March 22, 1938. J. N. REYNOLDS ET AL 2,111,902

RECORDING MECHANISM

Filed Sept. 12, 1933 5 Sheets-Sheet 1

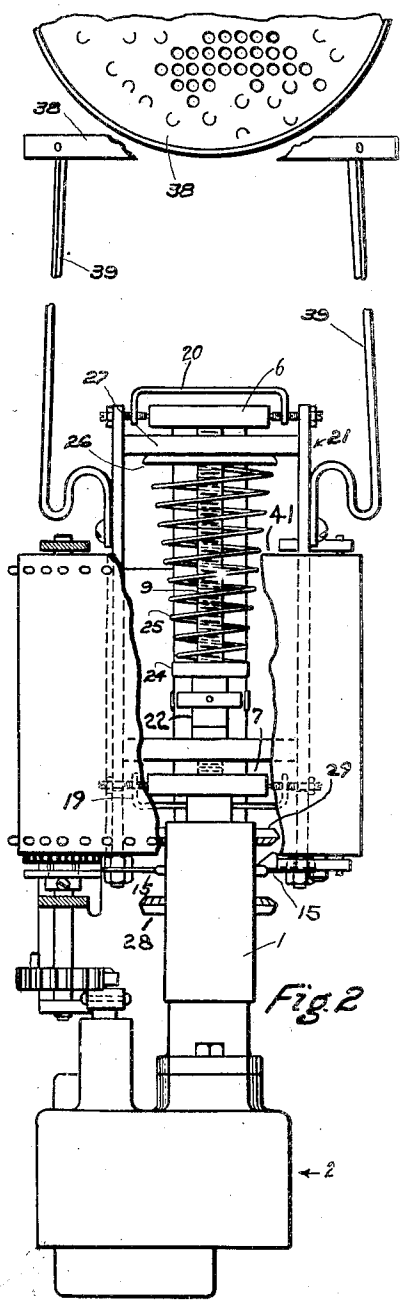

Fig. 2

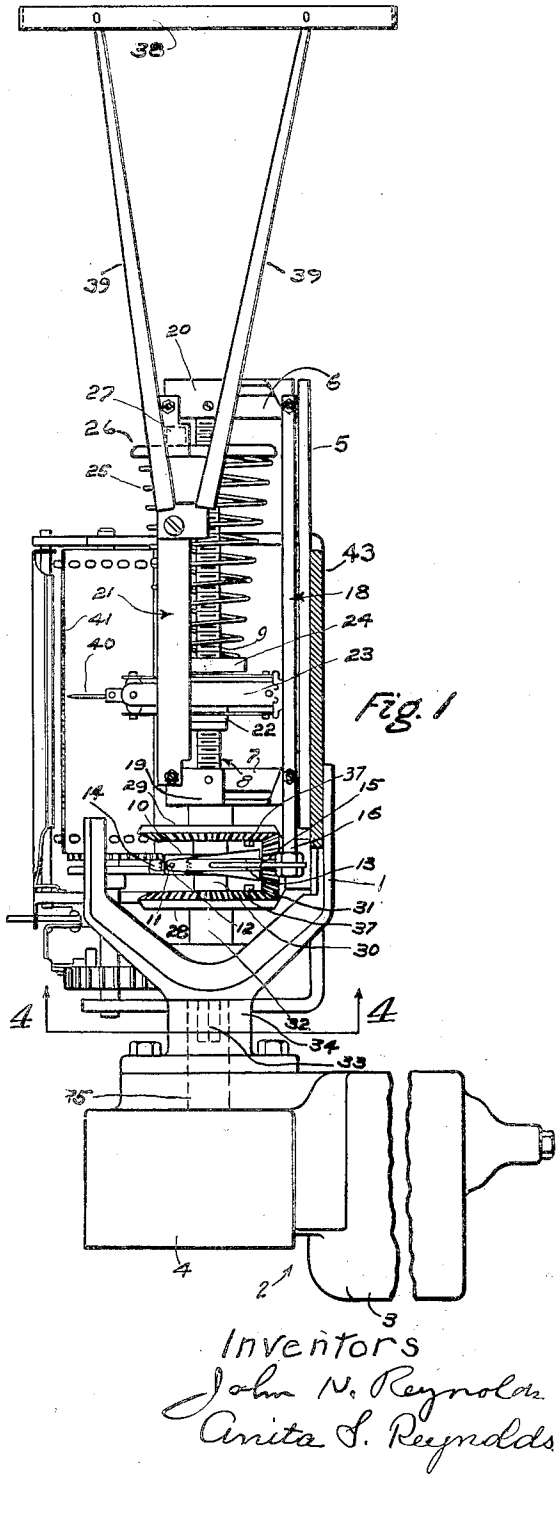

Fig. 1

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RECORDING MECHANISM

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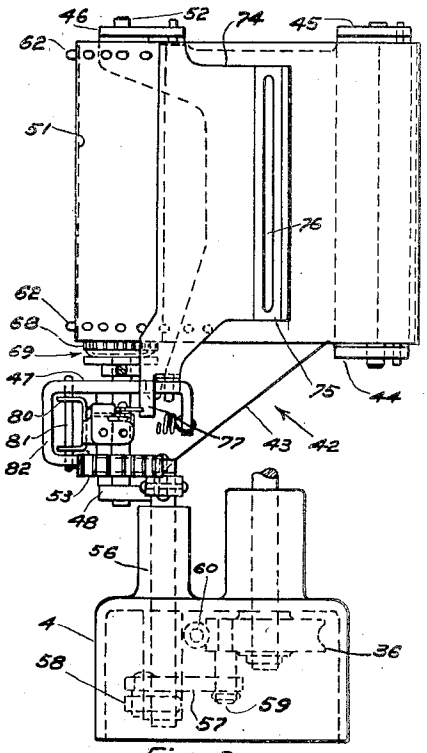

