

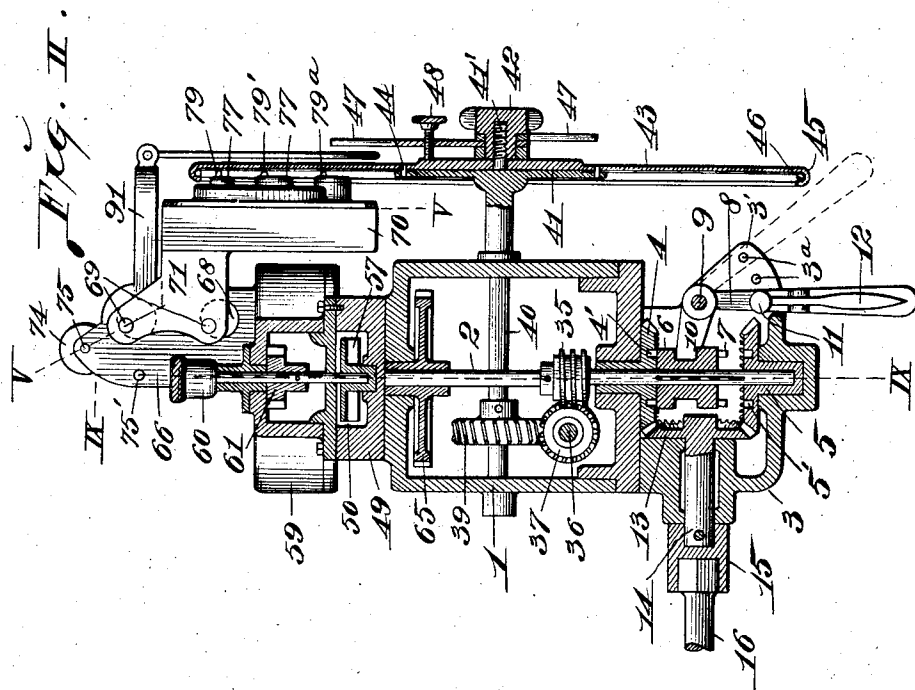
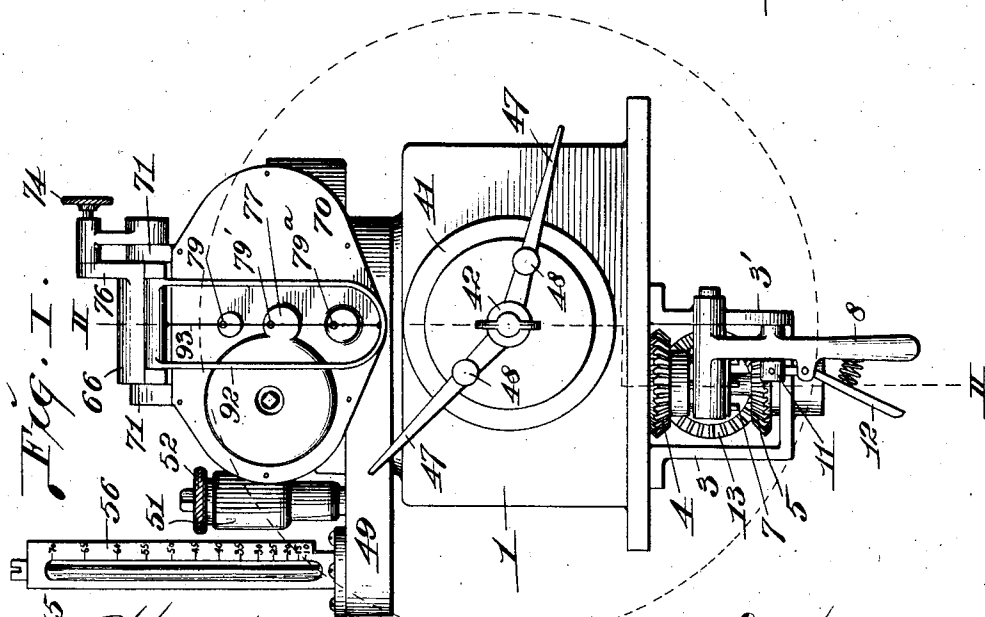
No. 887,823.

PATENTED MAY 19, 1908.

J. LIVTSCHAK.
SPEED RECORDER FOR LOCOMOTIVES.

APPLICATION FILED NOV. 3, 1903.

4 SHEETS—SHEET 1.



Attest:
M. P. Smith,
H. M. Kuehn

Inventor:—
Joseph Livtschak.
By Richard D. Atty.

