Aug. 29, 1944. W. L. McLAINE 2,357,051

DRILLING SPEED RECORDER

Filed June 10, 1940 3 Sheets-Sheet 1

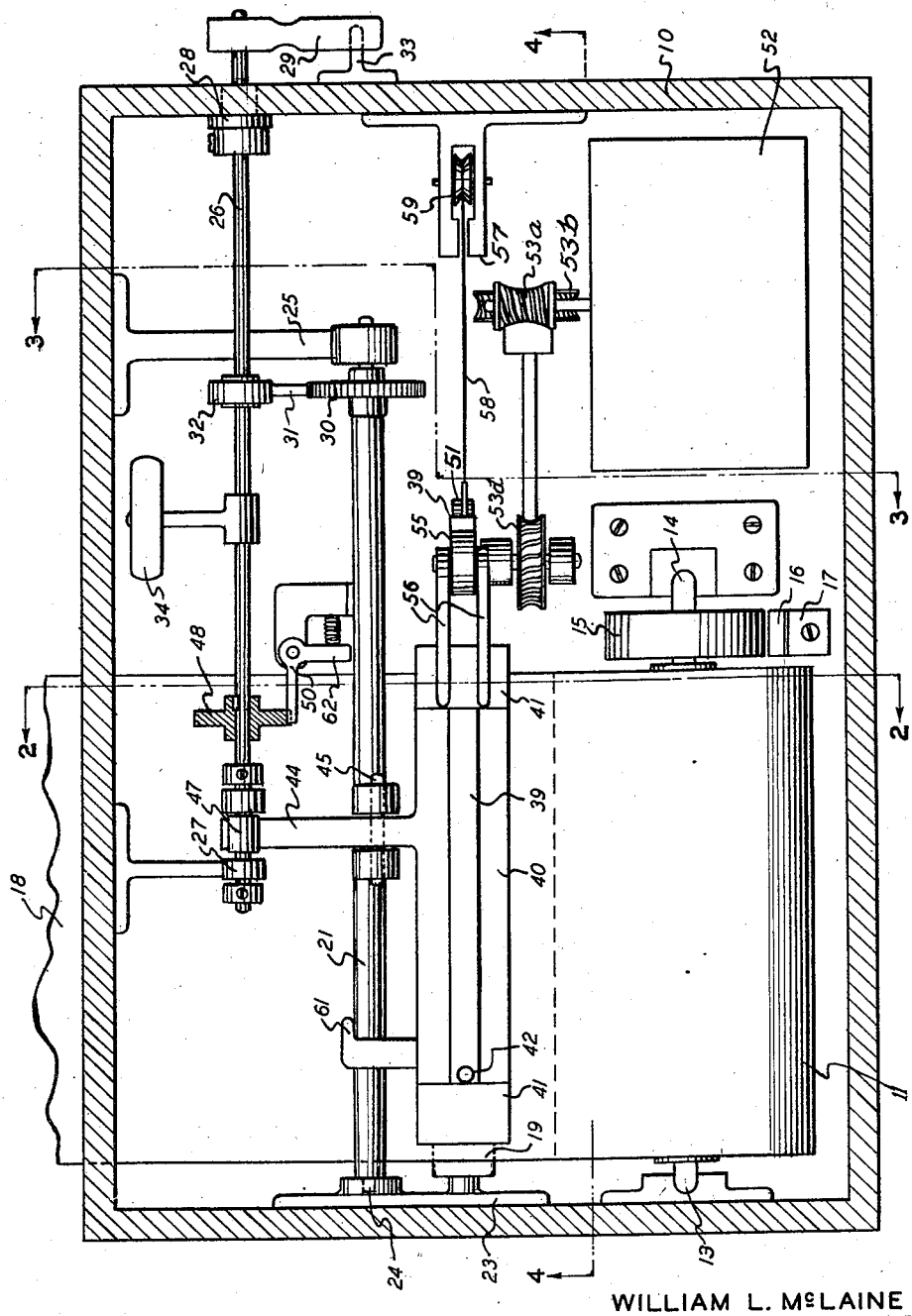

FIG. 1

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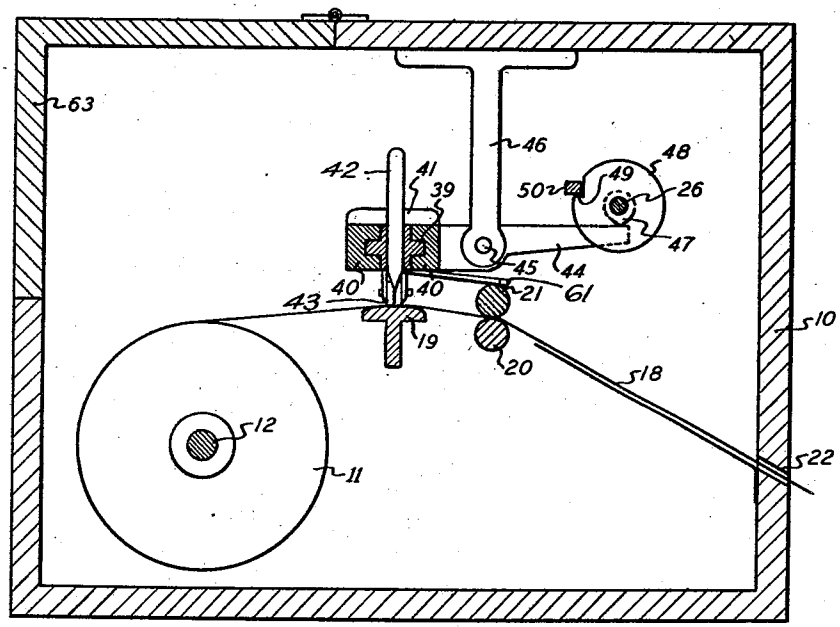

