(No Model.) 3 Sheets—Sheet 1.

J. BOYER.

RECORDING VELOCIMETER.

No. 356,916. Patented Feb. 1, 1887.

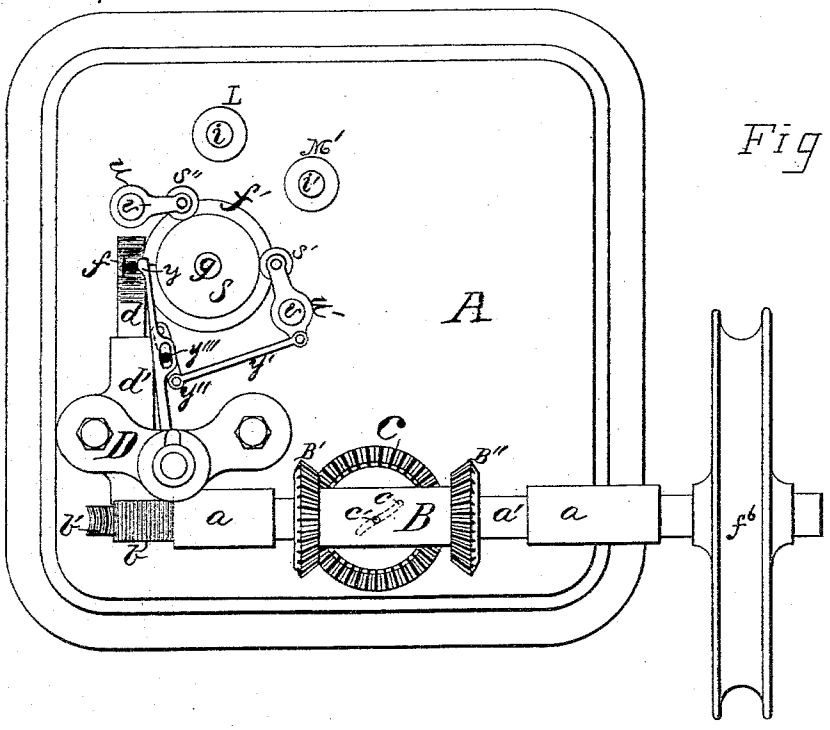


Fig I

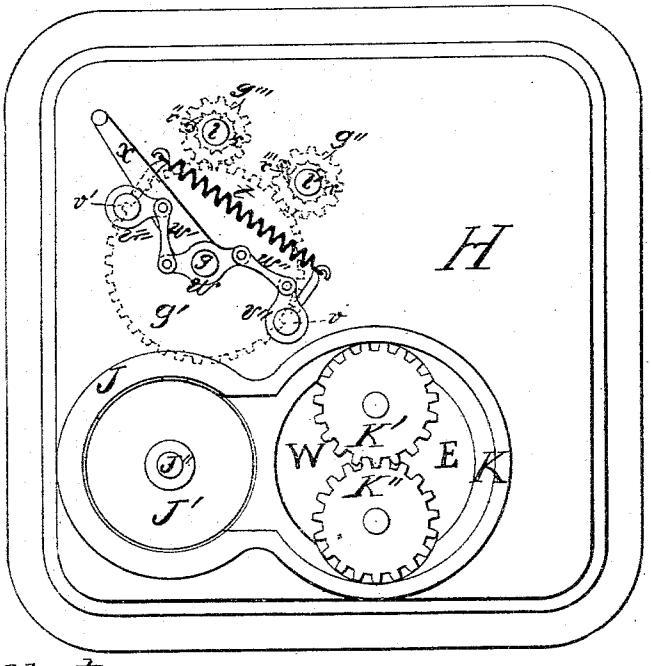


Fig II

Attest.
Edward Hotchkiss

Inventor.
Joseph Boyer

N. PETERS. Photo-Lithographer. Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

J. BOYER.

RECORDING VELOCIMETER.