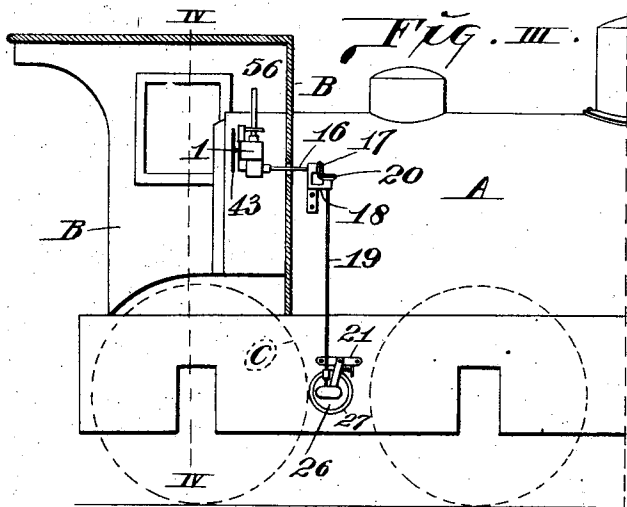
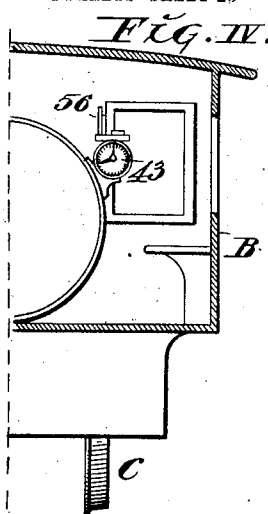
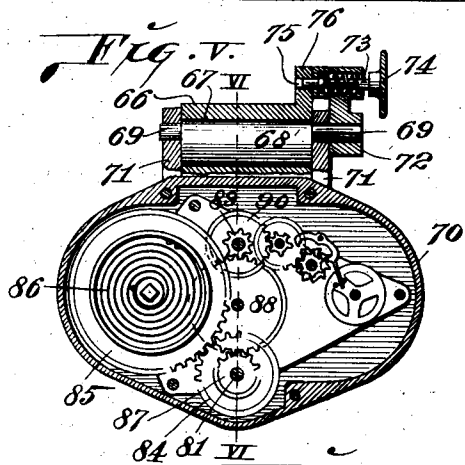
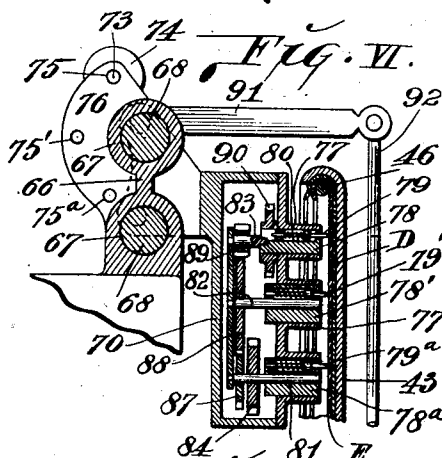
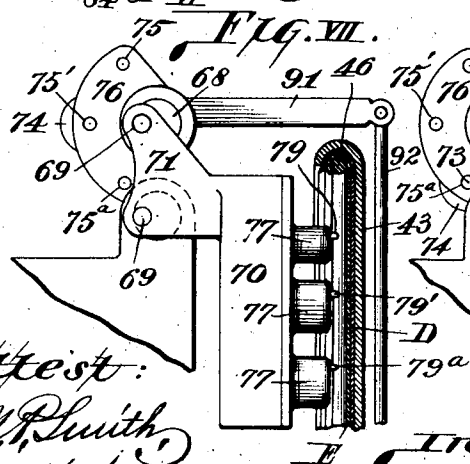
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4 SHEETS—SHEET 2.