Fig. 3

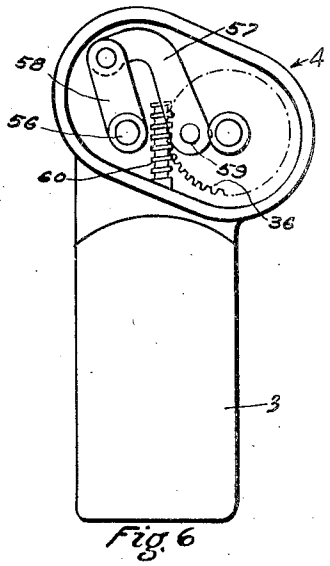

Fig. 6

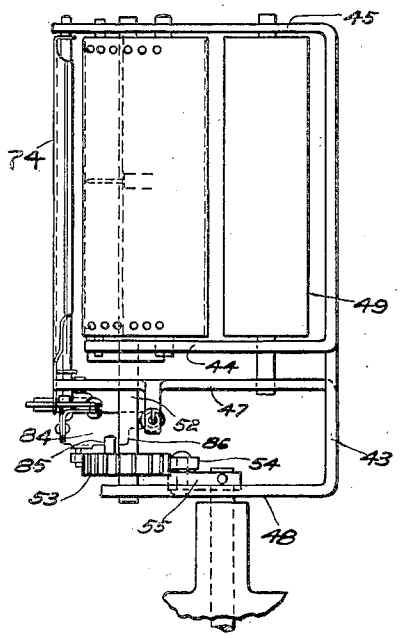

Fig. 5

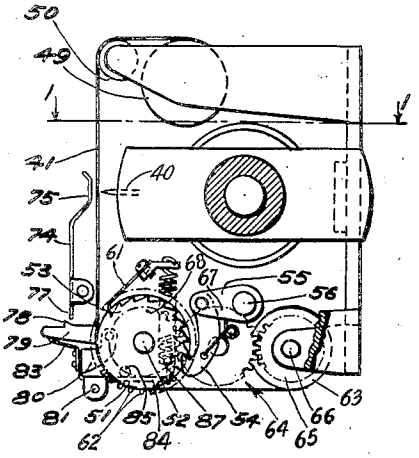

Fig. 4

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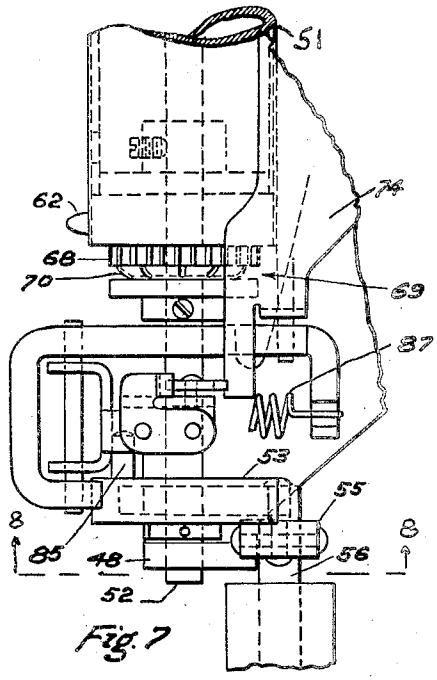

Fig. 7

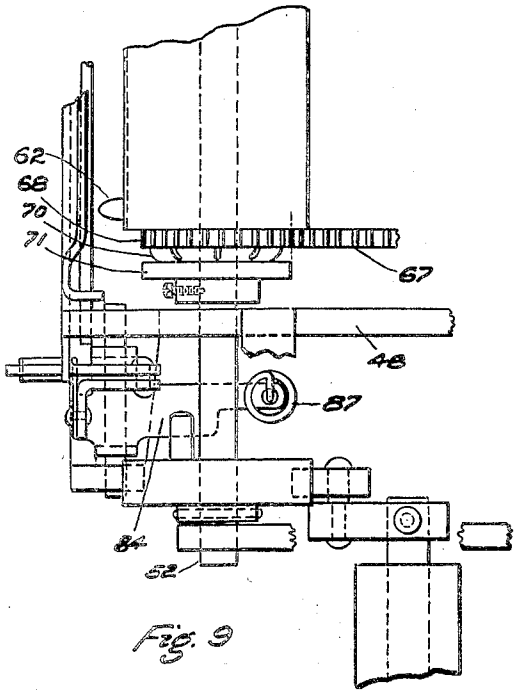

Fig. 9

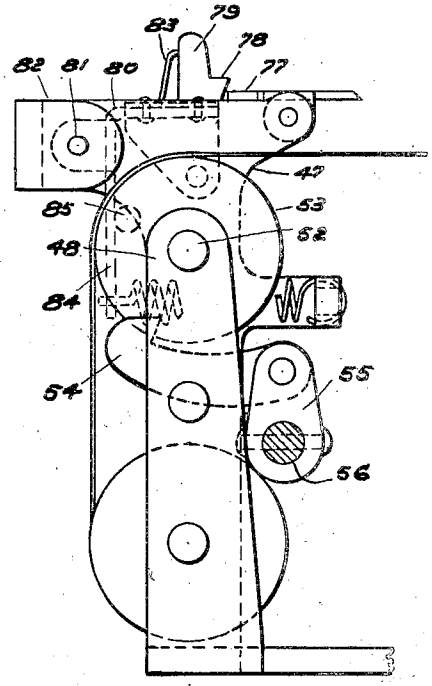

Fig. 8

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RECORDING MECHANISM

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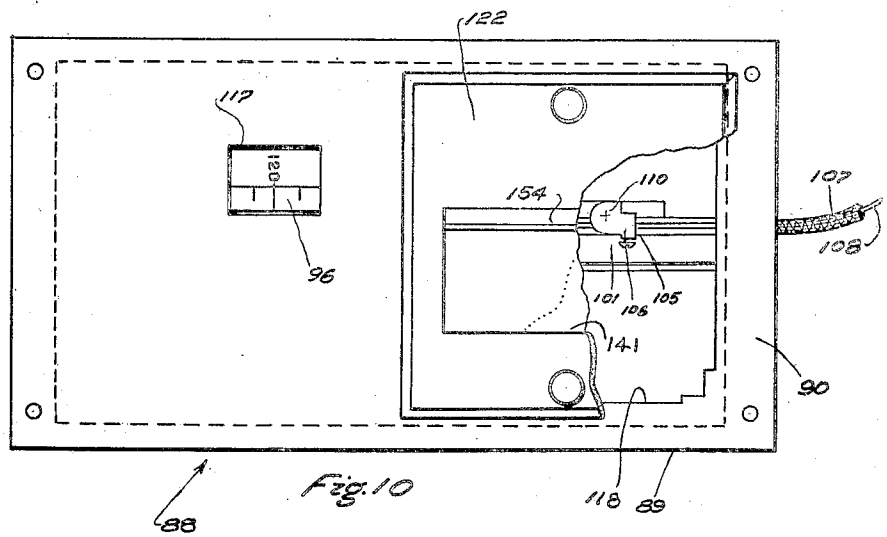

