(No Model.) 2 Sheets—Sheet 1.

P. DILLON.

APPARATUS FOR RECORDING OUTPUT OF MACHINERY.

No. 571,110. Patented Nov. 10, 1896.

Fig. 1.

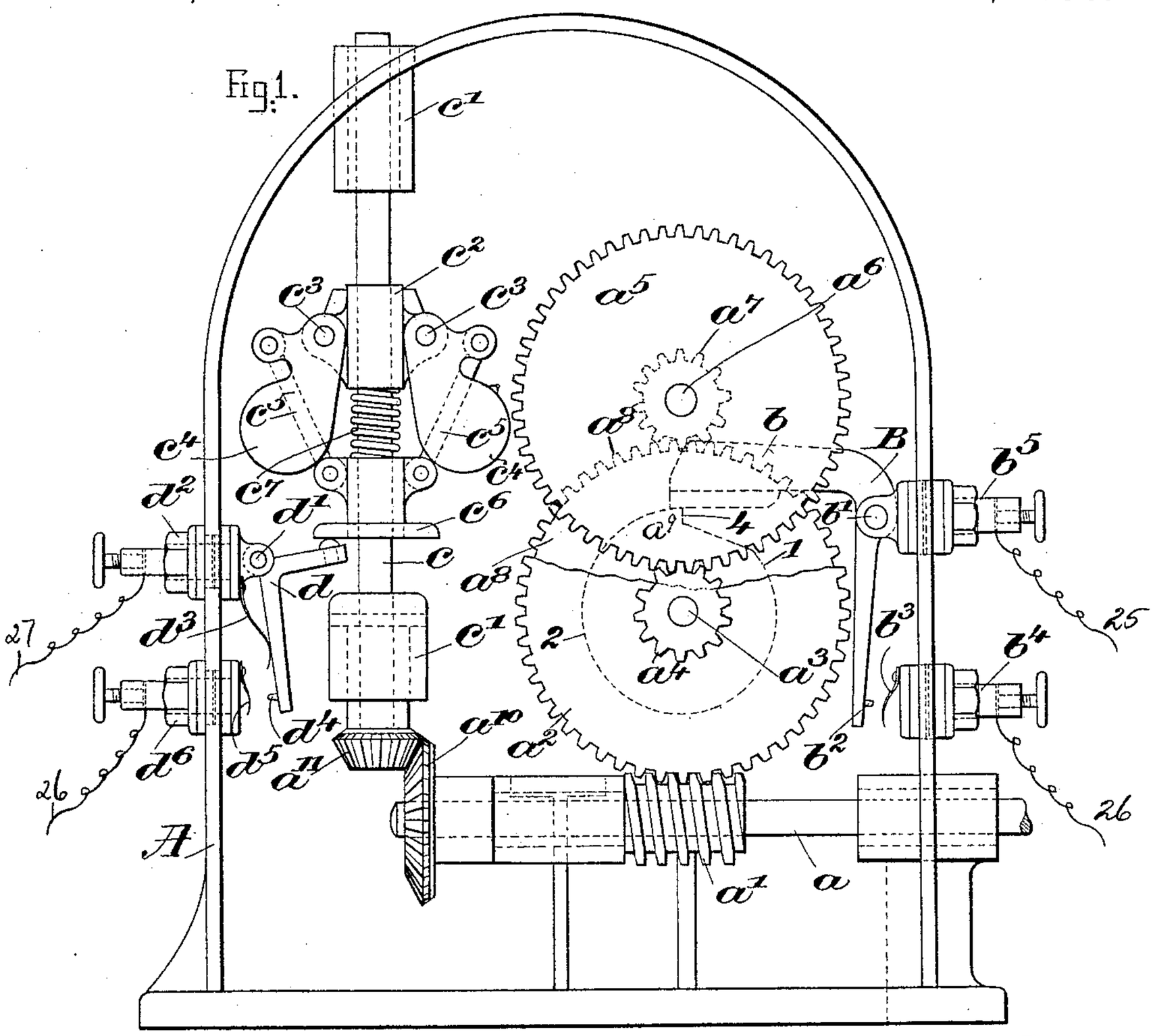


Fig. 2.

