No. 713,753. Patented Nov. 18, 1902.

F. N. DENISON.

COMBINED ELECTRIC LOG AND SPEED RECORDER.

(Application filed Sept. 26, 1901.)

(No Model.) 2 Sheets—Sheet 1.

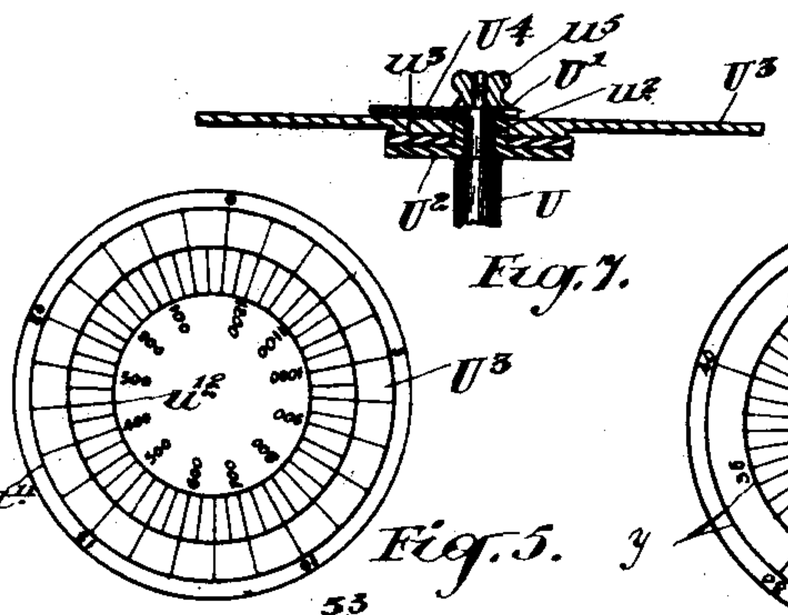

Fig. 7.

Fig. 5.

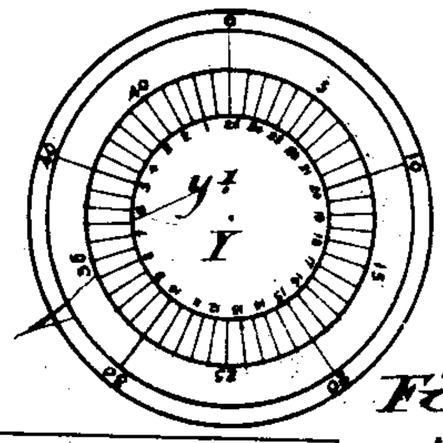

Fig. 6.