Fig. 10

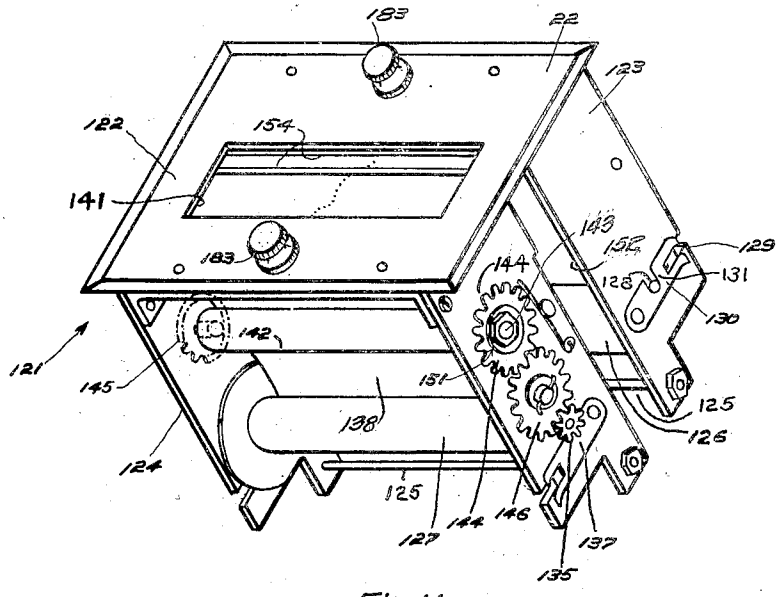

Fig. 11

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RECORDING MECHANISM

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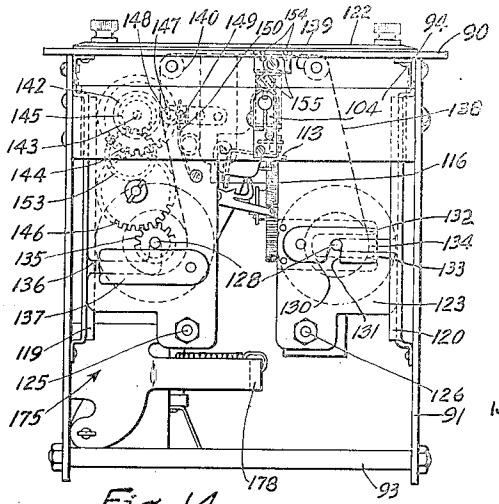

Fig. 14

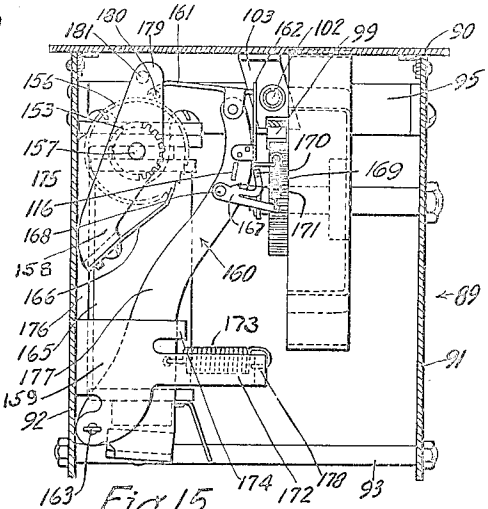

Fig. 15

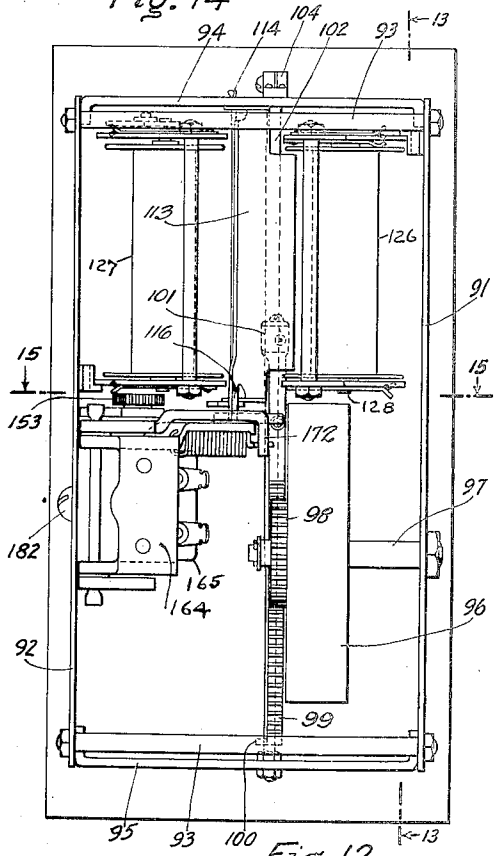

Fig. 12

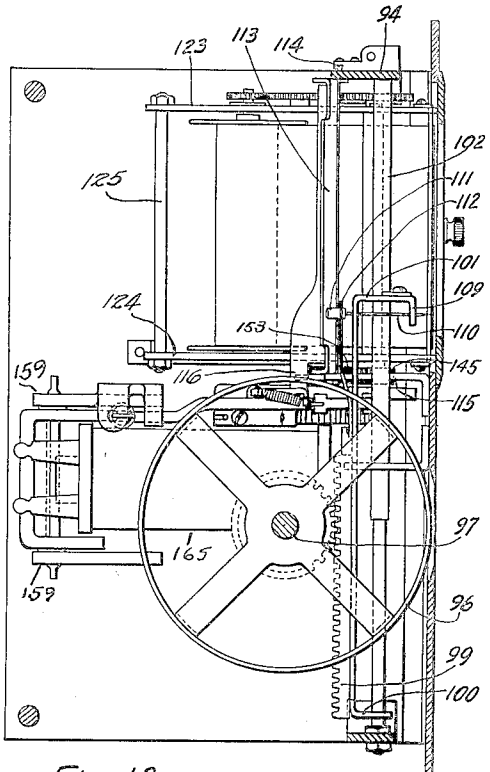

Fig. 13

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UNITED STATES PATENT OFFICE

2,111,902

RECORDING MECHANISM

John N. Reynolds and Anita S. Reynolds,
Princeton, N. J.

Application September 12, 1933, Serial No. 689,078

11 Claims. (Cl. 234—71)

This invention relates to recording mechanisms which are adapted to keep a continuous record of changes of conditions over an extended period of time.

It is an object of our invention to provide a machine which is adapted to record on a web of material, such as thin metal foil, paper, celluloid, or other suitable material, a continuous record which may consist of a series of marks on said web of material made by a perforating device or any suitable means.

Another object of our invention is the provision of a continuously indicating fluid pressure recording instrument which is adapted to measure the velocity of the flow of fluid at one point, and record the amount of said flow at another point.

Still another object is the provision of a recording unit which is adapted to be remotely controlled by the measuring instrument and which is adapted to be sealed for the obtaining of official records.