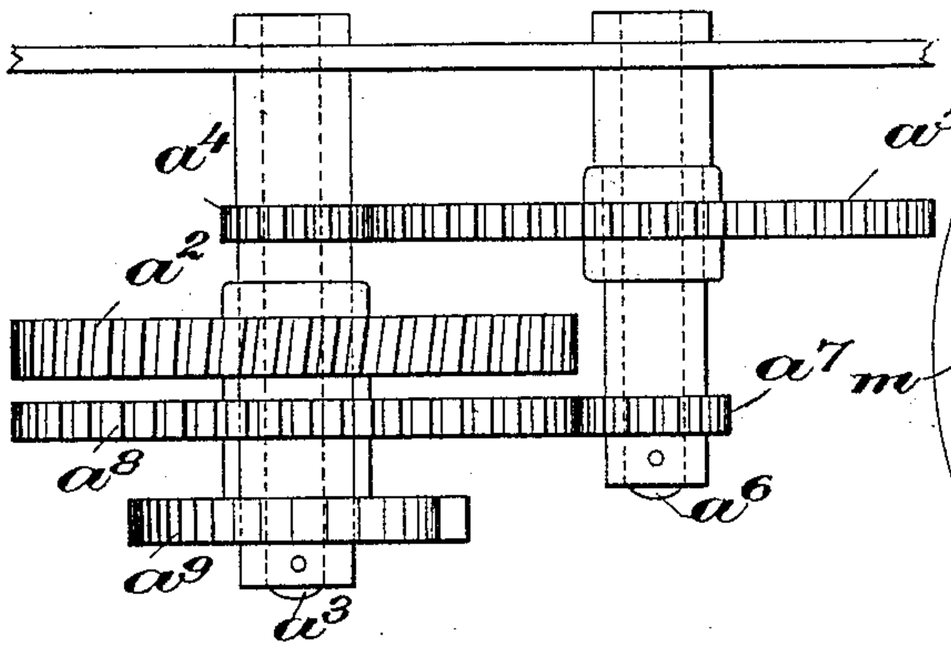
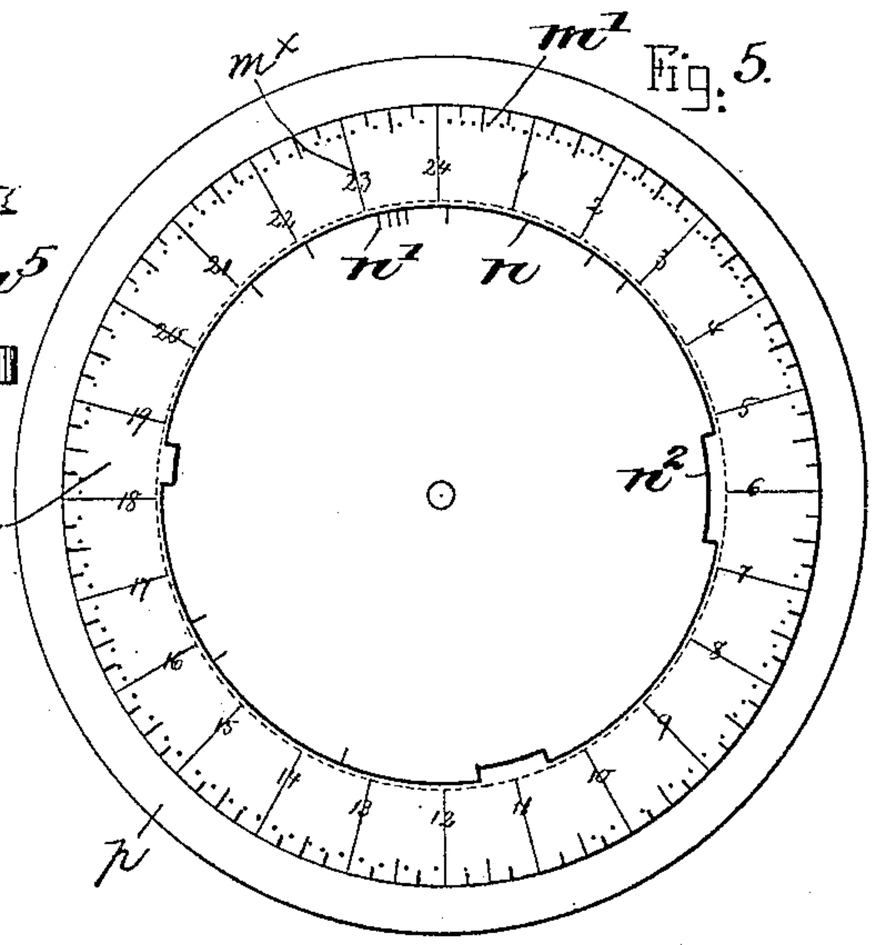


Fig. 5.