FIG. 2

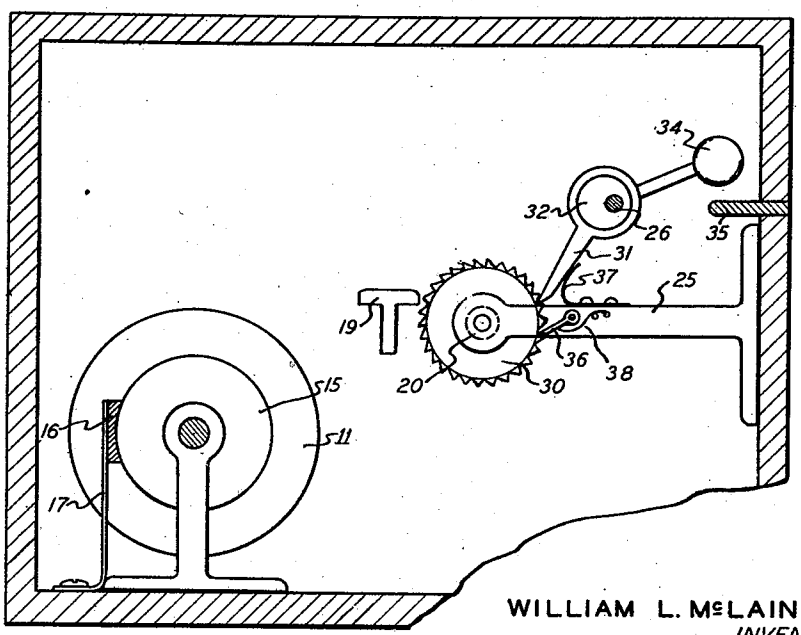

FIG. 3

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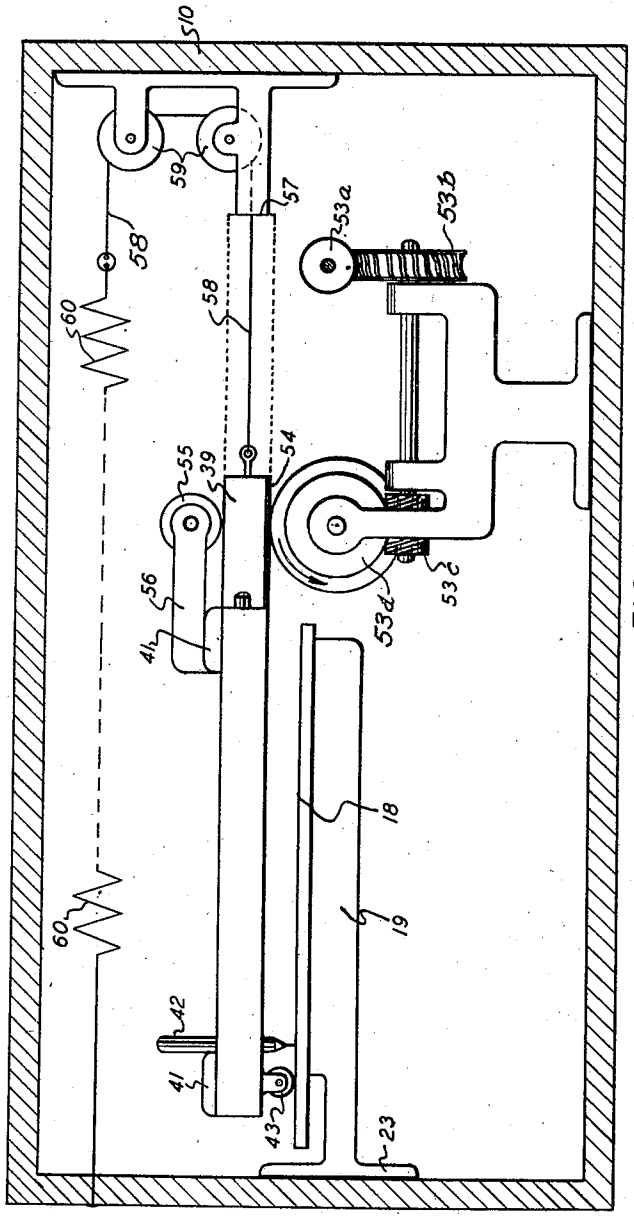

FIG. 4

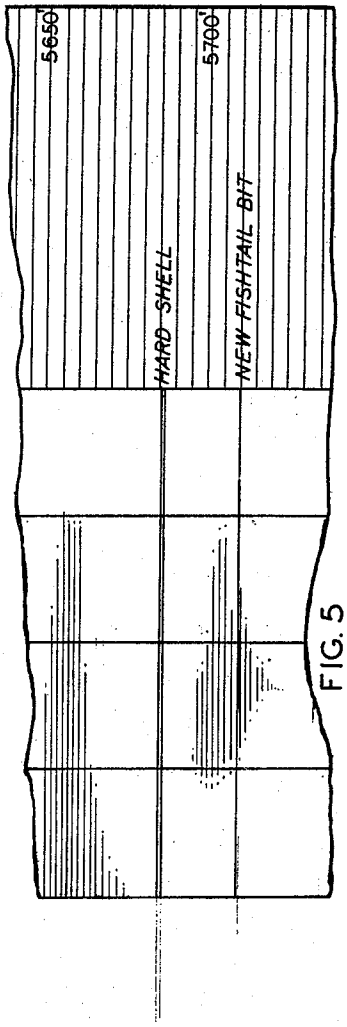

FIG. 5

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UNITED STATES PATENT OFFICE

2,357,051

DRILLING SPEED RECORDER

William L. McLaine, Los Angeles, Calif.

Application June 10, 1940, Serial No. 339,624

2 Claims. (Cl. 234—36)

The object of the invention is to provide a device for showing graphically the time consumed in drilling unit distances with rotary earth boring apparatus.

It is well known that in the practice of drilling with rotary apparatus, the time consumed in penetrating some unitary distance, as for example one foot, is an approximate measure of the hardness of the formation being penetrated. Obviously the relation is not exact inasmuch as both the type of bit and its momentary condition as well as, to a lesser degree, such factors as fluid viscosity and circulation velocity, influence the speed at which hole is made.