According to our invention, we accomplish these objects by providing a mechanism for measuring the velocity or dynamic pressure of a fluid and for recording, by means of a perforating needle and record web, the varying conditions of said pressure or velocity. The fluid velocity indicator may be of the type disclosed in our Patent No. 1,934,375 of November 7, 1933, and the record web and its operating mechanism may be mounted directly on the velocity measuring unit, or it may be separate therefrom. Or, where desirable, two recording units may be used, one being attached directly to the velocity measuring instrument, and the other spaced therefrom and connected thereto by a mechanical operating cable so that the results may be read in more than one place. Where the record web is to be positioned directly on the fluid velocity measuring instrument, a common source of power may be used for driving both mechanisms; whereas, when a separate recording unit is used, the power for operating that unit may be derived from any suitable source separate from that used for driving the fluid velocity indicator. In such case, the auxiliary separate recording unit may be operated electrically, if desired, by the use of solenoids or magnets.

As stated in our Patent No. 1,934,375, of November 7, 1933, the vane 38 consists of a frame over which is stretched a foraminous screen. The openings in the vane surface will reduce the suction on the rear thereof and the vane will respond more accurately to air pressure on its front side.

The main unit for measuring the velocity of fluid flow may comprise a recording marker, such as a needle, carried by a member which is adapted to be moved backward and forward by means of a driving mechanism interconnected with a power source and under control of a vane positioned in the path of flow of the fluid. For recording the different indications created by the movement of the needle responsive to variations in the fluid flow, a web of material is furnished and means are provided for causing this web of material to move with respect to said needle at a predetermined rate of speed. The record indication itself is made by causing the needle periodically to puncture the web, the position of the puncture being determined by the velocity of fluid flow at that instant of time. To secure an indication at a remote point, a separate unit is furnished which contains a needle and a moving mechanism therefor, as well as means for holding in position and advancing the recording web. The needle operating mechanism may be interconnected with the main unit by suitable means such as a wire enclosed by a cable, which wire is adapted to be moved longitudinally in response to movement of the needle in the main unit. This auxiliary unit may be provided with electrical means adapted periodically to advance the web of material so that a continuous record may be obtained. The web of material may be carried by a separate unitary cage which is adapted to be engaged with or disengaged from the casing of the recording unit. The puncturing of the web by means of the needle may be controlled by a periodically operated electrical device such, for example, as that employed in advancing the web. It is preferable to use a single means for advancing the web and causing the perforations to be made, for such an arrangement insures an equal spacing of the marks on the web. However, if desirable, the two might be separably operable, the web advanced at any predetermined speed, and the needle actuated at any desired interval of time, so that a record containing a greater or lesser number of indicating points may be obtained. The periodicity of operation of the needle point or marker would of course, be determined by the number of indications per unit of time.

The above mentioned objects and advantages and the manner of obtaining them will be made clear in the following description and accompanying drawings.

In the drawings, Fig. 1 is a view in side elevation, partly in section, of a fluid velocity measuring and recording device constructed in accord-

ance with our invention, this view being taken along line 1—1 of Fig. 4;

Fig. 2 is a plan view of the device shown in Fig. 1 with a portion of the mechanism broken away;

Fig. 3 is a fragmentary view showing a portion of the driving mechanism and the means for carrying the web;

Fig. 4 is a sectional view of the device shown in Fig. 1, taken along line 4—4;

Fig. 5 is a view showing separately the web-advancing mechanism forming part of the machine shown in Figs. 1 and 2;

Fig. 6 is a view of the transmission mechanism with the cover plate removed;

Fig. 7 is a fragmentary plan view of a portion of the web-advancing mechanism of the machine shown in Fig. 1;

Fig. 8 is an end view of the mechanism shown in Fig. 7, taken along line 8—8;

Fig. 9 is a side view of the mechanism shown in Fig. 7;

Fig. 10 is a plan view, with a section broken away, of a separate record unit;

Fig. 11 is a perspective view of the web carrying cage forming a portion of the recording unit, shown in Fig. 10;

Fig. 12 is a bottom view of the recording unit shown in Fig. 10 with the cover plate removed;

Fig. 13 is a sectional side view taken along line 13—13 of Fig. 12;

Fig. 14 is an end view of the unit shown in Fig. 10 taken from the left-hand end, as shown in that figure; and

Fig. 15 is a sectional view similar to Fig. 14, of Fig. 12 taken along the line 15—15 of Fig. 12.

Referring more particularly to the drawings, reference numeral 1 indicates a frame having affixed thereto a driving unit 2 comprising a motor 3 and a transmission 4. Attached to the lower side of the frame is a base plate 5 having mounted on one end thereof an upward extending bearing 6 and on the other end thereof an upward extending bearing 7. Journalled in the bearings 6 and 7 is a shaft 8 having intermediate the ends thereof a screw-threaded portion 9. The shaft 8 has secured at the left-hand end thereof, as viewed in Fig. 1, an arm 10 upon which is pivotally mounted a clutch yoke 11, which extends around both sides of the shaft and the arm and is secured to the arm by a pivot pin 12. The free end of the clutch yoke 11 has a slot 13 therein, in which is positioned a clutch-operating ring or annulus 14 arranged to be concentric with the shaft 8. Ring 14 is provided with two downwardly extending lugs 15 attached, respectively, to the ends 16 and 17 forming part of the floating member 18. The member 18 is pivotally supported at four points by two H-shaped yokes 19 and 20 which are pivoted, at points above their centers, to the bearing members 6 and 7. A second floating member 21 is pivotally attached to the upper ends of yokes 19 and 20 at a point above the pivots on which the yokes are supported from the bearings 6 and 7. The two floating members 18 and 21, with the yokes 19 and 20 to which they are pivoted, thus form a parallel motion device, whereby reciprocating motion imparted to the member 21 is repeated and amplified by the member 18.

Upon the central portion of the shaft 8 is threaded a nut 22 having guiding lugs 23 slidably engaging with the base plate 5 to prevent the nut from rotating as the shaft 8 is turned. Nut 22 has fastened to it a face plate or flange 24 for receiving the end of a compression spring 25 which surrounds the shaft 8 and has its other end positioned within a cup 26 fastened to a cross piece 27 of the floating member 21. Loosely mounted on shaft 8 at both sides of the clutch yoke 11 are bevelled gears 28 and 29. These gears are held in spaced relation by an interposed collar 30 pinned to the shaft 8. Disposed at right angles to shaft 8 and mounted in the base of the frame 1 is a short shaft, upon the upper end of which is mounted a bevel gear 31 meshing with the gears 28 and 29. Gear 28 has integral therewith a collar 32 which surrounds the shaft 8 and projects within an opening in the hub 34 of frame 1, and terminates in a squared portion 33. The gear 28 serves as a driving gear for the screw-threaded shaft 8, and for rotating the gear a connection is made through a shaft 35, furnished with a clutch member for engaging squared portion 33, to gear 36 of transmission 4. This transmission may be fastened to frame 1 in any suitable manner, for example by means of flange plates fastened to each member and bolted together as shown.

