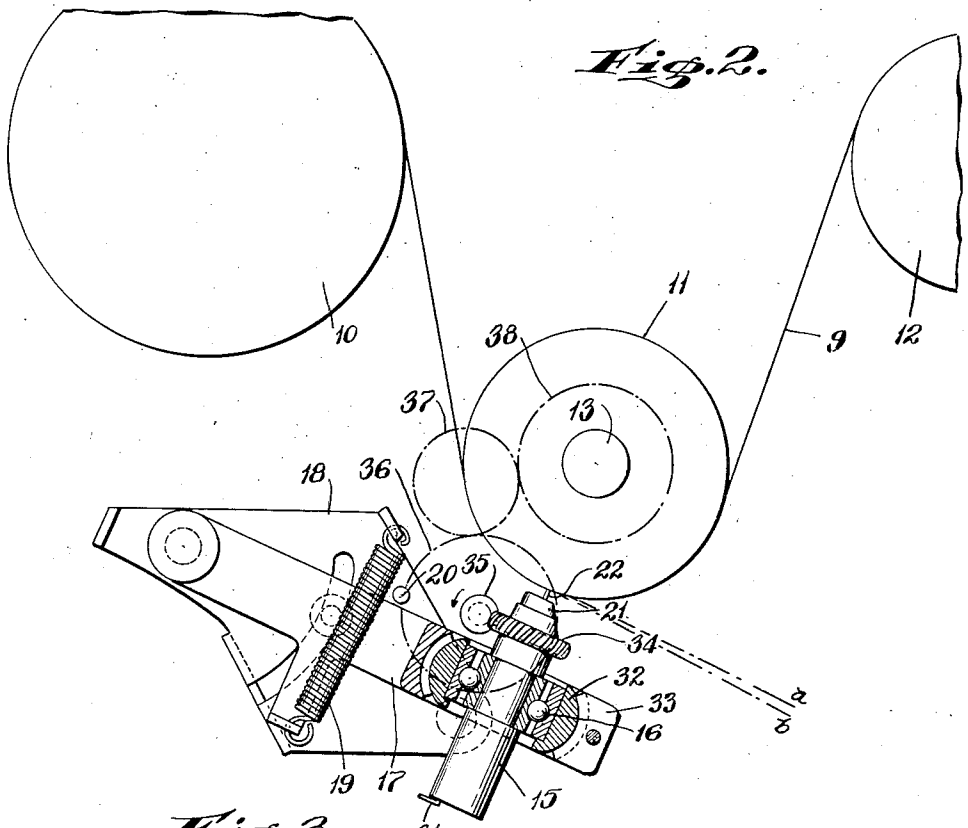


Fig. 3.

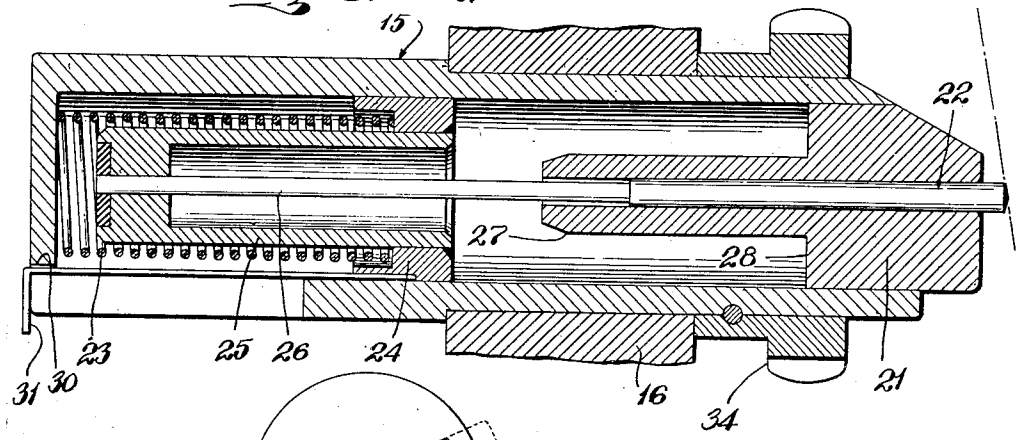
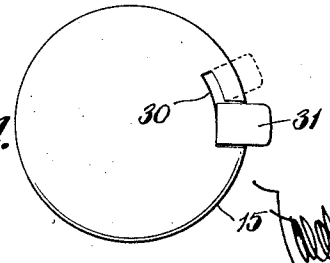


Fig. 4.