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Fig III

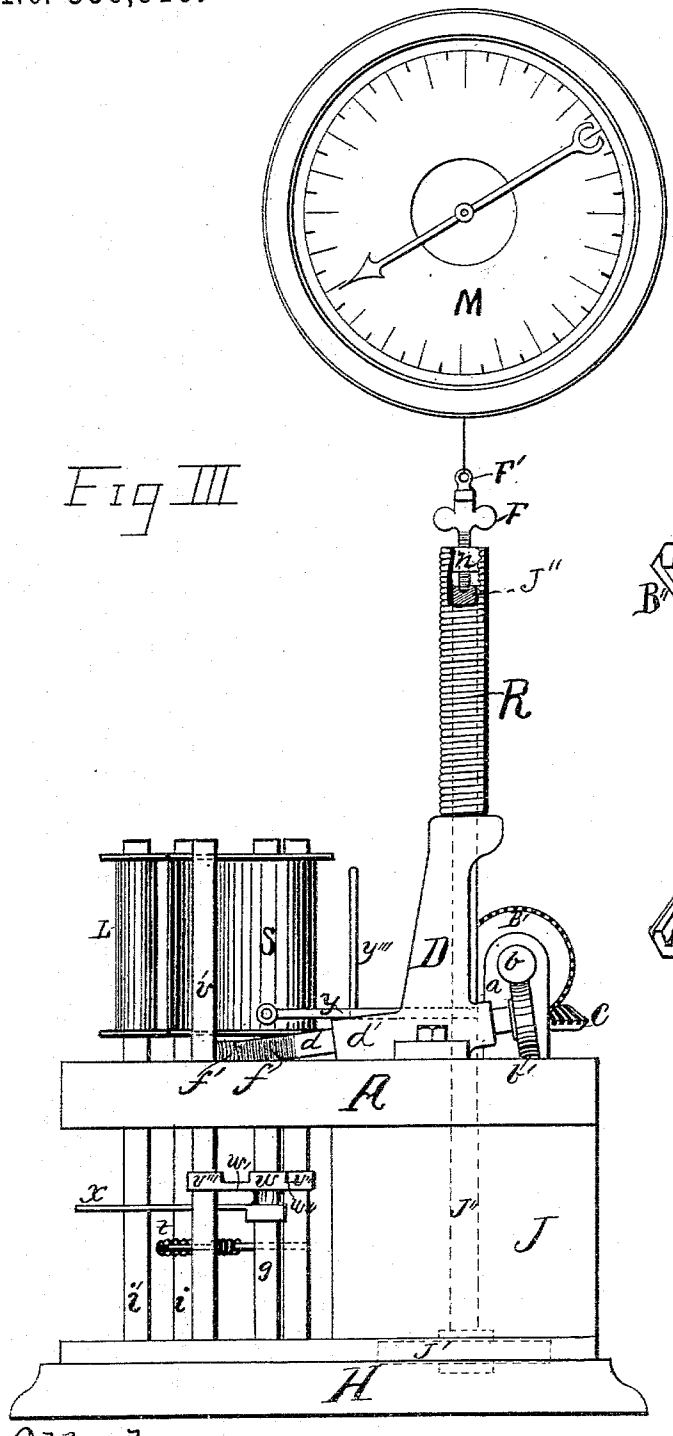
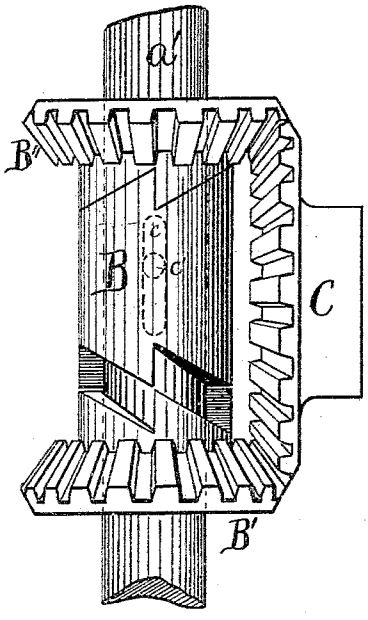


Fig IV



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(No Model.) 3 Sheets—Sheet 3.

J. BOYER.

RECORDING VELOCIMETER.

No. 356,916. Patented Feb. 1, 1887.

Fig. V.

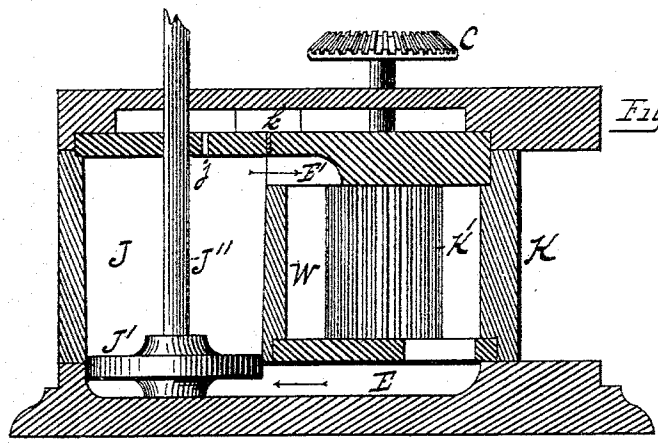
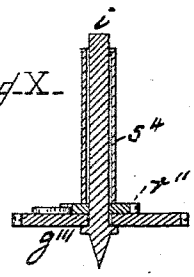


Fig. X.