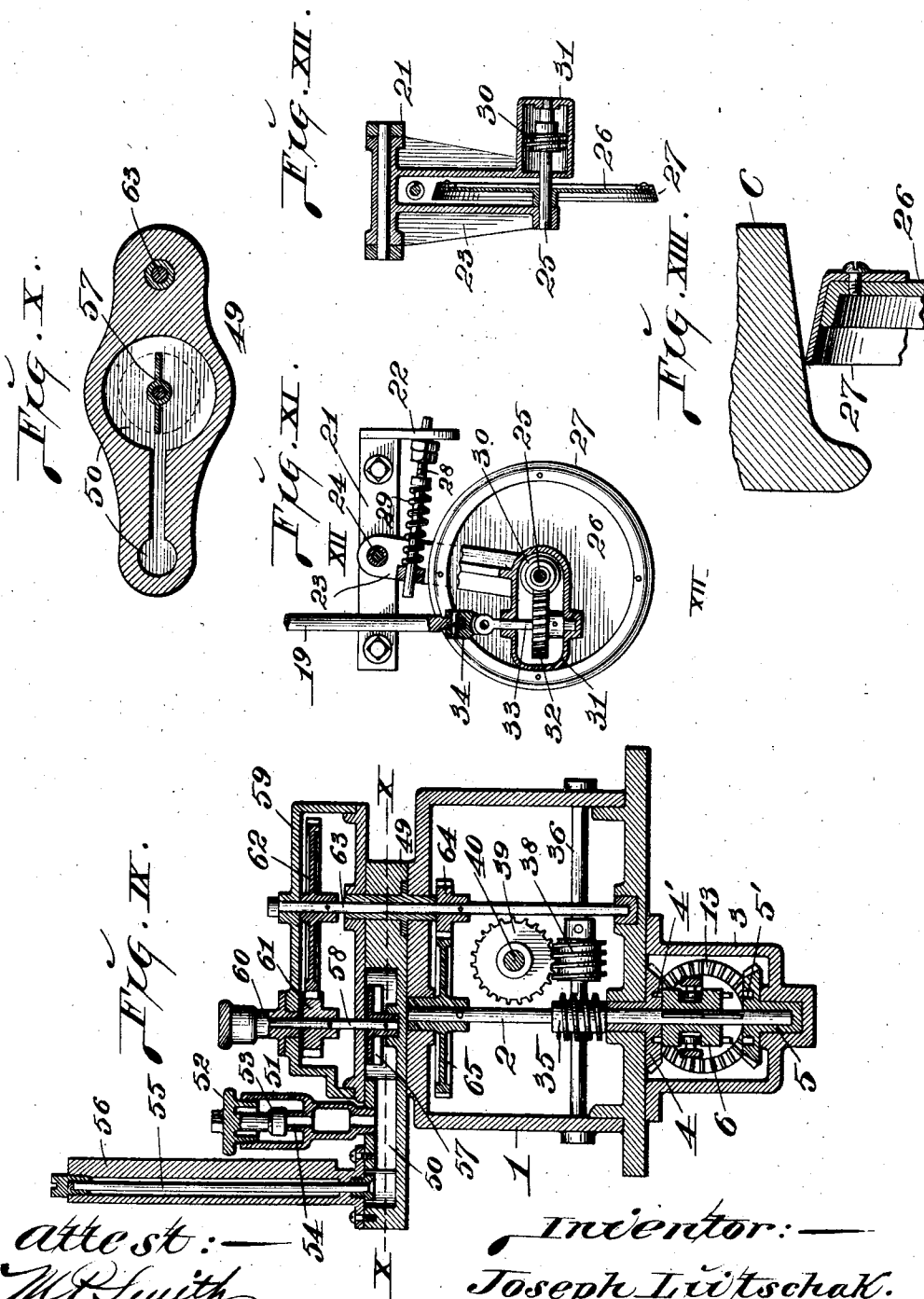
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4 SHEETS—SHEET 3.



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No. 887,823.

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4 SHEETS—SHEET 4.

Fig. XIV.

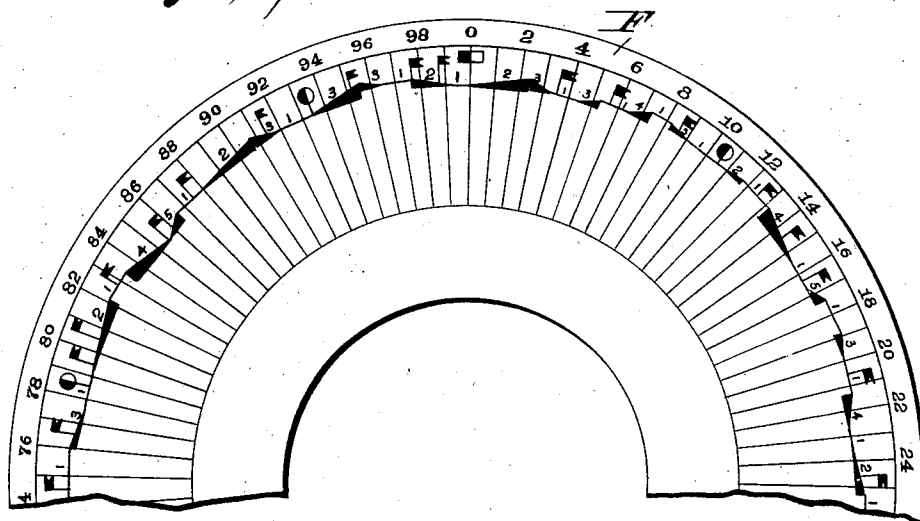
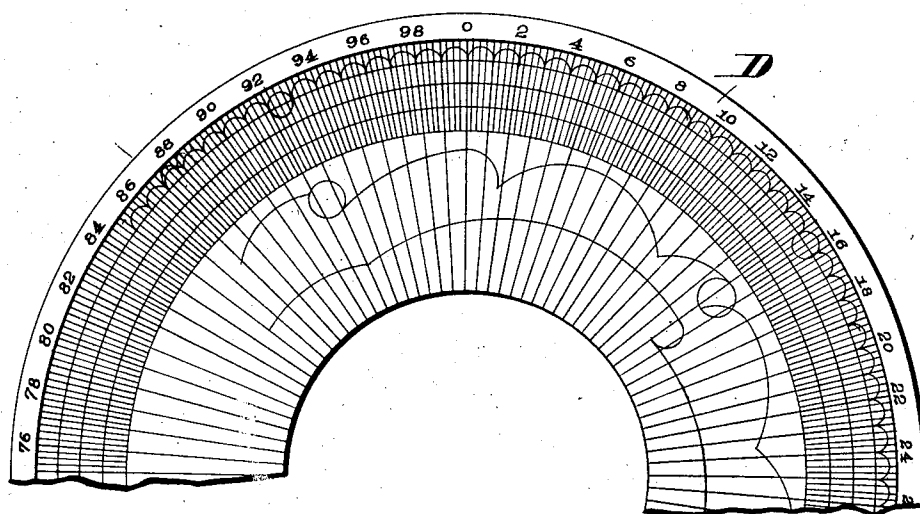


Fig. XV.