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Patented Apr. 20, 1943

2,316,906

UNITED STATES PATENT OFFICE

2,316,906

TAPE MARKER

William Bell Wait, New York, N. Y.

Application July 11, 1940, Serial No. 344,908

7 Claims. (Cl. 234—70)

This invention relates to improvements in tape markers.

The broad objects of this invention are the provision of improved means for supporting, controlling and operating a stylus or pencil so as to permit it to be moved freely over a recording surface to the required extent to accurately record the information desired and to produce a fine sharp line.

One object of this invention consists in the provision of improved means for rotating a pencil inclined to the normal drawn to a moving recording surface as of a tape, operating preferably to rotate the pencil proportionately to the movement of the tape and the transverse movement of the pencil across the tape.

Another object of this invention is to so support a pencil that it will be pressed against the tape by a light spring operating against a heavier pencil head operating spring, the movement of the pencil head toward the tape being preferably limited by a stop and the relation of the pencil spring and the pencil head spring being such that the pencil head will be moved away from the stop and tape when the pencil is advanced by its spring against the tape for the purpose of producing a mark.

Another object of this invention is to support a rotatable pencil inclined at a very small angle with respect to the normal drawn to the tape at the pencil point to produce a relatively narrow mark which at its widest point is substantially as narrow as the length of the radius of the pencil.

Still another object of this invention is the provision of means for adjusting the angle of inclination of the pencil and the direction of inclination of the pencil with respect to the direction of travel of the tape.

Other objects of this invention will appear from the following description taken in connection with the drawings, in which—

Fig. 1 is a side elevational view illustrating tape and pencil operating mechanisms;

Fig. 2 is a view showing details of the pencil supporting and operating mechanisms showing the pencil inclined to the normal to the tape at its point of contact with the tape;

Fig. 3 is a longitudinal central section through the pencil head; and

Fig. 4 is an end view of the pencil head looking toward the right in Fig. 3.

For purposes of illustration, the record bearing medium has been shown as a tape 9 drawn from a supply roll 10 by a registration or feeding roll 11 and wound on a take-up roll 12. The registration roll may be driven from a shaft 13 which may be operated by any suitable device such as a spring motor or it may be operated from any desired part of a machine with which this invention is used, and if desired it may be operated in accordance with the distance through which the machine operates. It is to be understood that the tape might be fed by the take-up roll and that the registration or platen roll might be replaced by a stationary flat platen as is well known in the art.

The pencil head 15 is preferably in the form of a cylinder and may be supported by a roller bearing 16 on an arm 17 pivoted on a bracket 18 supported on the frame of the machine for movement transversely of the tape. The pencil head is urged toward the tape 9 preferably by a relatively strong tension spring 19. A stop 20 may be provided to limit the movement of the head to prevent it from engaging and riding on the tape, as in cases where the point of the lead breaks off or the lead is used up or is retracted.

Secured in the front end of the pencil head 15 is a pencil or lead guide 21 for a length of lead 22. The lead may be pressed toward the tape by a relatively light expansion spring 23 seated on the closed end of the pencil head and bearing on a collar 24 on a hollow cylindrical piston 25 in the rear closed end of which is secured a plunger 26 extending into the lead guide 21 and bearing on the rear end of the lead 22. The lead guide 21 is preferably provided with a reduced shank 27 over which the piston 25 operates and with a shoulder 28 which limits the forward movement of the piston, the parts being so proportioned that the plunger 26 will advance the lead as its point is worn away so as to use up as much of the length of lead as possible as permitted by its support in the lead guide. This construction permits practically 100 percent use of lead and will produce a great saving over the present practice.

For the purpose of releasing the light spring 23 to advance the lead 22, the pencil head 15 may be provided with a bayonet slot 30 for a manipulative portion 31 of a rod connected to the collar 24. When the manipulative portion 31 is moved into registration with the longitudinal portion of the bayonet slot 30, the light spring 23 will advance the lead 22 against the tape and react against the closed end of the pencil head and move the pencil head away from the tape against the action of the heavier head positioning spring 19. By means of this construction the lead is permitted to recede in the pencil head 15 against the light spring 23 and also move along an arc about the pivot point

of the pencil head as a center and thus easily move over raised portions on the surface of the tape with reduced friction between the lead and tape resulting in more accurate recording.