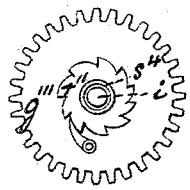


Fig. XI.

Fig. VI.

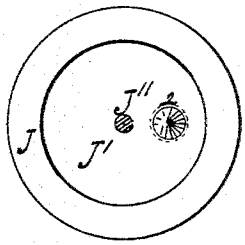


Fig. VIII.

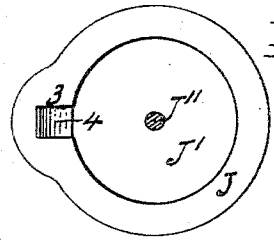


Fig. VII.

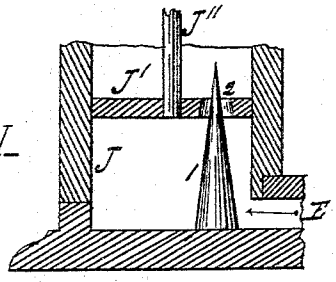
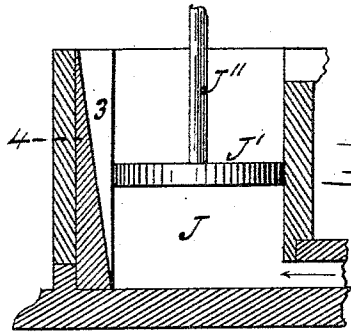


Fig. IX.



Witnesses
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UNITED STATES PATENT OFFICE.

JOSEPH BOYER, OF ST. LOUIS, MISSOURI.

RECORDING-VELOCIMETER.

SPECIFICATION forming part of Letters Patent No. 356,916, dated February 1, 1887.

Application filed March 23, 1886. Serial No. 196,234. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH BOYER, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Velocimeters; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, wherein—

Figure I is a plan view of devices embodying my invention. Fig. II is a similar view, the top plate being removed to show the pump, chamber, piston, and, in dotted lines, the gearing for actuating the paper-rolls. Fig. III is a side elevation showing paper-drum, paper-rolls, the stylus, springs, gage, &c. Fig. IV is an enlarged detail view of preferred form of shifting bevel-gear for driving the pump in one direction, notwithstanding any change of direction or reversal of motion of the power shaft or axle. Fig. V is a vertical section through the pump and chamber, showing the ingress and egress ports by which the two are connected. Fig. VI is a top view, and Fig. VII a vertical section, of a cylinder or chamber, J, of uniform diameter throughout, the gradually-increasing leak past the piston J′ being accomplished by a tapering post, 1, and a hole, 2, in the piston. Fig. VIII is a top view, and Fig. IX a vertical section, of a third means of accomplishing the same result—viz., a cylinder of uniform bore having one or more grooves, 3, partially filled by wedges 4. Fig. X is a vertical section, and Fig. XI is a plan view, of one of the paper-spools with loose cog-wheels, ratchet and pawl, and slip-sleeve.

Like letters refer to like parts wherever they occur.

My present invention relates to the construction of velocimeters or devices for measuring velocities, and, if desired, recording the same, such as moving vehicles, the atmosphere, &c.

Heretofore, so far as I am aware, most devices of this character have depended for their operation on a centrifugal governor, and, owing to the practical impossibility of adapting the power of the springs to uniform action under widely-different speeds, it has been only possible to measure the variations of speed within limited range—say from fifteen (15) to forty (40) miles an hour—and this approximately and not accurately. In some instances, however, clock-work has been used to run the recording-stylus, while the speed of the paper was taken from the power shaft or axle; but such devices have proved more or less inaccurate, owing to the well-known difficulty attending the proper adjustment and regulation of clock-work.