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UNITED STATES PATENT OFFICE.

JOSEPH LIVTSCHAK, OF ST. PETERSBURG, RUSSIA.

SPEED-RECORDER FOR LOCOMOTIVES.

No. 887,823.

Specification of Letters Patent.

Patented May 19, 1908.

Application filed November 3, 1903. Serial No. 179,703.

To all whom it may concern:

Be it known that I, JOSEPH LIVTSCHAK, a subject of the Emperor of Russia, engineer, residing at St. Petersburg, 18 Troitzky Perspective, Russia, have invented certain new and useful Improvements in Speed-Recorders for Locomotives; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to a speed recorder for use upon railway locomotives, the recorder having for its object the facilitation of the regular driving of the locomotive by furnishing information to the engineer of the route over which he is traveling and the position of the locomotive on the route from time to time; also to furnish a record of the speed traveled by the locomotive throughout its course and the duration of the locomotive run between stations and the duration of stoppages at various points. By providing a speed recorder constructed to attain the culmination of the objects recited, I enable the engineer operating a locomotive to become thoroughly familiar with the particulars of the railway over which he is operating the locomotive such as stations, grades, crossings, bridges, sidings, signals, etc., so that he may operate according to various circumstances both in good and adverse weather and exercise any necessary caution from time to time. The recorder operating mechanism involves a construction whereby the speed record is rendered mathematically accurate, due to the peculiar driving mechanism employed.

Figure I is a front elevation of my speed recorder. Fig. II is a vertical cross section taken on line II—II, Fig. I. Fig. III is a view in outline of a portion of a locomotive with my speed recorder shown mounted thereon. Fig. IV is a vertical transverse section taken through the cab of a locomotive on line IV—IV, Fig. III, showing my indicator in the position in which it is located in said cab. Fig. V is an enlarged vertical section taken on line V—V, Fig. II, through the stylus clock work box of the recorder and

parts adjacent thereto. Fig. VI is a transverse section taken on line VI—VI, Fig. V. Fig. VII is a view showing the stylus clock work box and its shifting mechanism in side elevation and the record and profile carrying disk in vertical section, the stylus box appearing in a varied position from that in which it is seen in Fig. VI. Fig. VIII is a similar view to Fig. VII, illustrating the stylus clock work box in a varied position. Fig. IX is a vertical longitudinal section taken on line IX—IX, Fig. II. Fig. X is a horizontal section taken on line X—X, Fig. IX. Fig. XI is a view partly in elevation and partly in vertical section of the friction driving wheel by which the recorder is operated and the driven mechanism associated with said wheel. Fig. XII is a vertical cross section taken on line XII—XII, Fig. XI. Fig. XIII is an enlarged section of a fragment of a locomotive track wheel and a fragment of the friction driving wheel which contacts with said locomotive wheel. Fig. XIV is a face view of a portion of one of the profile sheets used upon my recorder. Fig. XV is a face view of a portion of one of the speed record sheets used upon my recorder.

1 designates the main boxing of my recorder which is mounted in the cab of a locomotive in such position as to place the parts associated therewith conveniently accessible to the engineer by whom the locomotive is being operated. In the boxing 1 is a vertical shaft 2 that extends downwardly through the bottom of the boxing into a frame 3. The shaft 2 passes loosely through a beveled pinion 4 journaled in the bottom of the boxing and is loosely seated in a beveled pinion 5 that is loosely stepped into the bottom of the frame 3. The beveled pinion 4 is provided at its lower face with recesses 4' and the beveled pinion 5 has in its upper face recesses 5'.

6 is a grooved clutch collar that is feathered to the vertical shaft 2 between the beveled pinions 4 and 5 and is provided with studs 7 located at its ends that are adapted to enter the recesses in either of said pinions to operatively connect a driven pinion to said shaft. The clutch collar is shifted longitudinally on the shaft 2 through the medium of a lever 8 that is pivoted at 9 to a wing 3' of the frame 3 and is provided with an arm 10 that enters the groove in said collar. The lever 8 is retained in any position to which it

may be moved by a retaining pin 11 movably seated therein and having connected to it a trigger 12 pivoted to the lever. The pin 11 is adapted to enter any one of a series of pin holes 3* in the frame wing 3'.