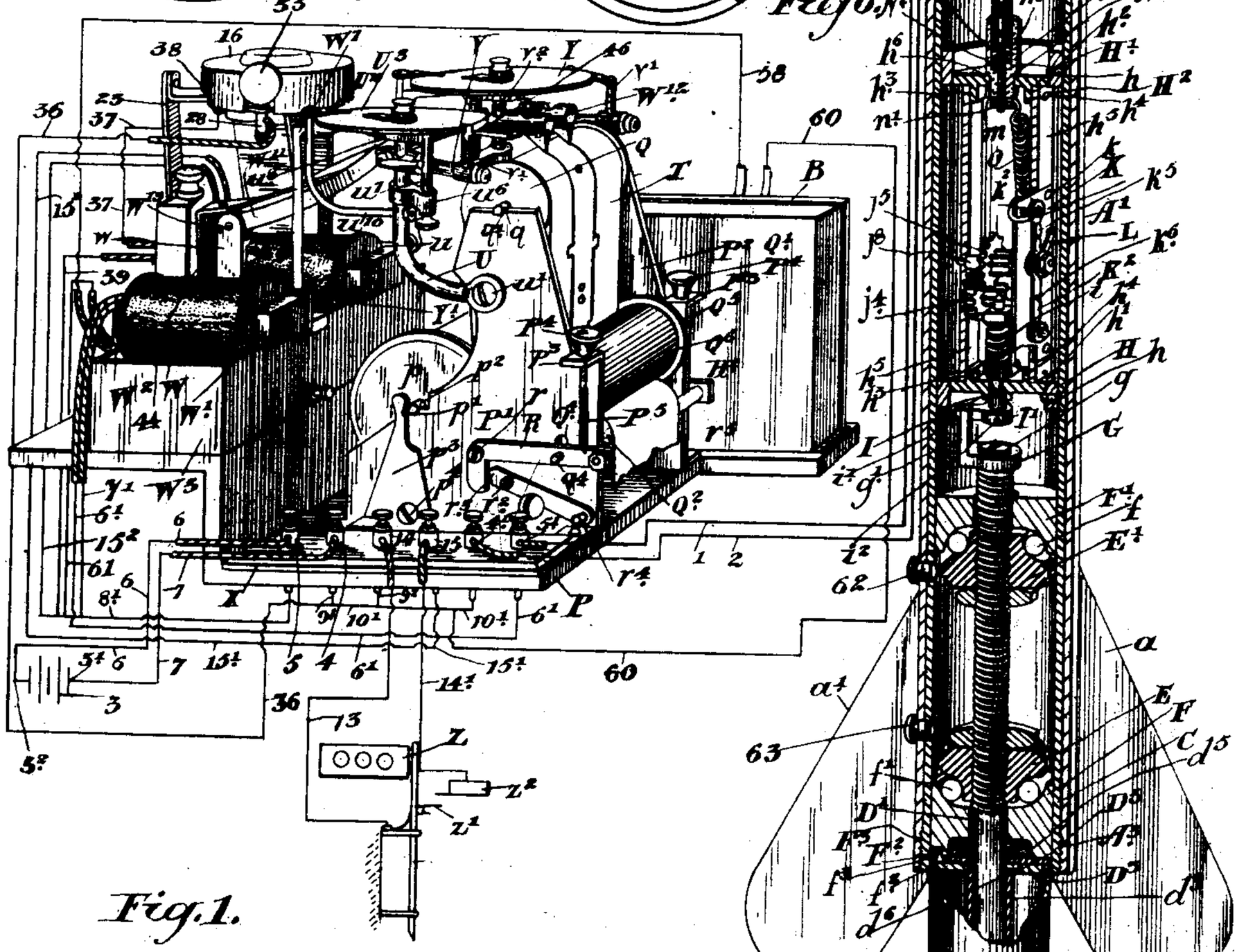

Fig. 1.

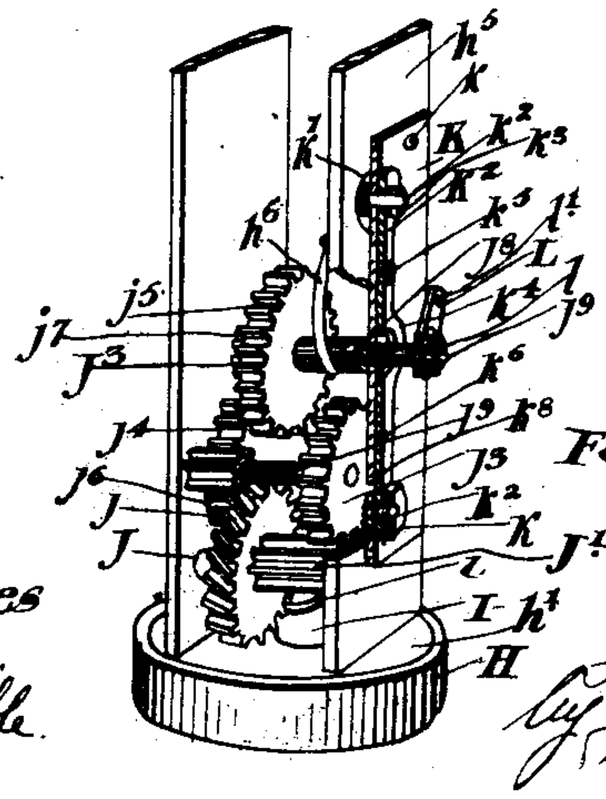

Fig 4.

Witnesses
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H. L. Tribble.

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No. 713,753. Patented Nov. 18, 1902.

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COMBINED ELECTRIC LOG AND SPEED RECORDER.

(Application filed Sept. 26, 1901.)

(No Model.) 2 Sheets—Sheet 2.