Witnesses.

Lauritz N. Möller.

Thomas J. Drummond

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(No Model.) 2 Sheets—Sheet 2.

P. DILLON.

APPARATUS FOR RECORDING OUTPUT OF MACHINERY.

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Fig. 3.

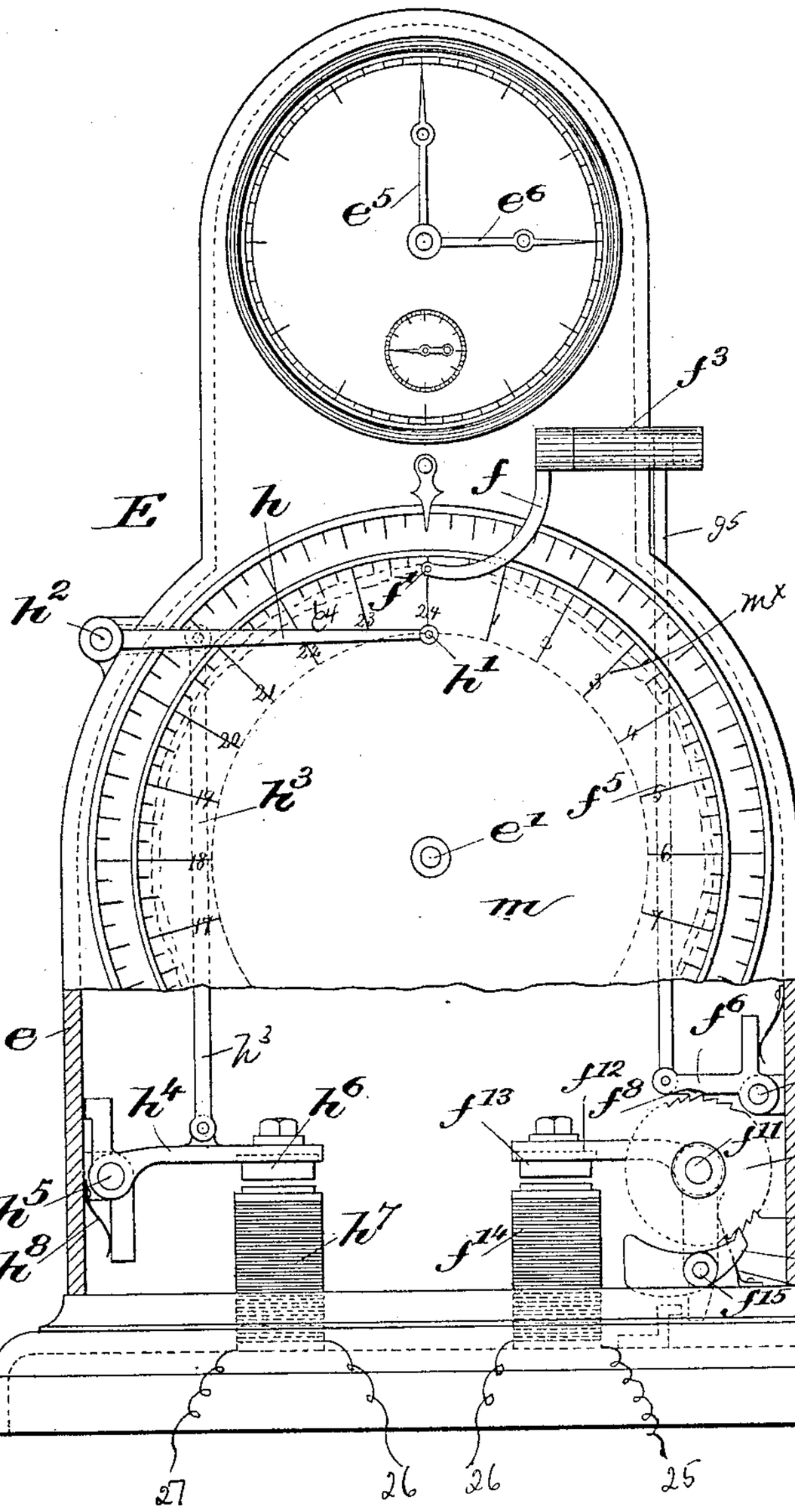
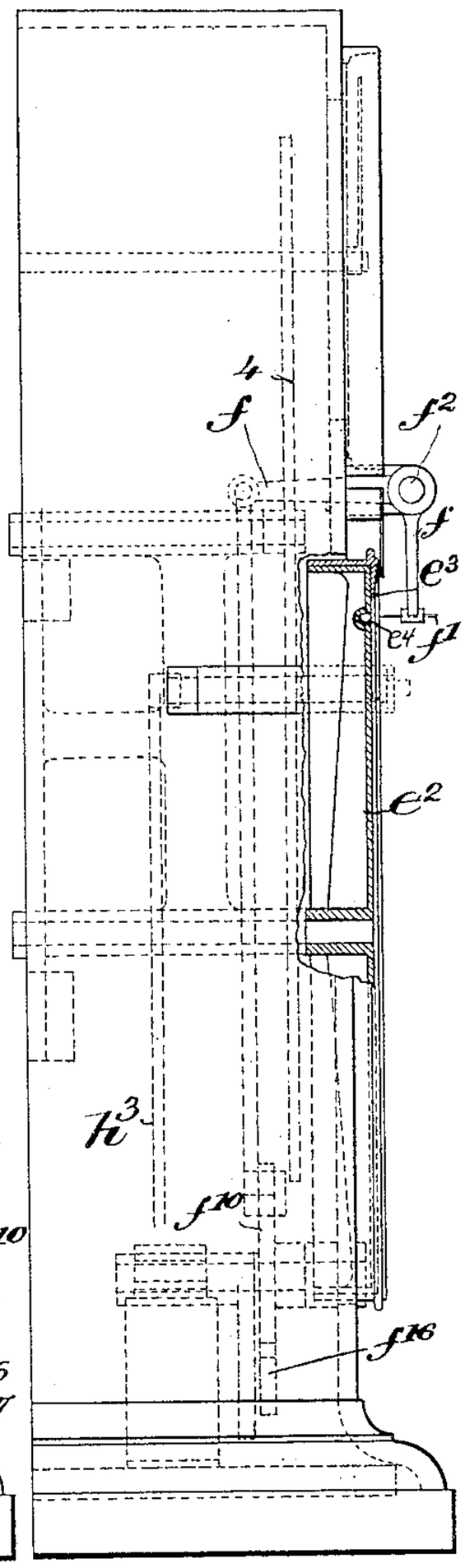