The gear 28 is therefore rotated in one direction by motor 3 through the agency of the transmission 4. By virtue of the idle bevel gear 31 the bevel gear 29 is rotated in a direction opposite to that in which gear 28 is turning. Each of these gears carries a lug 37 which is adapted to be engaged by the end of the clutch yoke 11 when the same is tilted in one direction or the other through movement of the ring 14 longitudinally of the shaft 8. The engagement of the clutch yoke with the lugs 37 is determined by the fluid pressure upon a vane 38 which is connected to the floating member 21 by means of braces 39.

The entire machine is so positioned that the vane 38 receives the force of the fluid flow past it and is caused by it to move the frame 21 in a left-hand direction, as shown in Fig. 1. This movement, through the action of the yokes 19 and 20 causes the floating member 18 to travel in a right-hand direction, carrying with it the clutch operating ring 14 which in turn tilts the clutch yoke 11 around its pivot pin 12 and causes it to move into the path of rotation of the lug 37 carried by gear 29, which gear, as above stated, is maintained in constant rotation. The result is that the gear 29 is locked to the shaft 8 through the agency of the yoke 11 and therefore causes the nut 22 to be moved in one direction with respect to the base plate 5. The rotation of the gear 29 is clockwise, as viewed from the right-hand side of Fig. 1, the thread 9 being right-handed, the nut 22 is moved in a right-hand direction, whereby spring 25 is compressed. When the compression in the spring reaches a sufficiently high value, the floating member 21 will be moved in a right-hand direction against the force created by the pressure on vane 38, until the clutch yoke 11 is disengaged from the lug 37 and rotation of the shaft 8 is stopped. The nut 22 will then remain stationary until such time as the pressure on the vane 38 varies sufficiently to cause the clutch yoke 11 again to engage one of the lugs. If the pressure on the vane 38 increases, the nut will be carried still further in the same direction, in the manner which has already been described; but if the pressure on the vane decreases, spring 25 will move the floating member 21 to the right, thereby moving the floating member 18 to the left and, through the

agency of the ring 14, move the clutch yoke 11 into the path of rotation of lug 37 carried by gear 28. This gear is rotating in a direction opposite to that of gear 29 and therefore the shaft 8 will be rotated in the direction opposite to that which was assumed in the preceding discussion. The result of this will be that the nut 22 is moved in a left-hand direction, thereby decreasing the compression of spring 25 until a balance is reached, when the clutch yoke 11 will swing free of clutch member 37 and assume its neutral position, as shown in Fig. 1. The shaft 8 will then remain stationary and nut 22 will be left in a new position with respect to frame 5. The position of the nut 22 at any given instant of time is therefore an indication of the pressure on the vane 38. The pressure on the vane is, of course, dependent on the velocity of the fluid flowing past it and so the position of the nut 22 is an indication of the velocity of the fluid stream in which the vane 38 is located.

The clutch mechanism disclosed in this application forms the subject matter of Patent No. 1,771,352, issued July 22, 1930 to A. S. and J. N. Reynolds, and the combination of this clutch mechanism with the vane 38 to form a fluid flow indicator, forms the subject matter of Patent No. 1,934,375 of November 7, 1933.

The traveling nut 22 may obviously be used to control any indicating or recording mechanism for determining and keeping a record of variations in the velocity of flow of the fluid within which the vane 38 is positioned. According to the present invention, guiding lugs 23 and the nut 22 are jointed together at their upper end and serve to support a marker 40, which is preferably a needle but might be of other forms where it is not desired to perforate the tape. The function of this marker is to perforate or otherwise mark a web of thin metal foil, celluloid or paper, or other suitable material 41. As this instrument is designed for use in places where the apparatus may be subjected to extreme degrees of heat or cold, and possibly to large amounts of moisture, it is preferable to use a metal foil web and a perforating needle as a marker. By utilizing this combination it is possible to avoid freezing of an ink supply or obliteration of the record by rain, fog or any other source of moisture.

For holding the web 41 an independent unit 42 is furnished (Figs. 3, 4, 5 and 6). This unit comprises a sub-frame 43, which may be made of sheet metal, having upwardly turned bearing members 44, 45, 46, 47 and 48. Rotatably journalled in the bearing members 44 and 45 is a web supply spool 49 from which the web 41 is withdrawn during the operation of the device. This web passes over an idler guide roller 50 and around a sprocket or driving drum 51, the teeth 62 of which engage with suitable holes in the web. This drum is secured to a shaft 52 journalled in the bearing members 46, 47 and 48. This shaft has fixed thereto a ratchet wheel 53 with which is held in spring pressed engagement a pawl 54 pivotally connected to an arm 55 pinned to a driving shaft 56 forming part of the transmission mechanism 4. This shaft is adapted to be oscillated by means of a link 57 which connects a crank arm 58, which serves to interconnect the crank arm 59 secured to the shaft 56, with a pin 59 carried by the worm gear 36, which gear in turn is rotated by means of a worm 60 carried by the shaft of the driving motor 3. As the shaft 56 is rotated by the action of the driving motor, the pawl 54 is reciprocated backward and forward, thereby engaging successive teeth of the ratchet wheel 53 and causing that wheel and the drum or sprocket 51 to which it is coupled by shaft 52, to rotate. In order to prevent reverse rotation of the shaft 52 during action of the pawl 54, a dog 61 is furnished.

After leaving the driving drum 51, the web is wound up on a storage spool 63 which is adapted to be driven from the shaft 52 by means of a gear train 64, including a pinion 65 carried by a shaft 66 serving to support the storage spool 63. An idler gear 67 meshes with pinion 65 and with a gear 68 rotatably mounted on shaft 52. Gear 68 is held in frictional engagement with the shaft by means of any suitable slip friction clutch 69. This clutch may, for example, comprise a spring friction washer 70 interposed between collar 71 fastened to shaft 52 and the side of the gear 68, which is held in position by the end of the drum. The ratio of the gear 68 to the pinion 65 is such that, regardless of the amount of web rolled up on the spool 63, the spool will turn fast enough to take up the web as it leaves the driving drum 51.