13 designates a beveled pinion that is located between the beveled pinions 4 and 5 and in mesh with both of said pinions. The stem 14 of the pinion 13 is journaled in a horizontal position in the frame 3 and has connected to its outer end a socket 15 in which is fitted a horizontal shaft 16. The shaft 16, as seen in Fig. III, has fixed to it a beveled pinion 17 and it is journaled in a bracket 18 suitably secured to the locomotive A adjacent to its cab B, (see Fig. III).

19 designates a vertical shaft having its upper end journaled in the bracket 18 and having fixed to it a beveled pinion 20 that meshes with the beveled pinion 17 of the horizontal shaft 16.

21 designates a hanger secured to the locomotive frame work adjacent to one of its track wheels C and provided with a depending arm 22.

23 is a yoke pivoted at 24 to the hanger 21 and suspended therefrom for swinging movement. In the yoke 23 is journaled a shaft 25 (see Figs. XI and XIII).

26 designates a friction wheel fixed to the shaft 25. This friction wheel has at its perimeter a flaring or tapering friction ring 27 that is preferably of steel. The friction wheel is so supported by the yoke 23 and its rim is so disposed relative to the plane of the axis of the friction wheel, and the perimeter of the locomotive track wheel that the free edge of said rim will constantly bear against the usual tapering perimeter of the track wheel, as seen most clearly in Fig. XIII. For the purpose of holding the friction wheel to the locomotive track wheel I employ a rod 28 that is mounted in the hanger arm 22 and in the yoke 23 and bears an expansion spring 29 that exerts pressure against said yoke to hold it and the friction wheel journaled therein yieldingly while the friction wheel rim is in bearing with the locomotive track wheel. This construction is seen most clearly in Fig. XI. On the friction wheel shaft 25 is a worm 30 located in a box 31 carried by one of the arms of the yoke 23.

32 is a worm wheel also in the box 31 that is fixed to a vertical shaft 33 which extends to the exterior of said box and is united to the vertical shaft 19 by a universal joint 34. The parts just described constitute the means through which the vertical shaft 2 for my speed recorder is driven to furnish power for the operation of the speed recording mechanism and the indicators associated with said recording mechanism.

35 (see Figs. II and IX) designates a worm fixed to the vertical shaft 2 within the main boxing 1. 36 is a horizontal shaft jour-

naled in said boxing and having fixed thereto a worm wheel 37 that meshes with the worm 35 (see Fig. II). On the shaft 36 (see Fig. IX) is a worm 38 with which meshes a worm wheel 39 fixed to a shaft 40 journaled in the main boxing 1 and positioned at right angles to the horizontal shaft 36. The shaft 40 extends through the front wall of the main boxing and it bears at its forward end a head 41 (see Figs. I and II). Protruding from the forward end of the shaft 40 is a screw threaded stem 41' to which is fitted a winged nut 42.

43 designates a sheet carrying disk that is fitted against the forward face of the shaft head 41 and is held thereto by the nut 42, the said disk being held from rotation with respect to said shaft head by pins 44 that are carried by either the disk or shaft head and enter into openings in the other of said members. The edge of the disk 43 is curled rearwardly to furnish a pocket 45 within which record sheets to be hereinafter more particularly alluded to are held at the back of the disk through the medium of a spring ring 46 seated in said pocket.

47 are indicator fingers the inner ends of which are loosely mounted on the shank of the nut 42 and confined at the rear of the head of said nut in front of the disk 43. These indicator fingers have seated in them set screws 48 that are adapted to be tightened to the central portion of the disk 43 to hold the fingers in any position into which they have been moved for service as will hereinafter appear.

49 designates a fluid box located upon the main boxing 1 and containing a chamber 50 (see Figs. II and IX) adapted to contain a heavy fluid such as oil. Fluid is introduced into the chamber 50 through a cup 51 that is closed by a plug 52 bearing a valve 53 which rests upon a valve seat 54 in the cup.

55 is a transparent indicator tube surmounting the fluid box 49 and having communication at its lower end with the fluid chamber 50. Alongside of the indicating tube 55 and preferably partially inclosing said tube is a scale post 56 on which is a scale (see Fig. I) for indicating speed and to the various indicating characters of which the level of fluid entering said indicating tube is designed to rise when the fluid is forced from the chamber 50 into said tube. In the fluid chamber 50 is a winged centrifugal pump disk 57 that is carried by a vertical shaft 58.

59 is a housing surmounting the fluid box 49 and through which the shaft 58 extends to be seated in a bearing 60 seated in said housing. Fixed to the shaft 58 within said housing is a pinion 61. This pinion meshes with a larger pinion 62, also within said housing, and carried by a vertical shaft 63 through the medium of which the centrifugal pump disk is driven at proper speed to force the

fluid from the chamber 50 into the transparent indicating tube 55. The vertical shaft 63 extends downwardly into the main boxing 1 and is stepped into the bottom of said boxing. Said shaft within the boxing is in vertical alinement with the vertical driving shaft 2 and it bears a pinion 64 that is in mesh with a pinion 65 fixed to said shaft 2. This gearing provides for the driving of the shaft 63 to transmit power to the centrifugal pump disk.