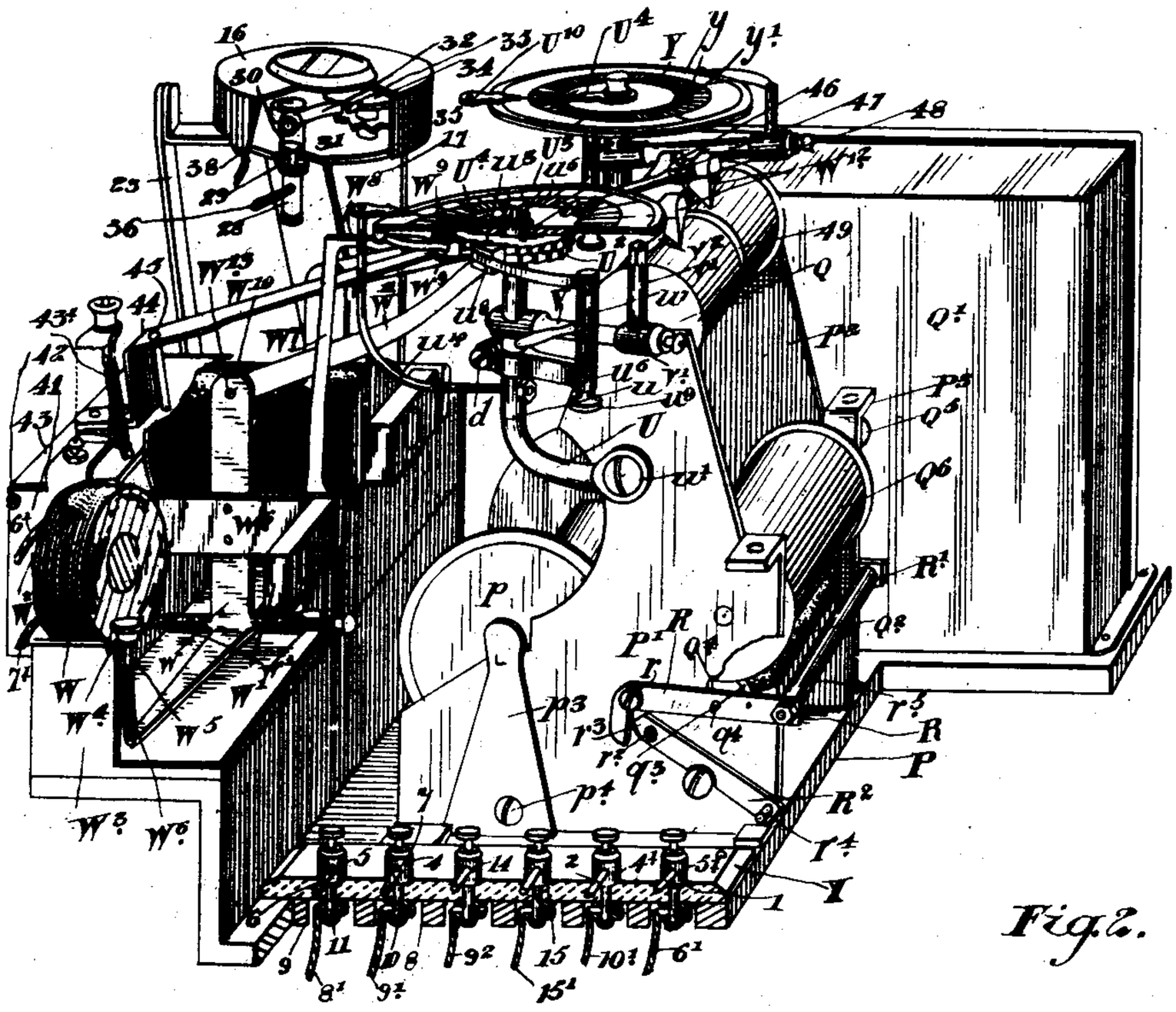

Fig. 2.

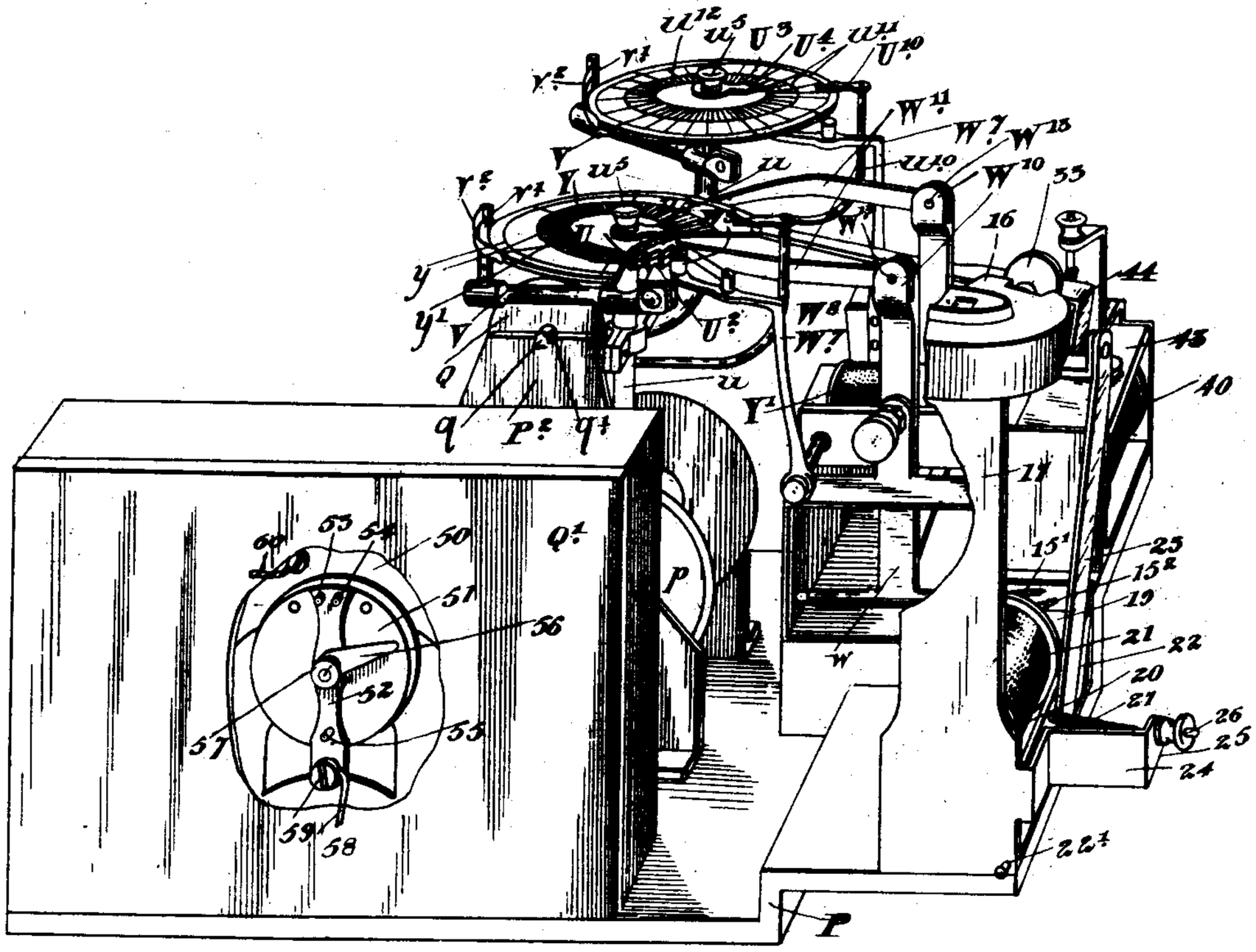

Fig. 3.