The entire sub-frame 43 is adapted to be attached to the frame 1 and base plate 5, as shown most clearly in Fig. 1 and when so attached holds the web 41 just above the point of the marker needle 40. The width of the web is such that it will always cover the marker 40 over its entire path of travel on the shaft 8. In order to produce a record of the position of the needle at any given instant of time, it is necessary to cause the web and the needle to engage so that a perforation is made. This may be done by means of a presser plate 74 pivotally supported by bearing members 46 and 47. This presser plate has an outwardly extending arm or presser foot 75 having a narrow elongated opening 76 therein which coincides with the path of travel of the marker needle. The plate also has a finger portion 77 extending back of its pivot point into the path of travel of a projection or tooth 78, forming part of a vertically movable pawl 79. This pawl is pivoted to a bell-crank lever 80 which is rockably mounted on a pin 81. This pin 81 is supported by a portion of the bearing member 47 which is bent around laterally to form a U-shaped bracket 82. A leaf spring 83 is fastened to a portion of the bell-crank 80 to press the pawl 79 against the finger 77. The free end 84 of the bell-crank 80 is bent downwardly into the path of rotation of a cam pin 85 fixed to the ratchet wheel 53, so that as the ratchet wheel rotates the cam pin moves against the end 84 of the bell-crank and causes it to be rotated slightly in a right-hand direction, as viewed in Fig. 4. As soon as the maximum displacement of the bell-crank by the cam pin has occurred, the pin slips off the end of the bell-crank at 86 and permits the bell-crank to be snapped back to its original position by means of a tension spring 87. Upon the rotation of the bell-crank by means of the cam pin, the pawl 79 is moved downwardly so that the projection 78 thereof slides over the end of finger 77 of the presser plate 74 and engages the under side thereof, so that when the cam pin 85 permits the spring 87 to snap the bell-crank 80 back to its original position, the presser plate 74 is quickly rocked in a clockwise direction as in Fig. 4, thereby thrusting the presser foot 75 against the face of the web 41 sufficiently to cause the needle or marker 40 to perforate it. This action is substantially instan-

taneous and occurs at a moment when the web is substantially stationary. The reason for this is that the free end 84 of the bell-crank is so arranged with respect to the cam pin 85 that the two disengage just at the end of the advancing motion of pawl 54.

Pawl 54, as has been stated before, is carried by drive shaft 56 and this is in turn a part of transmission 4 fastened to the frame 1. On the other hand, ratchet wheel 53 is supported by the sub-frame 43, and so it is necessary to fix the sub-frame 43 to the frame in such position that the pawl and the ratchet wheel properly engage.

A separate recording unit 88 is furnished for recording at a remote point the fluid velocity indications given by the measuring unit. This unit, as shown in Figs. 10, 11, 12, 13, 14 and 15, comprises a casing 89 having a cover plate 90 and two side plates 91 and 92 which serve to support the interior mechanism. The side plates are held in spaced relationship by tie bolts 93 at the bottom of each end thereof, and spacer bars 94 and 95 at the top thereof. The indicating mechanism of this unit comprises a drum or dial 96 rotatably mounted on a stationary shaft 97. Attached to the side of the drum and rotatable on the shaft 97, and supported from the side plate 91, is a pinion 98 which meshes with rack 99. Rack 99 has secured to one end thereof a guide 100 and to the other end thereof a guide 101. These guides are apertured to receive a guide rod 102 which is secured to the spacer bars 94 and 95 at each end of the casing. For holding the rack in proper alignment with the teeth of the pinion 98, a bifurcated stationary bracket 103 is supplied. This bracket, as shown most clearly in Fig. 15, is secured to the cover plate 90 and has a hole through it for receiving the guide rod 102, as well as a notch for holding the rack 99 in proper alignment. For moving the rack backwards and forwards to cause the indicating drum or dial to be turned; any suitable means may be used, but we prefer to perform this action by means of a stiff wire enclosed in a flexible cable, a well-known mechanism. For holding the cable, a split clamp 104 is attached to the spacer bar 94, in alignment with the guide rod 102. This clamp is also in alignment with a perforated block 105 forming part of the guide 101 (Fig. 10). The perforation in this block is adapted to receive the stiff actuating wire and a set screw 106 is furnished for holding the wire in the block. In the drawings, the cable is indicated by 107 and the wire by 108.

The guide 101 has a turned-over lip 109 at the top which serves, in cooperation with a portion at the bottom, suitably to hold a needle or marker 110. This marker has at its lower end a button 111 which is grooved to receive the bifurcated end of a leaf spring 112 fixed to an extension of the rack member 99. For pushing the needle up and down to perforate a tape, in a manner to be explained more fully hereafter, a pusher plate 113 is provided. This plate has its two ends turned over to form bearings and is pivotally mounted on a stationary shaft 114 which is fastened to the spacer bar 94 and to a bracket arm 115, which is in turn secured to the cover plate 90. The pusher plate has, at the end of the bracket arm 115, a downwardly and outwardly projecting finger 116 by which the pusher plate can be operated through the agency of a mechanism which will be explained in detail hereinafter. This finger strikes against the end of the bracket arm 115 and so holds the pusher plate in its proper normal or inactive position. The indicating drum or dial 96 is mounted so as to be near the cover plate 90, and a sight opening 117 is made in that plate. Likewise an opening 118 is provided in the cover plate 90 over the pusher plate 113 and a pair of guide rails 119, 120 are attached to the side plates 91 and 92 in alignment with this opening.

For carrying the record receiving web a record cage 121 is supplied. This cage comprises a face plate 122 and two side or bearing plates 123, 124. These two latter plates are held in spaced relation by spacer bars 125, and have rotatably mounted between them web supply spool 126 and web take-up or storage spool 127. These two spools are placed near the bottom of the bearing plates so that they may be removed therefrom. Each of the spools is provided with a pair of projecting bearing spindles 128 which are adapted to slide into slots provided within the bearing plates. The slots for holding the supply spool are furnished with spring clips so that the spool may be pushed directly into position and then held in place by means of the clips. The supply spool, for example, is arranged to slide into a pair of slots 129 in the bearing plates and is held in position by means of spring clips, one of which, 130, appears very clearly in Figs. 11 and 14. This clip which is pivotally secured to the bearing plate 123, has a notch 131 therein and is serrated at its end to form three teeth, the two outside ones of which are numbered 132, 133, and the middle one 134. The middle tooth is bent downwardly to engage in the slot 129 and the two outer teeth are bent outwardly, away from the plate, so that the clip may be manipulated. When it is desired to insert the supply spool in position, the clip 130 is rotated in a counter-clockwise direction, as viewed in Fig. 14, until the slot is uncovered; then the spool is slipped into place, its bearing spindle 128 entering the slot to its entire depth. The clip is then rotated in a clockwise direction until the middle tooth 134 snaps into the notch 131 and holds the clip in position with the spindle 128 in the notch 131. The take-up or storage spool 127 may be similarly supported, but in this case the spool carries at one end a drive pinion 135, and in order to hold the spool firmly in position a slightly different arrangement in used. The slot 136 is made L-shaped so that the spool may be pushed into position and then drawn up into the short end of the L by the tension on the web as it is wound up on the spool. For holding the spool in its proper position a clip 137 similar to 130 is provided. This clip has no notch in it as the spool is held in position by its spindle entering the short end of the L, as shown most clearly in Fig. 14. The opposite ends of the spools may be held in like manner or, in place of the notched clip 130, a plain clip may be used. In this case the end of the clip is not serrated but is turned outward, away from the bearing plate entirely. This clip may have just a plain hole in it to receive the bearing spindle when the spool is in its working position. With this arrangement the spool may simply be pushed into position, the spindle snapping into the hole in the clip.