I will next describe the means through which the speed recording record is produced upon the record sheet mounted at the rear of the sheet carrying disk 43. One of these sheets indicated by the letter D is illustrated in Fig. XV and in practical use of the sheet it is mounted against the rear face of the disk 43 with a sheet E of manifolding paper resting against it as seen in Figs. VI to VIII inclusive. While in position the sheets D and E are held from displacement by the spring ring 46 previously referred to.

66 designates a post surmounting the housing 59. Extending longitudinally through the post are bores 67 disposed in the same vertical line. In these bores are located barrels 68 each provided at its ends with stems 69 positioned eccentrically to the axes of said barrels.

70 designates a stylus carrying box that is provided with hanger arms 71 which are journaled to the eccentric barrel stems 69, as seen most clearly in Figs. I, II, V, VII and VIII. One of the eccentric stems 69 projects through the hanger arm 71 in which it is seated and on the projected portion of said stem is fixed a crank 72. Seated in the free end of this crank arm is a spring controlled bolt 73 provided with a handle 74. The bolt 73 is adapted to enter one of a series of bolt holes 75, 75' and 75^a in a wing 76 extending rearwardly from one end of the post 66. These holes are disposed in an arc of a circle. In Figs. V and VI the spring bolt is shown in the uppermost bolt hole 75 of the wing 76; in Fig. VII in the intermediate rearmost hole 75' and in Fig. VIII in the lower hole 75^a. When the spring bolt 73 is withdrawn from one of the bolt holes in the wing 76 the crank 72 may be rocked to rotate the eccentric barrel stem 69 to which said crank is fitted and the stem at the opposite end of the corresponding barrel and at the same time the other barrel 68 will be rotated correspondingly. To illustrate the action that takes place when said crank is so rocked it may be assumed that the spring bolt is in the uppermost position seen in Figs. V and VI, and the stylus carrying box 70 is in its most elevated position with its front side in close proximity to the rear side of the sheet carrying disk 43. When the crank 72 is rocked rearwardly and the spring bolt is carried to the bolt hole 75', the stylus

carrying box is drawn away from the rear side of the sheet carrying disk, as seen in Fig. VII. A further downward movement of the crank 72 to carry the bolt to the hole 75^a occasions descent of the stylus carrying box to a lowered position and into close proximity with the rear side of the sheet carrying disk as seen in Fig. VIII. Projecting from the front wall of the stylus carrying box 70 are a series of bearings 77 (see Figs. I, II, and VI to VIII inclusive.)

78, 78' and 78^a are rotatable barrels loosely mounted in the bearings 77 (see Fig. VI). These barrels have extending respectively through them eccentric to their axes and in a longitudinal direction, styluses 79, 79' and 79^a held projected forwardly by springs 80 so that the forward point of each stylus it constantly and yieldingly maintained in a protruded condition toward the rear side of the sheet carrying disk 43 and the record and manifolding sheets D and E carried by said disk.

81, 82 and 83 are axles having engagement with the barrels 78, 78' and 78^a to impart rotation thereto. The axle 81 bears a pinion 84 that is arranged in mesh with the main wheel 85 of clock work mechanism (see Fig. V), the said wheel 85 being driven by a clock work spring 86. Fixed to the axle 81 is a pinion 87 from which motion imparted to said axle is transmitted to the axle 82 through the medium of a pinion 88 fixed to said last named axle. The pinion 88 meshes with a pinion 89 fixed to the axle 83 to transmit motion to the last named axle.

90 is a pinion carried by the barrel 78 to which the axle 83 is fitted. This pinion 90 is geared to the escapement mechanism of the clock work (see Fig. V). Through the medium of the clock work mechanism described the styluses 79, 79' and 79^a are continually rotated, while the barrels in which they are seated are being driven by the clock work. The toothing of the pinions associated with the axles by which the stylus barrels are rotated is so calculated that a full revolution of the stylus 79^a will occur in sixty minutes, a full rotation of the stylus 79' will occur in ten minutes and a full rotation of the stylus 79 will occur in one minute. Provision is thereby made for the actuation of the styluses to record accurately the speed traveled by the locomotive due to the movement of the record sheet D with the disk 43 by which it is carried, during which movement the various styluses are maintained in pressure contact with the manifolding sheet laid against said record sheet and the styluses continually rotating under the influence of the clock work to transcribe on said record sheet a record of the speed at which the record sheet travels. The speed traveled by the record sheet corresponds, manifestly, to the speed of rotation of the disk 43 and as previously

explained the speed rotation of said disk corresponds exactly to that of the locomotive wheels from one of which said disk is driven.