Fig. 4.



Witnesses.

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UNITED STATES PATENT OFFICE.

PETER DILLON, OF LAWRENCE, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO HENRY C. KING, OF SAME PLACE.

APPARATUS FOR RECORDING OUTPUT OF MACHINERY.

SPECIFICATION forming part of Letters Patent No. 571,110, dated November 10, 1896.

Application filed September 7, 1894. Serial No. 522,372. (No model.)

To all whom it may concern:

Be it known that I, PETER DILLON, of Lawrence, county of Essex, State of Massachusetts, have invented an Improvement in Apparatus for Recording the Output of Machinery, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

It is frequently desirable in manufacturing plants to automatically record at some suitable point, as, for instance, in the office, the output or work performed by various machines in the workrooms. Particularly is this true in connection with the manufacture of paper wherein the paper-making machines are run night and day, it being a great desideratum that the superintendent should in the morning be able to determine accurately the amount of work performed during his absence in the night.

In the manufacture of paper the paper-making machine is usually adjusted to produce paper of a specified weight per yard, and it frequently happens that during the night or other time when the overseer or superintendent is absent, the workmen readjust the machine to cause it to make a heavier paper, so that the rolls of paper produced, while of the required aggregate weight, are, nevertheless, short in the number of yards they contain. The workmen may also vary the operation of the machine to vary the output. With these facts in mind, I have conducted experiments in order to produce, if possible, an apparatus which would automatically record in the office the operations of the machines at all times. Such an apparatus to be intelligible and to show the superintendent exactly what had taken place during his absence should not only record the number of feet of web or paper produced by a machine per minute, but should also record the time and duration of various stops for the changing of wires and felts, breakage of the web, repairs, &c.