Witnesses.
A. J. S. Young.
A. L. Trumble.

Inventor
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by Fetherstonhaugh & Co. Atty.

UNITED STATES PATENT OFFICE.

FRANCIS NAPIER DENISON, OF VICTORIA, CANADA.

COMBINED ELECTRIC LOG AND SPEED-RECORDER.

SPECIFICATION forming part of Letters Patent No. 713,753, dated November 18, 1902.

Application filed September 26, 1901. Serial No. 76,678. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS NAPIER DENISON, meteorologist, of the city of Victoria, in the Island of Vancouver, in the Province of British Columbia, Canada, have invented certain new and useful Improvements in a Combined Electric Log and Speed-Recorder, of which the following is the specification.

My invention relates to improvements in combined electric logs and speed-recorders; and the object of the invention is to produce an instrument whereby the speed of the ship and speed of the engine may be graphically recorded on the same sheet simultaneously and the total movements of both indicated in such a manner that the speed of the ship and the distance traversed may be read at all times and the speed of theengine as to time also recorded, preferably by the hour and half-hour. To carry out this object, I have devised an arrangement of mechanism for feeding a roll of paper by means of clockwork and certain frictional mechanism and have provided recording-pens for indicating certain details on such paper as it is fed, and, further, indicating counters and disks, all of which are suitably operated by coacting magnetic devices arranged in the manner hereinafter more particularly explained.

Figure 1 is a perspective view of my device partially in section. Fig. 2 is an enlarged detail of the recording mechanism. Fig. 3 is a similar view showing the recording mechanism from the reverse side. Fig. 4 is an enlarged detail of the contact mechanism of the log. Fig. 5 is an enlarged detail plan view of the knot-recording disk. Fig. 6 is a similar view of the disk for recording the revolutions of the engine. Fig. 7 is an enlarged cross-section through one of the disks and driving-gear therefor.

In the drawings like characters of reference indicate corresponding parts in each figure.

A is a log, and B is the recording device.

A′ is the outer tubular casing of the log, having an internal thread A^2 at its upper end and a similar thread A^3 at its lower end and to which are secured the wings $a\ a'$.

B′ is a conical cap screwed into the upper end of the casing A′.

C is an inner casing secured into the outer casing by the screw-thread A^3.

D is a screw formed of the rotatable tubular portion D^2, provided with wings d^2, and with closed ends D^3 D^4, provided with orifices D^5 D^6.

d^3 is a sleeve secured within the orifices D^5 D^6 at either end.

D′ is a central spindle which passes through the sleeve d^3 and is secured therein by the end screw d^4, and the key d^5, fitting into the keyway d^6 in the head of the tubular portion D^2. The upper portion of the spindle D′ is threaded and has secured thereon the cones E, held in place by the lock-nuts E′.

F and F′ are cups forming the ball-race for the bearing-balls $f\ f'$. In the cup F is a recess F^2, in which is placed a suitable packing f^2, which is held in place by the end plate f^3, secured to the cup F by screws F^3.

G is a crank secured to the upper end of the spindle D′ by the screw g and is provided with the upturned end g'.

H and H′ are annular rings secured in the inner casing C by the screws h. Within the annular rings H are secured by suitable threads the disks h' and h^2, having lugs h^3 and h^4, to which are secured the supporting-plates h^5 by bolts H^2.

I is a vertical spindle which passes through the center of the disk h' and has formed on the upper enlarged portion thereof the worm-thread i, and upon the lower portion is secured the collar I′, provided with a projection i'. The collar I′ is secured to the spindle by the pin i^2.

J is a cross-spindle journaled in the supporting-plates h^5 and has secured thereon the worm-wheel j, designed to mesh with the worm-thread i on the spindle I.

J′ is a pinion forming part of the worm-wheel j.

J^3 is a train of gears comprising the gear-wheels j^3, j^4, and j^5 and the pinions j^6 and j^7, supported upon the cross-shafts j^8 and j^9.

K is a mica insulating-plate secured to the supporting-plate h^5 by screws k.

K^2 is a conducting-bar secured to the mica plate by the bolts k^2 and nuts k^3. The bar K^2 is formed centrally into an annular ring k^4, through which passes the reduced end of the shaft j^8, thereby forming an insulating air-place between the bar and the shaft.

k^5 and k^6 are platinum contact-points.

k^7 and k^8 are cut-away portions of the plate h^5, into which the heads of the bolts k^2 are inserted, so as to prevent contact between the plates h^5 and the bolts k^2.

h^6 is a spring-contact secured to the supporting-plate h^5 and having its lower end pressing upon the cross-shaft j^8, so as to insure perfect electrical connection between the plate and the shaft.

J^9 is a further-reduced end of the cross-shaft j^8, on which is secured the hand L by the nut l. The hand L is provided with a platinum contact l', designed to engage with the contacts k^5 and k^6. In the conical cap B' is secured an insulating-disk B^2, having a central orifice b^2.

b' is a metal contact which is screwed into the orifice b^2 and has secured thereto the wire 1 (one) by the screw b^3.