91 designates a hanger projecting from the post 66. 92 is a yoke suspended from this hanger and occupying a position in front of the sheet carrying disk 43. Extending across the face of the profile sheet at the front of the disk 43 and within the yoke 92 is a thread 93 that is stretched longitudinally of said yoke. This thread serves as a marker for the various points throughout the profile sheet as the sheet advances in its rotation with said disk, thereby illustrating to the engineer in a continuous manner the position of the locomotive on the railway corresponding to the point on the profile sheet that is brought to said marking thread.

Indication of the progress of the locomotive on the railway is obtained by the slow rotation of the sheet carrying disk 43 on the face of which are fixed in turns special profile sheets F, see Fig. XIV, that may be of card board or sheet metal. These sheets have provided thereon graphical profile plans of sections of the railway. The speed of rotation of the disk 43 corresponds exactly to the speed of travel of the locomotive and consequently the rotation of the profile sheet always continues the same as the rotation of the locomotive track wheel from which said disk is driven through the intervening mechanism. As will be seen by referring to the profile sheet the longitudinal profile of the railway is traced on an annular net-work of lines formed by inter-crossing and radial dividing divisions. These divisions correspond to miles or kilometers, and associated with the divisions are corresponding ordinals while the concentric lines are to be considered as the relative scale of the slope of single sections of the railway and their altitude above the sea level. In order that the gradients may be more visible they are represented by dark triangles more or less acute, to correspond to the degree of such gradients. The tracing of the elements of the profile plan of the wave section is made on the base of existing longitudinal profiles of the wave and this, according to the rule, is square and corresponding to divisioning of a circle of the profile sheet. For the scale of exact evaluation of the gradients of the wave such gradients are marked with numerals indicating thousandth parts in usual manner.

In order to ascertain which part of the profile plan of the sheet is in correspondence to the respective location of the locomotive on the railway the indicating thread 93 is so disposed as to extend across the profile sheet in a direction transversely of the profile on said sheet. In leaving a respective station on the railway the disk 43 is properly moved so that the marker thread 93 will coincide with the point on the profile sheet corresponding

to said station as indicated on said sheet. Thereafter each subsequently reached point on the railway will be accurately indicated in line with the thread to exactly show the position of the locomotive from time to time. The profile sheets are preferably made with divisions of hundreds order and when the profile has been carried a complete revolution corresponding to the course to which it is suited, the used sheet is removed and another substituted for use in the same manner as before to show the profile of the continued run of the locomotive.

It will be noticed that on the profile of each section of the sheet F are also laterally traced arc lines that furnish indications of various particulars along the railway such as high-way crossing points, bridges, tunnels, etc.

In instances where the engineer desires to make notation of any particular point throughout the run of the locomotive in order that he may observe particular care at such point he may, preliminary to reaching such point, move one of the indicating fingers 47 so that it will mark the particular point he desires to remember and secure the finger at such point by setting the set screw 48 corresponding thereto and such finger will, at the proper time, reach the location of the marker thread 93 to serve as a reminder to the engineer. Two of such fingers are illustrated in the drawings but one or a number greater than two may be provided if desired.

The circumferential velocity of any track wheel of a locomotive is always equal to the progressive travel of the locomotive and therefore power may be acquired from the tread of the track wheel C and transmitted through the friction wheel 26 with the same virtue as if said friction wheel traveled directly in contact with the railway rail on which the track wheel runs. So for instance, if the circumference of the friction wheel is equal to one meter the wheel will make in the space of a kilometer of the railway section one thousand revolutions entirely independent of the diameter of the locomotive track wheel from which it is driven. As it is a most essential condition that the proportion of the number of rotations of the friction wheel with respect to the unity of length of the road be kept constant the friction wheel is provided with the flaring rim 27 which is so disposed relative to the conical tread of the locomotive wheel C that only its free edge touches said wheel. It is apparent that the narrow wear edge of this rim will be reduced very slowly and that the friction wheel will be displaced laterally toward the opposing track wheel of the locomotive as wear of such rim occurs. According to mathematical calculation the reduction and lateral movement of the friction wheel and its rim will have no influence on the proportion of the number of rotations of the friction

wheel with respect to the unity of length of the railway, provided the inclination of the conical rim with respect to the rim's axis is a proper one with respect to the conical tread of the locomotive wheel against which the friction wheel operates. The constancy of the proportion between the number of rotations of the friction wheel and the progressive speed of the locomotive affords a guarantee of the precision of the indications of the apparatus.

From the description it will be understood that the sheet carrying disk, the profile sheet fitted thereon and the centrifugal pump disk 57 are operated in common and exactly proportional to correspond precisely to the rate of speed of travel of the locomotive. Hence the indications in the speed indicating tube 55 and the profile sheet F always coincide so that such indications control each other.

The object of mounting the stylus box 70 in a shiftable manner is to provide the three definitely different positions of said box; namely, high, low and intermediate with respect to the sheet carrying disk 43.