The object of my invention is to provide a velocimeter which will measure the speed of moving trains, &c., accurately through a wide range of variations, the limit being dependent only on the will of the constructor or size of certain portions of the device, and to this end I employ a pump, a chamber, and a piston, and a fluid for causing a pressure on the piston, proportionately increasing or decreasing with the velocity of the pump, said pump and piston-chamber being so connected by passages that the fluid for causing pressure on the piston may circulate from the pump-well through the piston-chamber and back into the pump-well, the pump being operated by the axle or shaft of the moving structure, and the register denoting the position of the piston by means of the usual or any approved gage, which pump, chamber, piston, and gage so conjoined in a velocimeter form the first novel feature of my invention.

I drive the shaft of the paper-receiving and take off roll by positive gearing, and as the surface speed of these rolls will gradually increase as the size of the record-paper increases, I provide the shafts of said rolls with detachable friction-sleeves to permit the rolls to slip on their shafts, so that the paper record-strip may not be torn from undue strain, while the delivering roll or spool is left free to rotate as the paper is drawn off therefrom, and said spool may also be readily removed from its driven shaft, which constructions embody the second feature of my invention.

As the pump must rotate in one and the same direction independent of the direction in which the structure is moving, I combine with the velocimeter-chamber and piston, and the rotary pump coacting therewith, a shifting gearing connected with the shaft which drives the pump, and this forms a third feature of the invention.

As it is desirable to maintain a smooth and uniform surface for the record-strip, I combine with the paper-drum a series of spring-acting gripping-rollers, which bear lightly but uniformly on the face of the drum, and thus prevent any irregularity in buckling, &c., in the record-strip, and this forms the fourth feature of my invention.

It is also desirable at times to move said gripping-rollers and the stylus simultaneously from contact with the record-strip—as, for instance, when removing or replacing the strip—and for this purpose I combine two or more spring gripping-rollers with each other and with the stylus by means of cranks, links, and a rod which engages the stylus-arm, and said devices or their equivalents constitute a fifth feature of my invention.

There are other minor features, which will hereinafter more fully appear.

I will now proceed to describe my invention more specifically, so that others skilled in the art to which it appertains may apply the same.

A indicates a top plate, and H a base or bottom plate, on and between which are the operative parts of my devices.

K indicates a pump, which in the present instance is a rotary pump, composed of the interlocking winged rolls K′ K″, to one of which the power is applied. This pump is connected with a chamber, J, by means of two ports or passages, one of which, E, leads from the pump K into the chamber J, and the other, E′, leads from the chamber back into the pump-well W.

J′ indicates the piston of the chamber, provided with a piston-rod, J″, which moves in guides or in a standard, D, on the chamber or plate A, and is provided with a tension-spring, R, one end of which is connected to a nut, *n*, through which passes a thumb-screw, F, which bears on the end of piston-rod J″, by which means the resistance or tension of spring R may be controlled or adjusted. On the end of thumb-screw F is a swivel-eye, F′, which is connected with the gage M. The other end of spring R is secured to the piston-standard D or other fixed point. In lieu of the expansion-spring R shown a compression-spring might be used with the piston and obtain similar results; but for well known reasons a compression-spring is not desirable. The function of the spring R is to progressively counterweight the piston against the pressure from the pump, and to cause the return of the piston when the pump ceases operating. With the pump a suitable fluid—such as mercury, glycerine, or its equivalent fluid—is used for translating the velocity of the pump into pressure on the piston.

A very important feature of the construction of these devices is to preserve such a relation between the chamber J and its piston J′ as that the pressure on the piston shall increase uniformly, and this may be accomplished by making the piston fit the chamber snugly at first, and as it moves up unclose a gradually-increasing port or passage for the escape past the piston of the fluid in the cylinder. I can accomplish this in several ways. For instance, a tapering post secured to the chamber passes through a hole in the piston, the diameter of the post at the one end being such as to close the hole in the piston during the first part of the piston's stroke, or a series of grooves of gradually-increasing size may extend from end to end of the chamber J. I prefer, however, the manner shown in the drawings—that is to say, the chamber is bored out tapering, or with gradually-increasing diameter from end to end—so that the piston which fits snugly for the first part of the stroke will, as it moves, leave a gradually-increasing annular passage between itself and the chamber.

The pump K is driven by means of a driving-shaft, *a′*, with bearings *a* on plate A, and having a pulley, f^6, from which a belt passes to a car-axle, or to the propeller, power, or wheel-shaft of a moving structure, in the well-known manner of attaching velocimeters for measuring speed.

k, Fig. V, indicates a chamber through which the piston-rod J″ and the pump-spindle pass, and said chamber has a port, *j*, leading back into the piston-chamber J, so that any surplus liquid which may be carried out by the piston-rod or spindle will be collected and returned to the pump-well.