As disclosed in Figs. 2 and 3 the bearing 16 may be supported by a universal member 32 in the arm 17 which may be split as indicated at 33 and tightened on the member 32 by means of a screw bolt as indicated. By means of this construction the pencil may be inclined to the normal to the tape at different angles and in different directions with respect to the direction of movement of the tape as found desirable and advantageous. In the drawings I have shown the pencil inclined to the rear of the normal with respect to the direction of movement of the tape, the dash and dot lines *a* and *b* Fig. 2 indicating respectively the tangent to the tape and the normal to the lead at the point of contact of the lead with the tape. This produces a narrow line lengthwise of the tape and a broader line transversely of the tape, the breadth of which can be controlled by adjustment of the angle of inclination of the pencil so as to produce a line substantially as narrow as the length of the radius of the lead.

In order to produce and maintatn a conical point, the pencil is rotated not only by the means which drives the tape but also by means which operates as an incident to the movement of the pencil transversely of the tape. For this purpose the pencil head 15 is provided with a worm wheel 34 in mesh with a worm 35 suitably mounted in the frame of the machine and driven by gears 36 and 37 from a gear 38 which is here shown as mounted on the registration roll driving shaft 13. As the tape is moved from left to right the pencil is rotated counter-clockwise in proportion to the distance moved by the tape. The worm and the teeth on the worm wheel engage loosely to permit the lead to be adjusted into any one of different inclined positions.

The object of rotating the pencil and angling the pencil at a very small angle from the perpendicular to the writing surface is twofold: first, to produce a smaller and finer line than would otherwise be possible because it is possible to produce a writing point with a writing surface smaller than it is practicable to manufacture a graphite or other type of lead and, second, to reduce the area of the pencil in contact with the paper from the full end area of the lead, as shown, to a fraction thereof, thus resulting in a substantial saving of the writing material. The inclination of the pencil with respect to the normal may be at a very small angle such as one degree or less under the most favorable circumstances where the record strip is very smooth and of uniform thickness but in general practice, where the ideal conditions do not obtain, the angles of inclination with respect to the normal are larger, such for example between 4° and 9°.

As the pencil is moved transversely of the tape the worm 35 will act as a fixed rack and the worm wheel 34 as a rack gear to rotate the pencil. This rotation of the pencil as an incident to its transverse movement is especially desirable when there are a large number of abrupt changes in the values of the matter being recorded. The construction is such that the pencil will be rotated counter-clockwise as the pencil head is moved upward toward no-speed position to effect a more accurate zero registration.

I have disclosed the pencil bracket 18 as being supported and as being moved transversely of the tape by means of a rack 40 operated by a double segment gear 41 and a rotatable rack 42 which may be moved up and down by a governor 43 operated by a shaft 44 connected to operating shafts of the machine with which the invention is used. Insofar as the invention is concerned it is not important how the pencil head is moved transversely of the tape. It might be moved directly by the operator's hand, by a speed-responsive device as disclosed or by any other device or devices operated by the machine to record one or more factors.

It is now apparent that I may employ a very small diameter stylus such as lead and that because of the very slight inclination with respect to the normal drawn to the tape at the point of contact with the lead a very sharp line will be produced, the width of which at no point will exceed the length of the radius of the lead by any considerable amount. By rotating the pencil not only substantially in proportion to the distance through which the tape is fed but also to lengths of movements of the pencil transversely of the tape, the lead will continuously be worn and maintain conical. I have shown the pencil inclined from the normal in the opposite direction from the direction of movement of the tape. This reduces the friction on the tape and produces a very fine line longitudinally of the tape and not an objectionally broad line diagonally and transversely of the tape. It is obvious of course that the pencil head and lead may be inclined to the normal of the tape in any direction found desirable.

In prior constructions in which the pencil head and lead were pressed toward the tape by a single spring, such as the tension spring 19, it was found that the friction of the pencil head against the paper, thus supporting the lead to the writing surface and permitting 100 percent use of lead, was sufficient to adversely affect the accuracy of the calibration of the instrument. In the present construction the light spring 23 when released puts pressure on the lead and advances the lead out of the orifice of the lead guide against the tape and reacts to push the pencil head away from the tape so that the lead alone is in contact with the writing surface even in the absence of a stop and when a stop is employed, the stop will be so located that the arm supporting the pencil head will be pushed away from the stop providing a floating construction. The distance through which the pencil head is forced back from the paper is dependent upon the relative forces of the two springs and the arm carrying the pencil head floats between the two springs, one end of the arm rotating around a fulcrum and the other end of the arm tending to impinge against the paper but being kept therefrom by the pencil lead as described. By preventing engagement of the pencil head with the tape and by having the friable surface of the small lead as the only point of contact with the tape, the difficulty encountered with prior constructions is avoided. As the pencil point meets inequalities in the writing surface such as a raised point on the tape or a joint in the paper, the lead is forced against the light lead advancing spring and moved along the axis of the pencil holder. As the pencil head spring reacts the pencil holder is moved away from the cylinder over which the tape is carried, automatically compensating for such inequality in the tape. This causes the point of the lead to move in the direction of the length of