2 is a wire secured to the inner portion of the cap B' by the screw b^4.

M is a plug of insulated material, having a reduced lower end m, designed to be screwed into the orifice h^6. The plug M is provided with a central vertical bore M'.

m' is an enlarged portion of the bore M'.

N is a contact-pin designed to fit into the enlarged portion m' of the bore M' and is provided with the reduced portion N^2, which passes through the bore M' and is held in place by the nut n'.

n^2 is a spiral spring held in the enlarged portion of M' beneath the lower end of the pin N and encircling the reduced portion N^2, thus forming a resilient contact between the pin N and the metal contact b'.

O is a wire connecting the end of the pin N with the conducting-bar K^2. The apex of the conical cap is provided with an opening through which the wires 1 and 2 pass. The opening is suitably sealed to prevent the ingress of water.

P is the base-plate of the recording mechanism B.

P' and P^2 are standards secured to the base-plate.

p is a roller journaled in the notches p' by the pintles p^2. The pintles p^2 are secured in place by the spring-plates p^3, secured to the standards P' and P^2 by the screws p^4 and designed to press against their pointed ends on both sides. The roller p is designed to form a magazine for the paper upon which the record is to be written.

Q is a roller having end pintles q journaled in the notches q' in the tops of the standards P' and P^2. The roller Q is provided with an annular groove 49.

Q' is a casing in which is held a suitable clock mechanism. Q^5 is the main shaft of such mechanism.

Q^6 is a roller secured on the main shaft Q^5, which passes through the standards P' and P^2.

Q^2 is a roller, provided with a suitable rubber covering q^3 and provided with pintles q^4, which pass through the slots Q^4 in the standards P' and P^2.

R R' are a pair of bell-crank levers in which the pintles q^4 are journaled. The levers R R' are pivotally secured to the standards P' and P^2 by the screws r and connected together at their outer end by the rod r^5.

R^2 is a lever pivotally secured to the standards P' and P^2 by the screw r^2, provided with a V-shaped end r^3 and at its opposite end with a projecting pin r^4 to serve as a handle.

P^3 represents lugs formed on the standards P' and P^2, in which the set-screws P^4 are secured.

P^5 is a spiral spring connecting the outer end of the bell-crank R' with the set-screws P^4.

T is the paper on which the records are written. By raising the lever R^2 the bell-cranks R R' are tilted on their pivots against the pressure of the spring P^5, thereby lowering the roller Q^2 away from the roller Q^6, and thereby releasing the paper T.

U is an arm having a vertical upturned end u, secured to the standard P by the screw u'. The vertical portion of the arm U has a reduced upper end U'. (See Fig. 7.)

U^2 is a ratchet-gear having an annular flange u^2, loosely secured on the reduced end of the arm U by the nut u^5.

u^3 is a ratchet-wheel loosely encircling the flange u^2 and provided with one more tooth than the ratchet-wheel U^2.

U^3 is a graduated disk upon which the total number of knots is indicated.

U^4 is an indicating-pointer suitably secured on the flange U^2 of the ratchet-wheel u^3.

u^6 is a horizontal arm secured to the vertical arm U beneath the graduated disk U^3 and through the outer end of which passes the reduced end of the pin u^7.

u^8 is a spring-pressed dog secured to the pin u^7 and designed to engage with the ratchet-wheels U^2 and u^3 and keep them in alinement.

u^9 is a thumb-nut for adjusting the position of the pin u^7.

u^{10} is an upwardly-curved rod having its lower end secured in the arm U and provided at its upper end with a stationary indicating-needle U^{10}. The needle U^{10} indicates the number of knots on the outer graduated scale u^{11} to the number of twenty-five, and the center needle U^4, hereinbefore described, indicates the total number of knots on the center scale u^{12}.

V is an arm clamped to the vertical arm u by the screw d and has at its outer end the upwardly-projecting pin v', provided with the flat spring v^2, designed to press against the periphery to prevent the disk from rotating too far when operated.

W is an electromagnet, provided with the poles W' and W^2, supported upon the casing W^3.

w is a bell-crank pivotally supported in the casing by the adjusting-screws w'.

W^4 is a lug formed on the casing W^3, in which the set-screw W^5 is secured.

W^6 is a spiral spring connecting the lower arm of the bell-crank W with the set-screw W^5. Upon the upper arm of the bell-crank W is secured the armature w^6.

W^7 is a vertical arm secured to the armature w^6 and provided with a horizontal extension W^8 at its upper end.

W^9 is a spring-pressed dog pivotally secured to the end of the extension by the screw w^9. The vertical arm of the bell-crank W is provided with end jaws W^{10}.

W^{11} is the arm of the recording-pen W^{12}, pivoted at its lower end between the jaws W^{10} by the pin W^{13}.

X is an insulating-plate secured upon the base-plate P.

3 is the battery, and 4 and 5 are binding-posts secured to the insulating-plate X.

6 and 7 are wires connecting the terminals of the battery with the binding-posts 4 and 5. Beneath the binding-posts 4 and 5 are cut-away portions 8 and 9.

10 and 11 are screws which extend through the insulating-plate X into the binding-posts 4 and 5.

4′ and 5′ are binding-posts similar to the binding-posts 4 and 5, to which are connected the wires 1 and 2 of the log.

6′ is a wire leading from beneath the binding-post 5′ to the electromagnet W.