As the pump must always be driven in the same direction, no matter which way the car (or power-shaft) is moving, I provide a shifting bevel-gearing, consisting of a sleeve, B, having an oblique slot, *c*, which receives a pin, *c′*, on the shaft *a′*, and two bevel-pinions, B′ B″, adapted to mesh with the bevel-pinion C on the shaft of one of the wheels K′ K″, constituting the rotary pump K. The distance between the two bevel-pinions B′ B″ should be such that in shifting one shall engage with the bevel-pinion C of the pump the instant before the other disengages, so that the operation of the pump will be substantially continuous and in the same direction.

The distant end of shaft *a′* has a worm, *b*, which engages with worm-wheel *b′* on a cross-shaft *d*, which has its bearings in the hub *d′*, attached to the standard D, and the shaft *d* has a worm, *f*, which engages with a worm-wheel, *f′*, on the shaft *g* of the paper cylinder or drum S, and thus, through spur-wheel *g′*, with the spools L M′, for carrying the record-paper, the spindles of which are provided with loose pinions *g″* and *g‴*.

S indicates the cylinder or drum for presenting the record-paper to the stylus or pencil, said cylinder provided with a shaft, *g*, driven, as before specified, by the worm-shaft *d*, and having at its lower end a spur-wheel, *g′*, which gears with the pinions *g″* and *g‴* of the paper-delivering and paper-receiving spools L and M′.

The paper-spools L M′ (see Fig. I) act or may act alternately as delivering and receiv-

ing rolls, and both may be positively driven in one direction. I therefore construct them as follows: The shaft *i* of one spool has a loose pinion, *g'''*, and a pawl-and-ratchet mechanism, *r''*, by which it may be driven in one direction, while the shaft *i'* has also a loose pinion, *g''*, and a pawl-and-ratchet mechanism, *r'''*, by which it can be driven in the reverse direction. At the same time each spool is free to rotate at will in the reverse direction from which it is driven, as it is carried on a friction-sleeve, *s*, on the shaft, (see Figs. X and II,) and this renders the apparatus capable of recording the backing as well as the forward movement of the engine or structure. As, however, the diameter of the roll of paper is gradually increasing, so would its surface speed gradually increase if not provided against, and the paper between the cylinder or the drum S and the paper-rolls L M', if drawn too tight, might be torn, to prevent which I arrange a friction-sleeve, *s'*, on the shaft of rolls, and thus while driving the shaft at uniform speed its spool is permitted to slip when necessary to accommodate the speed to that of the paper passing over cylinder S, which latter is constant and uniform.

The gearing of the record-cylinder S is arranged and adapted to move a certain and predetermined distance (say one-half inch) for every mile in the manner now well known and commonly adopted in this class of instruments.

The record-paper is first contained on one carrying or delivering spool, L, passes thence around the paper-cylinder S, and is taken up after the speed is recorded thereon by the receiving positively-driven spool M'.

s' s'', Fig. I, indicate gripping-rolls carried by arms *u u'* on shafts or rods *v v'*, which rods are provided with cranks *v'' v'''*, (see Fig. II,) each of which is connected with an intermediate double lever, *w*, (pivoted on the shaft or spindle *g* of the paper-drum S,) by a link, *w' w''*, and connected to said intermediate double lever *w* is a lever, *x*, by means of which it may be operated to throw the gripping-rollers *s' s''* away or out of contact with the cylinder or drum S. The gripping-rollers *s' s''* are held up to the paper-drum S by the spring *t*, which connects said rollers, or in any other suitable manner.

Pivoted to an extension or second crank-arm on the rod *v* (see Fig. I) is a link or rod, *y'*, whose opposite end is pivoted to a short lever, *y''*, the opposite end of lever *y''* being pivoted or fulcrumed on the plate A or other convenient fixed point.

Upon the upper face of lever *y''* is a pin, *y'''*, which engages in an elongated slot in the stylus-arm *y*.

By the above-described or equivalent mechanism both the gripping-rollers and the stylus can be moved out of contact with the paper-drum S when desired.

The stylus or pencil *y*, for recording the speed on the paper which passes over cylinder S, is attached to the piston-rod J'' and adjusted up to the face of cylinder S.