A web of recording material 138 is drawn from the supply spool 126 and wound up on the storage spool 127. Between the two spools the web passes over a pair of idler rollers 139, 140 which serve to hold the paper adjacent to an opening 141 in the face plate 122. For drawing the web along at a constant rate of speed regardless of the

amount of web on the take-up spool, a frictional drive roller 142 is used. This drive roller is supported by a shaft 143 and carries at one end a gear 144, and at the other end a pinion 145. The gear 144, through the agency of an idler 146, meshes with the pinion 135. The web is held firmly pressed against the drive roller by means of a floating pressure roller 147, which is supported by a shaft 148 journaled in slots 149 in the two bearing plates 123, and is held pressed against the friction roller by means of a pair of leaf springs 150 which are secured to the side plates, and press against the shaft 148. The friction roller 142 is turned through the agency of drive pinion 145, thereby causing the web to be drawn off from the supply spool 126 and passed over the guide rollers to the storage spool 127. By means of the gears 135, 144 and 146, the storage spool is turned at a sufficient rate of speed to take up the web even when the amount of web rolled up on the storage spool is very small. This is because of the fact that the gear 144 is larger than the pinion 135, so that the pinion is caused to turn at a higher rate of speed. In order to permit slippage between friction drive roller shaft 143 and the take-up spool 127, a friction or slip clutch 151 is used. This may be of any suitable type, such as that disclosed in connection with the sprocket or drive drum 51 of the web moving mechanism which has already been discussed. The two side or bearing plates 123, 124 have openings 152 therein so that these plates can straddle the guide rod 102 and mechanism which serves to operate the marker needle 110. The guide rails 119, 120 are adapted to engage the edges of the bearing plates 123, 124 and properly position the record cage with respect to the rest of the recording unit. These rails are so arranged that when the record cage is in its operating position, the drive pinion 145 engages with a drive gear 153 forming a part of the motor mechanism. The record web is adapted to be perforated by the needle 110 in a manner to be explained more fully hereinafter, and for holding the web during the perforating operation, a pair of abutment bars or wires 154 are fastened to the face plate 122. These wires are spaced apart but a slight distance and are placed at one side of the sight opening 141 through which the record tape may be read. The opening 141 is placed slightly off center with respect to the needle 110, so that perforations are made in the tape at one side of the opening, and the tape then has a relatively wide space to travel over the opening before it is obscured by the rest of the face plate. This insures that a portion of the past record will be visible at all times for the guidance of one using this instrument. Placed underneath the abutment bars 154 is another pair of abutment bars 155 which are similarly aligned. The web passes between the bars 154 and 155 and so is always held taut for puncturing by the needle.

The driving gear 153 forms part of a driving unit 175. This unit comprises a frame member or base plate 176 which supports the entire driving mechanism. Attached to the top side of this frame member is a bracket 158, which has a portion bent back upon itself in the form of a U, rotatably to support a shaft 157. A ratchet wheel 156 is keyed to this shaft as well as the driving gear 153. The lower portion of frame member 176 has integrally formed therewith a pair of bracket arms 159 which serve pivotally to support at 163 a bell-crank member 160. This bell-crank member has one long leg 177 which pivotally supports at its free end a pawl 161 in such manner that the pawl is adapted to engage the teeth of the ratchet wheel 156. The pawl is thrown into engagement with the ratchet wheel through the agency of a leaf spring 162 which is secured to the leg 177 of the bell-crank and engages with an offset portion of the pawl. Therefore as bell-crank 160 is oscillated around its axis pawl 161 engages with the teeth of the ratchet wheel, and causes the wheel to be advanced one step in a counterclockwise direction. Reverse movement of the ratchet wheel is prevented by a spring dog 166 which is secured to the bracket member 158. For rocking the bell-crank in a counter-clockwise direction the free end thereof is made in the form of a magnetic armature 164 which is adapted to be attracted to an electromagnet 165 which is also supported by the frame 176, and for returning the bell-crank to its normal position after the magnet has acted a tension spring 173 is provided. This spring is connected between the leg 177 of the bell-crank and a plate 172 also fastened to the frame 176. Plate 172 has an angularly bent end portion 178 to which the tension spring is directly attached and a second angularly bent portion 174 which forms a stop for determining the normal position of the bell-crank when the magnet is not energized. The bracket member 158 carries at its free end 179 a pin 180 which determines the position at which the pawl 161 engages the teeth of the ratchet wheel, and a stop pin 181 which prevents overthrow of the pawl.

For lifting the needle 110 vertically and causing it to pierce the web each time the web is advanced one step, a pawl 167 is used. This pawl is pivoted to the long arm of bell crank 160 at 168, adjacent to the finger 116 of pusher plate 113. Pawl 167 is held in a normal position, as shown in Fig. 15, by means of a light tension spring 169 which rotates the pawl in a counter-clockwise direction until a stop 170 forming part of the pawl engages with the arm of the bell crank 160. With the pawl in position, a tooth 171 carried thereby is so positioned that when the bell-crank 160 is moved in a counter-clockwise direction by energization of the magnet, the tooth slips over the finger 116 and upon return movement of the bell-crank to its normal position this tooth 171 quickly moves the finger in a right hand direction as viewed in Fig. 15, thereby lifting the pusher plate 113 vertically and causing the needle 110 momentarily to pierce the recording web. Just at the instant when the bell-crank 160 is about to reach its normal position the tooth 161 disengages finger 116 and permits pusher plate 113 to return to its normal position ready for another cycle of operation. This arrangement insures that the web shall be stationary when the needle is caused to pierce it. From the description that has just been given it will be seen that the driving mechanism 175 is an entirely separate unit and may be removed from the machine as a whole for replacement and repair. The entire unit is secured to the side plate 92 in its proper position by any suitable means such as screws 182.