7′ is a wire leading from the electromagnet W to the wire 8′, connected to the screw 11 of the binding-post 5. The screw 10 is connected by the wire 9′ to the wire 10′, leading to the lower portion of the binding-post 4′.

Y is a graduated disk provided with graduated scales y y' for recording the total number of the revolutions of the engine and is similarly operated to the disk U^3 by the magnet Y′. The magnet Y′ is provided with a similar bell-crank armature as the magnet W, to which is similarly connected a recording-pen W^{12}.

Z is a mechanical counter located in the engine-room, provided with a spring-contact z' on its vertically-operated rod.

z^2 is a stationary insulated contact.

14 and 15 are binding-posts similar to the binding-posts 4 and 5.

14′ is a wire leading from the contact z^2 to the binding-post 14.

15′ is a wire leading from the lower portion of the binding-post 15 to the electromagnet 21.

15^2 is a wire connecting the electromagnet 21 to the screw 11 of the binding-post 5.

9^2 is a wire leading from the wire 10′ to the binding-post 14.

16 is a counter supported upon the standard 17.

21 is an electromagnet provided with poles 19 and 20.

22 is an armature pivoted on the screws 22′.

25 is a vertical arm secured to the armature 21 at the bottom and at the top to the operating-plunger of the counter.

I do not describe the mechanism of the counter, as it is a form generally used for this purpose.

24 is a projecting arm, and 25 is a lug thereon through which passes the set-screw 26.

27 is a spiral spring connecting the lower end of the screw with the armature 21.

28 is a binding-post located beneath the counter and insulated therefrom by the insulating-washer 29.

30 is a screw-post having a reduced end which extends down into the binding-post 28. The screw-post 30 is insulated from the counter by the insulating-washer 31.

32 is a spring-contact, curved, as shown.

33 is a set-screw which passes through the spring into the binding-post and which regulates the time of contact.

34 is a disk in the counter on which the hundreds are recorded, at the zero point of which is placed a metal contact 35, designed to engage with the spring-contact 32.

36 is a wire leading from the binding-post 28 to the wire 10′.

37 is a wire secured to the frame of the counter by the screw 38. The wire 37 passes down to the electromagnet 21, connected by the wire 39 to the wire 8′, connected to screw 11.

40 is an electromagnet.

43 is the armature of the magnet pivoted on the frame 41 by the screws 42, to which is secured the arm 44.

43 is a spring for returning the armature to its normal position.

45 is a set-screw which passes from the arm into the armature of the magnet. At the opposite end of the arm 44 is secured a needle-point 46 by the nuts 47 and 48. The arm 44 is operated by the electromagnet so as to cause the needle 46 to descend and perforate the paper as it enters the annular groove 49, so as to prevent the blunting of the point.

50 is the frame of the clock mechanism, which supports the insulating-disk 51.

52 is a conducting-bar, provided with platinum contact-points 53, 54, and 55.

56 is the hand of the clock, secured to the main shaft thereof by the thumb-nut 57.

58 is a wire secured to the conducting-bar 52 by the screw 59. The wire 58 leads to the electromagnet 40.

60 is a wire leading from any suitable portion of the clock-frame to the wire 10′, and 61 is a wire leading from the electromagnet 40 to the wire 8′ of the binding-post 5.

62 and 63 are oil-holes formed in the casing A′ and C of the log A to admit oil to the interior mechanism of the log.

Having described the principal parts involved in my invention, I shall briefly describe the operation of the same.

I will first describe the means whereby the knots are recorded on the recording-disk U^3 and paper T. As the log A′ passes through the water it is held from rotation by the wings a a'. The portion D^2 is rotated by the

wings d^2, thereby rotating the spindle d' and the crank G secured to the end thereof. In its rotation the upwardly-extending end g' of the crank G comes in contact with the projection i' on the collar I', thereby rotating the spindle I, connected with the cross-shaft J^8, through the worm i, worm-wheel J, pinion J', gear-wheel J^3, pinion J^6, gear-wheel j^4, pinion j^7, and gear-wheel j^5, secured to the shaft j^8. The hand L, secured upon the end of the cross-shaft j^8, is thereby revolved, bringing its platinum contact l' alternately into contact with the platinum contacts k^5 and k^6, and thereby completing an electric circuit from the battery 3. The circuit is completed from the terminal 3' of the battery 3 by the wire 7, binding-post 4, wires 9' and 10', binding-post 4', wire 2, metal contact b', the plug N, wire O, conducting-bar K^2, the hand L, contacts K K', spindle j^8, spring h^6, thence by the mechanism of the log to the ground-wire 1, to the binding-post 5' and by wire 6' leading to the electromagnet W, thence from the electromagnet W by the wires 7' and 8' to the binding-post 5, then from the binding-post 5 by wire 6 to the other terminal of the battery 3^2. When this circuit is completed, the bell-crank w is tilted on its pivot by the armature w^6 being drawn to the magnet W. The arm W^7, secured to the armature W^6, causes the dog W^9 to engage one of the teeth of the ratchet-wheels U^2 and u^3, turning them a distance of one tooth, and thereby turning the disk U^3, secured to the ratchet-wheel u^3, one-fiftieth of a revolution—that is to say, a space on the scale u^{11} equal to half a knot. As it has been before stated, the ratchet-wheel U^2 has one tooth less than the ratchet-wheel u^3. In consequence during the revolution of the ratchet-wheel u^3 the ratchet-wheel U^2 and the pointer U^4 have been turned one revolution and a space equal to the length of one tooth, thereby moving the pointer U^4 one-fiftieth of a revolution in a reverse direction in relation to the disk U^3—that is to say, one space on the scale u^{12}, equal to twenty-five knots, or the total number of knots recorded on the scale u^{11}. At the same time this operation is being performed the paper is caused to pass over the roller Q by the revolving roller Q^6, secured on the main shaft of the clock. When the electromagnet W is magnetized, the arm W^{11} of the pen W^{12} is drawn out of its track during the time the circuit is completed and is brought back to its normal position when the circuit is broken by the spring W^6. By this means a rectangular jog is formed on the track of the pen to indicate a knot or half-knot. As it has been before described, the contact k^5 is longer than the contact k^6, and therefore as the paper passes over the roller a longer jog is made to indicate a knot and a short one to indicate a half-knot.