My experiments have resulted in an apparatus embodying the invention forming the subject of this application, which apparatus operates preferably through the medium of electricity, such being the most practical means for recording at a distant point the operations of any machine.

In the preferred embodiment of my invention I provide a receiver adapted to be located in the office, or at any other desired point at which the permanent record is to be made, and which contains a recording-sheet, coöperating with which is suitable recording mechanism for recording not only the output of the machine, but also the times and duration of the stops, the sheet for the best results being made movable by suitable clockwork.

The movements of the recording mechanism in the apparatus here selected to illustrate my invention are controlled by two sets of electromagnets, one set in circuit with a circuit-changing device connected in suitable manner with the machine in the mill and adapted to change the condition of the circuit periodically or upon the completion of certain specified number of feet or other quantity of the output of the machine, the other of said receiving-magnets being electrically connected with a second circuit-changing device actuated only when the machine is stopped.

In applying the apparatus to paper-making machinery I prefer to arrange a roll in contact with the web of paper as it leaves the machine, which roll at the end of every predetermined number of rotations, indicating a certain number of feet of paper produced, actuates the circuit-changing device referred to to make the required record at the distant receiver.

In the drawings, Figure 1 represents one form of transmitting device adapted to be connected with the machine in the shop or mill, the face-plate of said device being removed to expose the working parts within. Fig. 2 is a view looking at the side of a portion of the mechanism shown in Fig. 1; Fig. 3, a face view partially broken away of one form of receiver; Fig. 4, a side view of the same, partially broken out; and Fig. 5, a view illustrating the preferred type of dial or recording-sheet from which the work of the machine is read.

The drawings illustrate the preferred construction of apparatus embodying my inven-

tion, though it should be understood that my invention is not restricted to the particular apparatus shown.

Referring to the drawings, Fig. 1, A represents an inclosing shell adapted to be arranged in close proximity to the machine the output of which is to be recorded, said shell having suitable bearings for the prime or motor worm-shaft a, having a worm a', working in a worm-wheel a^2, Fig. 2, loose on a shaft a^3, journaled in suitable bearings in the said shell, said worm-wheel a^2 having a hub on which is cut a pinion a^4 in mesh with and driving a larger toothed wheel a^5, loosely mounted upon a shaft a^6, the hub of said wheel a^5 being provided with a pinion a^7, geared to a larger wheel a^8.

The hub of the wheel a^8 is shown provided with a cam a^9, having a shoulder or drop 4. (See Fig. 1.) Resting upon and in contact with this cam a^9 is one arm b of the L-shaped circuit-changing device B, pivoted at b' and having its other arm fitted with an electrical contact b^2, adapted to coöperate with the spring-contact b^3, attached to the binding-screw b^4 for proper change in the condition of an electric circuit, as will be hereinafter described. The circuit-changer B has its pivot b' also preferably connected with a binding-screw b^5, as shown.

In practice the worm-shaft a is connected in suitable manner with some moving part of the machine, the said shaft, where the apparatus is used in connection with a paper-making or other similar machine, being preferably connected with a roller, as, for instance, the spring-roller, in contact with which the completed paper runs in leaving the machine, a certain specified number of rotations of the roller representing a certain number of feet of paper delivered from the machine. The cam a^9 is therefore rotated slowly, the circuit-changer B riding upon the cam-surface, and when it reaches the shoulder 4 in the cam drops, and thereby, through its contact b^2, closes an electric circuit through the spring b^3, the said circuit-changer being at once raised slightly by the cam, as shown, to again break the circuit, so that an electric impulse is sent over the circuit at the end of every predetermined number of rotations of the worm-shaft a, which shaft constitutes one form of prime actuator for the apparatus.