Despite its approximate character, a record of the foot by foot drilling time gives information regarding the formations penetrated which may be extremely useful, and the practice of recording the time at intervals of, say, one foot is coming into use by careful operators.

Such records require that the driller observe a clock and note down the time at each foot interval, an observation which is itself highly liable to error. It is also necessary that the intervals in minutes between these recorded times be plotted against well depths on a log sheet to produce a curve which will point out the positions of the harder and softer formations, this plotting being a laborious operation.

I propose an apparatus which will produce a traced log of hardness (as measured by time) on a continuous strip, the sole burden on the operator being to press a lever or button each time a mark indicating an increase in depth of one foot passes out of sight in the drilling table, or which may make such record automatically when actuated from some vertically moving part of the drilling apparatus.

An exemplary form of the invention is shown in the attached drawings, in which:

Fig. 1 is a plan view of the apparatus;

Fig. 2 is a cross section and internal elevation taken on the line 2—2 of Fig. 1;

Fig. 3 is a similar view taken on the line 3—3 of Fig. 1;

Fig. 4 is a longitudinal section and elevation taken on the line 4—4 of Fig. 1, and

Fig. 5 is a replica of a small portion of the tape record formed by the instrument.

Referring to the drawings, 10 is a case of some rigid material such as hardwood, metal, or plastic, which serves to protect and to support the working parts of the apparatus. 11 is a roll of the paper or other tape on which the record is formed. This roll is carried on a mandrel 12 supported in sockets at its ends as at 13 and 14. The mandrel is preferably provided with a drum 15 against which a brake block 16 is urged by a spring 17, the purpose being to keep the paper strip under a slight tension.

The paper strip 18 passes from the roll over a platen 19, thence between a pair of feed rolls 20 and 21 and out of the case through a slot 22. The platen is rigidly projected from the end of the case as by a bracket 23. The feed rolls are supported from the end and one side of the case as by socket 24 and bracket 25.

A rock shaft 26 is journaled in a bracket 27 and a bushing 28 and is provided outside the case with a thumb lever 29. One of the feed rollers, in the illustration (Fig. 2) the lower roll 20, carries on its end a ratchet wheel 30. The teeth of this ratchet engage a pawl 31 moved by an eccentric 32 which is attached to shaft 26 and which is rotated through say ⅛ of a turn when the thumb lever is depressed. The movement of this lever is limited by a stop 33 and its return to its original position is ensured by an unbalanced weight 34 which encounters a stop 35 at the end of its travel. A second pawl 36 prevents reverse movement of the feed roll and maintains the tension of the paper strip. The two pawls are held against the ratchet by flat springs 37 and 38. The relation between the diameter of feed roll 20 and the number of teeth in the ratchet 30 is such that the advancement of the ratchet one full tooth will move the paper strip a desired distance. For example, if the feed roll be 0.318 inch in diameter, the ratchet might have 100 teeth which would give a pitch of $\frac{1}{8}$ inch and a pitch diameter of 2 inches.

Above and parallel to the platen is arranged a pen carriage 39 sliding in ways 40—40 connected at their ends by straps 41—41. A pen or stylus 42 is passed through the outer end of the pen carriage which also carries at a point adjacent the pen a small idler roller 43. From the ways is projected an arm 44 which is pivoted at 45 in a bracket 46. The outer end of arm 44 bears on a cam 47 attached to shaft 26, which also carries a disc 48 having a notch 49 cut in its face. When the thumb lever 29 is depressed as above described, the disc is rotated until the notch engages and is held by a small bell crank 50 and the lobe of cam 47 is directed downwardly, depressing arm 44 and lifting the ways and the carriage sufficiently to clear the point of the pen from the paper.