I will now describe the means whereby the total revolutions of the engine are recorded on the disk Y and paper T. As the operating-rod of the mechanical counter Z is being operated by the engine the contact z' comes in contact with the contact z^2, thereby completing the circuit from the battery E by the wire 7, wire 9', wire 10', the binding-post 14, wire 13, the contact z', through the contact Z', thence by the wire 14' to the binding-post 15 and by wire 15' to the electromagnet 21, thence by wire 15^2 to the binding-post 5, and then by the wire 6 to the other terminal of the battery 3^2. Every time the contact Z' makes connection with the contact Z^2 the circuit is closed, so as to draw the armature 22, and thereby operate the counter 16 through the arm 23, secured to the plunger of the counter. This operation is continued until the counter 16 has registered up to the number of "999." When this number has been reached, the platinum contact 35 of the hundredth-wheel 34 of the counter comes in contact with the spring-contact 32, thereby completing a circuit from the terminal 3' of the battery 3 by the wire 7, wire 9, wire 10', wire 36, binding-post 28 through the frame of the counter to the ground-wire 37, leading to the electromagnet Y', thence from the electromagnet Y' by wire 39 to the wire 8', leading to the binding-post 5, and from thence by the wire 6 to the other terminal of the battery 3^2. It will be seen that every time this circuit is complete the armature W^6 of the electromagnet Y' is drawn over by the poles, so as to operate the disk Y in a similar manner as the disk U^3 is operated from the electromagnet W—that is to say, when the counter 16 has reached the number "999" the disk Y is turned one-fiftieth of a revolution, thereby indicating one thousand revolutions of the engine. When the disk Y has turned a full revolution, the pointer U^4 is turned in the opposite direction a distance equal to one-fiftieth of a revolution—that is, to the numeral "1" on the scale y'. It will thus be seen that when the disk Y has turned a complete revolution and the stationary hand U^{10} has indicated on the scale y fifty thousand revolutions of the engine the pointer U^4 is turned one space on the scale y' in a reverse direction, so as to indicate at each movement fifty thousand revolutions. This operation is repeated until the total number of one million two hundred and fifty thousand revolutions is reached. Every thousand revolutions of the engine is recorded on the paper T by a similar mechanism, which records the knots and half-knots of the paper—that is to say, when the thousand is registered a rectangular jog is formed in the track of the paper.

I will now describe the means whereby the time is recorded on the paper T. As the hand of the clock 56 revolves it comes in contact with the platinum points 53 and 54, thus completing the circuit from the battery by the wire 7, wire 9', and wire 10', wire 6 to the contact-bar 52 through the hand 56 and the contacts 53 and 54 in rotation, thence through the frame of the clock and ground-wire 58 to the electromagnet 40, then by wire 61 to the

wire 8′, connected to the binding-post 5, and thence by the wire 6 to the other terminal of the battery 3^2. Each time the electromagnet 40 is magnetized the armature 43 and the arm 44, connected thereto, are drawn down, so that the needle-point 46 perforates the paper T. In its revolution the hand of the clock 56 comes in contact first with the two contact-pointers 53 and 54, thereby closing the circuit twice and causing the needle-point to give a double perforation in the paper, and thereby indicating the hours on the paper. The hand then passes around till it comes in contact with the pointer 55, which causes the circuit to be closed once, and thereby causing only single perforation to be made in the paper indicating the half-hour.

What I claim as my invention is—

1. In a knot-recording device, the combination with the log provided with make-and-break electrical contacts, of an electromagnet connected by a suitable circuit passing through a battery and provided with a pivoted armature, a recording-disk supported on suitable standards having a suitable graduated scale inscribed thereon and provided with a ratchet-gear secured to its lower face, a stationary pointer secured to said standard, a vertical arm secured to said magnet, a spring-pressed dog designed to engage with said ratchet and means for bringing said armature back to its normal position as and for the purpose specified.

2. In a knot-recording device, the combination with the log provided with make-and-break contacts, of an electromagnet connected by a suitable circuit passing through a battery to said contacts and provided with a pivoted armature, a recording-disk having an inner and outer scale inscribed thereon supported loosely on a suitable standard and provided with a ratchet-gear secured to its face, a vertical arm secured to said armature, a spring-pressed dog secured on the end of said arm designed to engage with said ratchet, a stationary pointer secured to said standards, a rotating pointer and means for rotating said pointer one space upon every revolution of the disk as and for the purpose specified.