As will be seen from Figs. IV, VI and VIII the markers are in contact with the sheet in the high and low positions of the stylus box but are out of contact with the sheet when the box is in intermediate position. I thereby provide for change of the elevation of the stylus box and am enabled to trace on the diagram of the speed indicating record sheet D two ranges of markings or backward travel of the locomotive where such occurs. The record sheet D has printed thereon a net-work of lines that render it a dial as illustrated in Fig. XV. The diagram on the sheet is divided in conformity with the divisions of the profile sheet at the front side of the disk 43 into hundreds parts and marked with cardinal numbers from one to one hundred. During the operation of the styluses 79, 79' and 79^a by which the markings are made on the record sheet D and which are propelled through the medium of the described clock work, these styluses operate to produce markings on the record sheet in the following manner. If the locomotive be brought to a standstill the sheet carrying disk 43 will come to rest and the styluses will continue their movement and trace on the record sheet at a point corresponding to the station at which the stoppage is marked arcs of circles or circles from which the time of a stoppage may be determined from one to sixty minutes. The stylus 79^a which is rotated by the axle 81 corresponding thereto is so driven as to make a complete circle in sixty minutes and the styluses 79' and 79 which are respectively operated by the axles 82 and 83 make complete circles in respectively ten minutes and one minute, as previously stated. When the locomotive is in motion and the disk 43 as

well as the styluses are in motion the styluses will trace special curves on the record sheet, the elements of which represent resultants of the simultaneous motion in two different directions and with two different speeds. The tracings made by the styluses are indicated on the record sheet seen in Fig. XV. The duration of run of a locomotive between stopping points as the average speed of the locomotive corresponding to each kilometer or mile of the railway is determined by the wave line traced by the stylus 79 driven by the axle 83. As it requires one minute for said stylus to make a complete revolution the number of waves between the stoppage points will exactly correspond to the number of minutes of the respective run. As a measure for the speed corresponding to a definite mile or kilometer of the road further serves that length of arc of the dial which corresponds to the turning points of the respective wave *i. e.*, to the duration of a minute, so the greater the distances between the turning points of the wave is the greater has been the speed.

The styluses 79^a and 79' that are rotated through the medium of the shafts 81 and 82 and require respectively sixty minutes and ten minutes to make complete revolutions have no special practical value during the travel of a locomotive but are provided for the especial purpose of indicating on the record sheet the duration of stoppage of the locomotive at any station, the duration of the stoppages being learned by measuring the length of the arcs produced by such styluses on the record sheet.

I claim as my invention:

1. The combination with a locomotive track wheel, of a speed recording mechanism, and a conical driving wheel for said speed recording mechanism driven by said locomotive track wheel, said conical wheel being reversely arranged in relation to the locomotive wheel and having the base of the cone contacting with said wheel substantially as described.

2. The combination with a locomotive track wheel, of a speed recording mechanism, a yoke situated near the locomotive wheel, a conical wheel reversely arranged in relation to the locomotive wheel and carried in said yoke and having the base of the cone engaging the locomotive wheel, a spring for pressing the yoke towards the locomotive wheel to keep the conical wheel in contact therewith and means for transmitting the movement of the conical wheel to the speed recording mechanism.

3. In a speed recorder, the combination of a sheet carrying member, means for imparting movement to said sheet carrying member, a stylus box located in proximity to said sheet carrying member, a stylus in said box, means for operating said stylus and means

whereby said stylus box is shifted horizontally and vertically into varying operative positions, substantially as set forth.

4. In a speed recorder, the combination of
5 a sheet carrying member, mechanism for imparting movement to said sheet carrying member, a stylus carrying member located in proximity to said sheet carrying member, means for shifting said member into different
10 operative positions, a plurality of styluses mounted in said stylus carrying member, and means for operating said styluses at different degrees of speed, substantially as set forth.
- 15 5. In a speed recorder, the combination of a sheet carrying member, mechanism for imparting movement to said sheet carrying member, a stylus box arranged in proximity to said sheet carrying member, a stylus in
20 said box, means for operating said stylus, and means for shifting said stylus box; said box shifting means consisting of a plurality of barrels having stems eccentric to their axes and fitted to said box, substantially as
25 set forth.

6. In a speed recorder, the combination of a sheet carrying member, mechanism for im-

parting movement to said sheet carrying member, a stylus box arranged in proximity to said sheet carrying member, a stylus in
30 said box, means for operating said stylus, and means for shifting said stylus box; said last named means consisting of a plurality of barrels having stems eccentric to their axes and fitted to said box, and means whereby
35 said barrels are rotated to rock their stems, substantially as set forth.

7. In a speed recorder, the combination of a sheet carrying disk, mechanism for rotating said disk, an indicator finger movably supported at the axis of said disk, and a set
40 screw in said finger adapted to be seated against said disk to hold the finger in a fixed position in relation to the disk so that said finger will rotate with the disk, substantially
45 as set forth.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

JOSEPH LIVTSCHAK.

Witnesses:

ALEXANDER TSCHENALOFF,
GERHARD GLITSCH.