The carriage 39 and the pen 42 are moved along the length of platen 19, and across part of

the width of the strip, by a friction wheel 51 driven by any suitable motive power generally indicated at 52 through a speed reduction suggested by the train of worm gears and pinions 53a—53d. The motive power may be a spring actuated clock, a "telechron" clock, or a constant speed motor, in fact any prime mover having a dependably constant speed. The friction wheel revolves constantly in one direction, should be hard faced, and may well engage a facing strip 54 of slightly resilient material, such as paper fiber, applied to the lower face of the carriage. The diameter of the friction wheel and the gear reduction are so proportioned to the constant motor speed as to carry the pen across the paper at a desired rate, as for example at the rate of one inch in four minutes or six minutes. The carriage is lightly pressed against the friction wheel by an idler roll 55 which is journalled in a bracket 56 projected from the ways 40. So long as the pen is in contact with the paper, the carriage is in contact with the friction roller and is moved across the paper, up to the point where the end of the carriage passes out from between the rollers, after which the pen stands still. When thumb lever 29 is depressed and the pen lifted from the paper as above described, the ways and carriage are lifted, freeing the carriage from contact with the friction roller, and the carriage is then returned to its starting position against a stop 57 by a pull cord 58 which passes over idler rolls 59 and connects with a long light spring 60, or by equivalent means.

As the carriage reaches the end of the return stroke, an arm 61 projected laterally from the outer end and lower face of the carriage encounters the arm 62 of bell crank 50, thus disengaging the opposite arm from notch 49 and allowing weight 34 to rotate shaft 26 and retract the lobe of cam 47 from arm 44, thus allowing the pen to come again into contact with the paper and the carriage into contact with the friction wheel. This returns all the parts to their starting position and the travel of the pen across the paper begins again, tracing a new line spaced from the previous line by a distance equal to the distance through which the paper strip has been fed by the ratchet and feed roller as above described.

In using the instrument the drill stem or kelly is marked at desired intervals. As each mark reaches a predetermined point, such as the surface of the table, the thumb lever is actuated and thus the length of the line drawn by the pen is proportionate to the time elapsed between two such actuations, with the proviso that if the time exceeds that required for the carriage 39 to effect its maximum travel, the carriage runs out from between idler 55 and drive pulley 51 and thus the length of the line is limited to the capacity of the paper strip provided. It may be desirable to provide a strip wide enough and a carriage long enough to indicate up to, say, one hour, a single line of this length between much shorter lines indicating either a very hard thin shell or that drilling was suspended at that point. This distinction may be indicated by making a suitable mark on the record, or the travel of the pen may be stopped when drilling is discontinued, as by stopping the motive power or by moving one of the worm pinions 53a or 53c out of contact with its mating gear.

In order to interpret the record it is desirable to endorse on it notations of bit changes and other factors which would influence the drilling rate. A record produced in this manner will appear as in Fig. 5, in which the paper is so scaled that each main division laterally indicates, say, fifteen minutes and each main division longitudinally indicates, say, fifty feet.

I claim as my invention:

1. A device for recording, from a series of irregularly occurring events, a chart in which the duration of each time interval between events is traced against the ordinal numeral of said interval, comprising: a platen and means for maintaining a record strip in position on said platen; a marking implement; means for driving said marking implement across said strip at a predetermined constant velocity; resilient means arranged to urge said implement in the direction opposite to that of the motion caused by said driving means; means for substantially simultaneously disengaging said driving means to permit the return of said marking implement to its starting point and advancing said strip longitudinally a fixed distance at the moment of each of said irregularly occurring events; and means for reengaging said driving means immediately upon a return of said marking implement to its starting point.

2. A device for recording, from a series of irregularly occurring events, a chart in which the duration of each time interval between events is traced against the ordinal numeral of said interval, comprising: a platen and means for maintaining a record strip in position on said platen; a marking implement mounted in a carriage transversely movable with respect to said record strip; driving means frictionally engaging the under side of said carriage; means for moving said driving means at a constant, predetermined velocity; resilient means arranged to urge said carriage in the direction opposite to that of the motion caused by said driving means; means for lifting said carriage and thereby removing said marking implement from said record strip and disengaging said carriage from said driving means, thus permitting the return of said carriage to its starting point; means for advancing said record strip longitudinally a fixed distance; means for substantially simultaneously actuating said lifting means and said advancing means at the moment of each of said irregularly occurring events; and means for reengaging said carriage with said driving means immediately upon a return of said carriage to its starting point.

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