3. In a knot-recording device, the combination with the log provided with make-and-break electrical contacts, of an electromagnet connected through a battery by a suitable circuit to said contacts and provided with a pivoted armature, a recording-disk having an inner and outer scale inscribed thereon and provided with a ratchet-gear w^3, secured to the lower face thereof, a ratchet-gear U^2 provided with one more tooth than the ratchet w^3 loosely supported on a suitable standard beneath said recording-disk and ratchet w^3 and provided with an annular flange extending up through the recording-disk, a pointer secured to said flange, a vertical arm secured to said armature, a spring-pressed dog designed to engage the ratchets w^3 and U^2 as and for the purpose specified.

4. In a knot-recording device, the combination with the log provided with make-and-break electrical contacts connected by a circuit passing through an electromagnet and battery, of a recording-pen connected to said magnet and operated upon the closing of the circuit, a magazine-roller for holding a paper band supported on suitable standards, a platen-roller supported on said standards and over which the paper is designed to pass and in which the free end of the pen rests, a feed-roller, mechanism for operating said feed-roller and a supplementary spring-pressed feed-roller provided with a suitable rubber cover as and for the purpose specified.

5. The combination with the log, the electromagnetically-operated recording-pens, and the platen provided with an annular groove the clock mechanism and feed-roller supported on the main shaft thereof, of an electromagnet supported on a suitable frame and provided with a pivoted armature, an arm secured thereto and having its outer end extending over the said platen, a needle-point suitably secured to the outer end of the arm, make-and-break contacts operated by the said clock mechanism and designed to complete a circuit through the electromagnet and battery at predetermined intervals and means for carrying the armature back to its normal position upon the breaking of the circuit as and for the purpose specified.

6. The combination with the log, the electromagnetically-operated recording-pens, and platen provided with an annular groove the clock mechanism and feed-roller supported on the main shaft thereof, of an electromagnet supported on a suitable frame and provided with a pivoted armature, an arm secured thereto having its outer end extending over the said plate, a needle-point suitably secured to the outer end of the arm, a spring contact-arm secured to the outer end of the main shaft of the clock mechanism, an insulating-plate secured to the clock-frame and through which the main shaft passes, a conducting-bar secured thereto, suitably-located contacts on said bar designed to lie in the path of the said contact-arm, the said arm and conducting-bar being connected by a suitable circuit passing through the said magnet as and for the purpose specified.

7. The combination with a mechanical counter electromagnetically operated, of an electromagnet supported on a suitable frame and provided with a pivoted armature, a platen-roller supported on suitable standards, a pen secured to an arm pivotally connected to said armature and designed to rest on a paper band, a platen contact-piece suitably placed on the ultimate disk of said counter, a suitable contact secured to the frame of the counter designed to lie in the path of the contact on the disk, a circuit connected to said contact and passing through said electromagnet to a battery as and for the purpose specified.

8. The combination with a mechanical coun-

ter electromagnetically operated, of an electromagnet supported on a suitable frame and provided with a pivoted armature, a contact-piece suitably placed on the ultimate disk of said counter, an insulated contact secured to the frame of said counter and designed to lie in the path of the contact on the disk, a circuit passing from the contacts through the said electromagnet to a battery, a graduated disk supported on a suitable standard, a stationary pointer secured to a suitable arm secured to the said standard and mechanism designed to rotate said disk on the closing of the circuit passing through said electromagnet as and for the purpose specified.

9. The combination with a mechanical counter electromagnetically operated provided with a contact-piece on the ultimate disk thereof and an insulated contact on the frame thereof, of an electromagnet provided with a circuit connected to said contacts and to a battery and provided with a pivoted armature, a graduated disk loosely supported on a suitable standard, a ratchet-gear secured thereto, an arm secured to said armature, a spring-pressed dog designed to engage with said ratchet, a stationary pointer secured to an arm on said standard as and for the purpose specified.

10. The combination with a mechanical counter electromagnetically operated, provided with a contact-piece on the ultimate disk thereof, and an insulated contact on the frame thereof, of an electromagnet provided with a suitable circuit connected to said contacts and to a battery and provided with a pivoted armature, a disk loosely supported on a suitable standard provided with a ratchet-gear u^3, a ratchet-gear U^2 loosely held on said standard beneath the gear u^3 provided with one more tooth and an annular flange extending up through said disk, a pointer secured to said flange, an arm secured to said armature, a spring-pressed dog secured thereto and designed to engage the ratchet-wheels U^2 and u^3 as and for the purpose specified.

11. The combination with the mechanical counter electromagnetically operated, provided with a contact-piece on the ultimate disk thereof and an insulated contact on the frame thereof, of an electromagnet provided with a circuit connected to said contacts and to a battery and provided with a pivoted armature, a graduated disk loosely supported on a suitable standard, a ratchet-gear secured thereto, an arm secured to said armature, a spring-pressed dog designed to engage with said ratchet, a stationary pointer secured to an arm on said standard, a rotating pointer held on said standard and means for rotating said pointer one space upon every revolution of the disk as and for the purpose specified.

FRANCIS NAPIER DENISON.

Witnesses:
L. TRIMBLE,
R. SHIELDS.