M indicates a gage, of the usual or any approved pattern, which is set at zero and connected with the piston-rod J'' of the velocimeter through the intermediate thumb-screw, F, as before specified.

The devices being of substantially the character or embodying the principles of construction hereinbefore specified, and the pump-well having been supplied with mercury or its equivalent, will operate as follows: The motion of the car-axle or power-shaft of the moving structure, being transmitted to the driving-shaft in the usual manner, will operate the pump K in proportion to the velocity of the car-axle or power-shaft of the structure, and through the worm-shaft will revolve the paper-cylinder S at proportionate speed. The pump will draw the fluid, mercury, or its equivalent from the well and force it into the chamber, thus translating the velocity into pressure, which, acting on the piston, causes it to move in the chamber. As before specified, the piston fits snugly in the initial end of the chamber, so as to conserve the power when the speed is low, and as the speed-pressure increases a gradually-increasing vent or passage is obtained, which permits the mercury or its equivalent to leak past the piston and escape back into the well. The piston in its travel increases or decreases the power of spring R, and permits the index of the gage to follow the motion of the piston and accurately indicate the extent and variation of the pressure on the piston, and as the pressure on the piston is the measure of the velocity of the axle or power-shaft, it follows that the velocity at any given time must be and is accurately measured, and that the devices must be constant both in condition and operation, so that there is no lost power from wear, &c., as in the case of a governor, to interfere with the accuracy of the devices.

It is also apparent that as a pump and a fluid are the means for translating the velocity into pressure there is no appreciable loss of power, while the instrument will be very sensitive, and will measure the lowest speeds as accurately as the highest attainable speed. The power transmitted by worm-shaft *d* will revolve the cylinder S, which at the same time drives the positive geared take-off or receiving-spool, and thus draws the paper from the delivering-spool, winding it up as the record is made, and as the surface speed of the spool will increase as its diameter increases, the friction-sleeve will slip to accommodate the movement of the spool to the speed of the paper-cylinder S, which latter is geared to move at a predetermined and unvarying surface speed for each and every mile. As the pencil or stylus *y* is attached and moved with the piston-rod and over the paper, it will not only record the speed for any given mile, but every variation in the speed, even the slightest.

Having thus described the nature, operation, and advantage of my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a velocimeter, the combination of a pump, a chamber and piston, and a liquid which circulates from the pump-well through the piston-chamber and back into the pump-well for translating the velocity into pressure, substantially as and for the purposes specified.

2. In a velocimeter, the combination, with a pump, of a chamber and its piston and a gradually-increasing escape from the pressure side of the piston, substantially as and for the purposes specified.

3. In a velocimeter having a chamber and piston and a pump, the combination, with the shaft which drives the pump, of shifting-gearing, substantially as and for the purposes specified.

4. In a velocimeter, the combination, with the paper-cylinder, of a slip-spool and a positively-driven spool having a friction-sleeve on its shaft to enable the driven spool to accommodate its speed to that of the paper-cylinder, substantially as and for the purposes specified.

5. In a velocimeter, the combination of a rotary pump and a chamber and piston, the chamber and pump-well having ingress and egress passages which connect them, substantially as and for the purposes specified.

6. In a velocimeter, the combination, with the paper-drum, of spring-acting gripping-rolls and link-and-lever mechanism for retracting the rollers simultaneously, substantially as and for the purposes specified.

7. In a velocimeter, the combination of a paper-drum, gripping-rolls, and stylus with intermediate and connecting link-and-lever mechanism for retracting the gripping-rolls and stylus, substantially as and for the purposes specified.

8. In a velocimeter, the combination of a pump, a chamber connected with the pump by ingress and egress ports, and a piston having a suitable piston-rod with a tension-spring, substantially as and for the purposes specified.

9. In a velocimeter, the combination, with a paper-drum, of spool-shafts having gearing, whereby the shafts may be driven from the drum-shaft, and detachable friction-sleeves, substantially as and for the purposes specified.

10. In a velocimeter, the combination of a pump, a piston-chamber and a piston, the piston-chamber having ingress and egress ports which connect it with the pump-well, and a collecting-chamber having a port which communicates with the well and piston-chamber, whereby any fluid which may be carried out by the piston-rod or pump-spindle will be collected and returned to the pump-well, substantially as and for the purposes specified.

In testimony whereof I affix my signature in presence of two witnesses this 20th day of March, 1886.

JOSEPH BOYER.

Witnesses:
STEPHEN SULLIVAN,
EDWARD A. PRIMEAU.