the tape causing a rubbing motion by the lead along the surface of the tape. This movement of the lead on the tape together with its rotational movement facilitates the passage of the lead over rough places in the surface of the tape. The lead is preferably rotated in a direction to roll towards the zero mark on the tape facilitating the movement of the lead toward that mark and if desired this movement may also be facilitated by inclining the lead away from the normal to the tape in the direction of the movement toward this zero mark.

While I have described my invention with reference to but one embodiment including preferred mechanism, it is to be understood that I reserve the right to all such changes as fall within the principles of my invention and the scope of the appended claims.

I claim:

1. In recording mechanism for marking upon a movable sheet, a rotating marker of a material worn away by friction against the sheet and movable crosswise of the sheet, branched means for moving the sheet and for rotating the marker, and means for moving the marker crosswise of the sheet and cooperating with the branch of said first mentioned means rotating said marker to rotate the marker in proportion to the amount of movement of the marker crosswise of the sheet.

2. In recording mechanism for marking upon a movable sheet, a marker of material worn away by friction against the sheet and movable crosswise of the sheet, branched means for moving the sheet and for rotating said marker, and means for supporting said marker at an angle with respect to the normal as drawn to said sheet at the points of contact between said marker and sheet.

3. In recording mechanism comprising a movable sheet and a rotating marker of a material worn away by friction against the sheet and movable crosswise of the sheet; means for supporting said marker so as to be adjustable to incline said marker with respect to the normal as drawn to the surface of said sheet in any angular direction with respect to the direction of movement of said sheet, the angle of said marker being close to the normal to the writing surface but not at it and said means being manipulatable within said angular relation.

4. In recording mechanism for marking on a movable sheet, a rotating marker of a material worn away by friction against the sheet and movable crosswise of the sheet, means for moving the sheet, means for supporting said marker inclined to the rear with respect to the direction of movement of the sheet and at an angle with respect to the normal at the point of contact between said marker and sheet, and branched means operated by said sheet moving means for rotating said marker to roll on the sheet in the direction of its movement crosswise of the sheet.

5. In a recording mechanism comprising a rotating marker mechanism adapted to move and mark upon a sheet, said mechanism comprising a head provided with a marker guide and a marker slidable within said guide, means movably supporting said head, a spring urging said head and guide and marker toward said sheet, and a relatively weaker spring within said head reacting between the head and stylus and advancing and feeding said marker toward said sheet, said springs being so characterized that the relatively weaker marker spring reacts to move and hold the marker guide and head away from said sheet.

6. In a recording mechanism comprising a movable sheet and a rotating marker mechanism adapted to move and mark upon a sheet, said mechanism comprising a head provided with a marker guide and a marker slidable within said guide, means movably supporting said head, a spring urging said head and guide and marker toward said sheet, a stop cooperating with said supporting means and preventing engagement of said guide with said sheet, and a relatively weaker spring within said head reacting between the head and marker and advancing and feeding said marker toward said sheet, said springs being so characterized that the relatively weaker marker spring reacts to move and hold the marker guide and head away from said sheet and the said supporting means away from said stop.

7. In a recording mechanism for marking upon a movable sheet, a marker mechanism comprising a head provided with a marker guide and a marker slidable within said guide, means movably supporting said head, a spring urging said head and guide and marker toward said sheet, and a relatively weaker spring within said head reacting between the head and marker and advancing and feeding said marker toward said sheet, said springs being so characterized that the relatively weaker marker spring reacts to move and hold the pencil guide and head away from said sheet, said supporting means comprising a pivoted arm whereby the end of the marker marking said sheet upon encountering a raised portion in said sheet will first move axially against said weaker spring and then arcuately with said head in a rubbing movement over said raised portion.

WM. BELL WAIT.

CERTIFICATE OF CORRECTION.

Patent No. 2,316,906. April 20, 1943.

WILLIAM BELL WAIT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 27, for "maintatn" read --maintain--; and second column, line 26, for "maintain" read --maintained--; page 3, second column, line 15, claim 5, for "stylus" read --marker--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of July, A. D. 1943.

Henry Van Arsdale,

(Seal) Acting Commissioner of Patents.

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Acting Commissioner of Patents.

(Seal)