Magnet 165 may be periodically energized by any suitable source of electric current to cause advancement of the web. The web may, for example, be advanced at a constant rate of speed by causing the magnet to be energized through the agency of a contact closing mechanism operated by clockwork, or where the instrument is used to measure the speed of a moving vehicle the contact mechanism may be operated by the

driving mechanism of the vehicle. For example, where the device is used on an airplane the contacts may be closed by some suitable circuit breaker adapted to be operated from the propeller drive shaft or the tachometer which is customarily used to indicate engine revolutions. Where clockwork is used the readings will be taken at a constant rate of speed, while if connection is made to an engine drive shaft readings will be taken more frequently at higher speeds than at lower speeds. This may be a desirable feature where the engine speeds are subject to wide variations as in the case of airplanes.

The operation of the device is as follows: Vane **38** is positioned in the path of flow of the fluid, the velocity of which it is desired to record and the pressure received by the vane causes spring **25** to be compressed more or less and at the same time the clutch yoke **10** to engage with one of the lugs **37** carried by the gears **28** and **29**. As these gears are rotated in opposite directions through the agency of the driving motor **3** and the transmission **4**, the screw threaded shaft **8** is turned in either one direction or the other. This causes the nut **22** to travel in either a right-hand or left-hand direction until equilibrium is reached. By this action the position of the marker **40** is at all times made indicative of the fluid pressure on the vane **38** and consequently indicative of the velocity of the fluid past the vane. Transmission **4** also serves through the crank arm **58**, link **57** and gear **36** to rock shaft **56** backward and forward and thereby cause the pawl **54** periodically to advance the ratchet wheel **53** and move the recording web **41** ahead step by step. Upon each forward movement of the web the presser foot **75** is caused to press the web against the marker **40** so that a perforation is made. This action is brought about by the cam pin **85** which, upon a revolution of the ratchet wheel **53**, rocks the bell-crank **80** backward and forward whereby the pawl **79** engages the finger **77** of presser plate **74** and causes it quickly to be tilted in a clockwise direction. As web **41** is advanced step by step it is removed from supply spool **49** and wound up on storage spool **63**. The web is always wound up on the storage spool at the proper rate of speed by means of friction clutch **69** which slips when too great tension is applied to the web but still retains a sufficient tension to wind up the web smoothly.

Movement of the traveling nut **22** and marker **40** may be communicated through wire **108** of cable **107**, to the auxiliary recording unit **88**. By this arrangement upon any movement of the traveling nut **22** and marker **40**, the marking needle **110** is similarly moved. This movement is communicated through the rack **99** and pinion **98** to indicating drum **96**, which will at all times show at the sight opening a figure indicative of the position of the marker or needle in both the main unit and the recorder unit. All the time that the machine is in operation the magnet **165** is being periodically energized by any suitable source through the action of a contactor mechanism of any desirable type, not shown, and for each energization of the magnet the web **138** is advanced one step. Likewise upon the completion of each advancing step of the web the marking needle **110** is caused to pierce the web whereby a continuous record of the readings is kept. The record cage **121** is a separate unit and may be taken out of the recording unit **88** simply by moving a pair of holding clips **183** to an unlocked position and sliding the cage out of its pocket. The driving gear **153** automatically slips out of engagement with pinion **145** and reengages with the gear upon the return of the record cage to its operating position. Once the cage is free from the unit, the web **138** may be removed and a fresh one substituted. This may be done simply by taking out the filled storage spool and the empty supply spool, substituting fresh supply and storage spools and threading the new web through the mechanism.

While I have described a particular embodiment of my invention for the purpose of illustration it will be understood that various modifications and adaptations may be made within the spirit of the invention as defined by the following claims.

What I claim is:

1. In an instrument for recording the velocity of air flow, a web, means for moving said web along a certain path past a marker, a screw-threaded shaft for moving said marker adjacent to the face of said web and at an angle to the direction of movement thereof, means for rotating said shaft in one direction or the other, responsive to variations in said velocity, and means for causing said marker periodically to engage said web.

2. In a recording mechanism, a rotatable shaft, a bell-crank mounted adjacent to said shaft, a cam pin carried by said shaft, said bell-crank being so mounted that upon the rotation of said shaft said cam pin engages one end of said bell-crank, a bracket carried by the other end of said bell-crank, a finger rockably connected to said bracket, a presser arm, and a projection carried by said finger for engaging a portion of said presser arm.

3. A device in accordance with claim 2, wherein the relationship between the bell-crank and the rotatable shaft is such that the cam pin rocks the bell-crank upon initial engagement therewith and thereafter snaps free therefrom, and spring means is provided for holding said bell-crank against movement by said cam pin.

4. A device in accordance with claim 2, wherein the finger has an inclined tooth adapted to slip past a portion of said presser arm upon movement in one direction, and upon movement in the other direction to engage the end of said presser arm and cause the movement thereof.

5. In an air speed recording mechanism, means for moving a web of material in a certain direction, means for moving a marker in a direction at an angle to the direction of motion of said web, an elongated presser arm positioned parallel to the path of travel of said marker, and means for moving said presser arm against said web.

6. A device in accordance with claim 5, where the marker comprises a needle and wherein the presser arm has an elongated slit to accommodate the point of said needle when said arm is pressed against said web to produce a mark.

7. In an air speed recording mechanism, a guide, a member slidably mounted on said guide, a needle reciprocably mounted on said member and adapted for movement at an angle to said guide, a pusher plate mounted beneath said guide and adapted to engage said needle, and means for forcing said pusher plate against said needle to move it with respect to said member.

8. A device in accordance with claim 7, wherein spring means is provided for the needle to oppose motion thereof by said pusher plate.

9. In a recording mechanism, a web, means for

advancing said web comprising a pawl and ratchet mechanism, a marker, pusher means for moving said marker in contact with said web, and means responsive to a return movement of said pawl for actuating said pusher mechanism.

10. In a recording mechanism, a pivotally mounted pusher plate a finger carried by said plate, a rockably mounted arm, a pawl pivotally mounted on said arm and adapted upon motion in one direction of said arm to slip by said finger, and upon return movement of said arm to engage said finger and rock said pusher plate.

11. In an instrument for recording the velocity of air flow, a frame, a web carried by said frame, means for moving the web transversely of said frame, a needle, means for moving said needle longitudinally with respect to said frame, means for causing said needle to puncture said web, wherein the means for moving the needle longitudinally of the frame comprises a screw-threaded shaft rotatably mounted longitudinally of the frame, and a traveling nut carried by said shaft, said needle being supported by said nut.

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