In the apparatus shown the worm-shaft a is provided at its inner end with a bevel-gear a^{10} in mesh with and driving a mating-gear a^{11} on a vertical shaft c, journaled in suitable bearings c' in the inclosing shell. Fast on this shaft c is a hub c^2, to which are pivoted at c^3 the swinging governor-weights c^4, connected by links c^5 with the vertically-movable sleeve c^6, surrounding the said shaft c, a spring c^7 tending to press the said sleeve normally down into its lowermost position with the governor-weights also in their lowermost position nearest their axis of rotation. Immediately beneath the flanged bottom of the sleeve c^6 I have arranged a bell-crank circuit-changing device d, pivoted at d' to a part of a binding-post d^2 and having a spring d^3 to retain it normally in its elevated full-line position, Fig. 1. The circuit-changing device d has a contact d^4, adapted to coöperate with the spring-contact d^5 on the binding-post d^6. Rotation of the worm-shaft a causes corresponding rotation of the shaft c and the governor-weights c^4, which, by centrifugal force, move to a greater or less distance from their axis, according to the speed of rotation, and should rotation of the worm-shaft a cease because of the stopping of the machine for any reason the said governor-weights will immediately drop to their lowermost position, causing the sleeve c^6 to be pushed downwardly and, acting through the circuit-changing device d, close an electric circuit between the two contacting or binding posts d^2 d^6, for a purpose to be described. The shaft c, with its governor-weights, operating as shown constitutes one form of stop-indicator, that is, said shaft and weights act to indicate the stopping of the machine for any reason.

Referring now to Sheet 2, E is one form of receiver, the same, as shown, consisting of an inclosing shell e, in which is journaled the shaft e', carrying at its front end a dial-plate e^2, adapted to receive and carry a paper or other recording dial or sheet m, the latter being retained in position upon the plate e^2 by a suitable annular holding-ring e^3. The dial-plate is provided with a circular groove e^4 to enable the sheet applied to the plate to be punctured by a suitable needle-point, as will be described. The shaft e', with its dial-plate and recording-sheet, is rotated, preferably once in twenty-four hours, by suitable clock mechanism contained in the upper part of the inclosing shell, the minute and hour hands e^5 e^6 for the said clock mechanism being shown at the face, Fig. 3.

The measuring recorder-arm f, herein shown as carrying the prick or needle-point f', is fast upon a shaft f^2, journaled in a suitable lug f^3 on the outside of the shell e, said shaft at its end opposite the arm f having a crank f^4, (see dotted lines, Fig. 4,) to which is jointed one end of the link f^5, jointed at its opposite ends to the lever f^6, pivoted at f^7. (See Fig. 3.) This lever f^6, as shown, has a detent f^8, which rests always in one of the notches f^9 in a ratchet-wheel f^{10}, mounted upon a shaft f^{11}, journaled in suitable bearings within the inclosing shell. Mounted loosely upon the shaft f^{11} is an L-shaped armature-carrying lever f^{12}, having one of its arms fitted with an armature f^{13}, coöperating with the receiver-magnet f^{14}, the other arm of said lever having pivoted to it at f^{15} an operating-pawl f^{16}, which latter coöperates with the teeth on the wheel f^{10}, a spring f^{17} retaining the said armature-lever normally in its retracted position.

The magnet f^{14} is connected in circuit by wires 25 26 with the circuit-changing device

B in the transmitter A of the apparatus, so that whenever the circuit is closed by the circuit-changing device B, indicating the completion of a certain predetermined number of yards of the web or other specified quantity of work produced, such closure of the circuit will energize the magnet f^{14}, causing it to attract its armature and through its pawl f^{16} to rotate its ratchet-wheel f^{10} through a distance of one tooth, which movement causes the detent f^{8} and its lever f^{6} to ride over the crown of one of the teeth of the said wheel and to drop down again into the next succeeding notch, such rise of the detent-lever f^{6} causing the needle-point f' on the marker to puncture the recording-sheet, as best illustrated in the detail, Fig. 5, thus indicating upon the said sheet and with relation to the hour and minute divisions thereupon the precise time of completion of the specified number of yards or quantity of output.

The stop-recorder arm is shown at h, the same at its free end being provided preferably with a marking pencil or pen h' and at its opposite end pivoted at h^{2}, the same intermediate its length having jointed to it one end of a link h^{3}, at its opposite end jointed to the armature-lever h^{4}, pivoted at h^{5} and provided with the armature h^{6}, coöperating with the receiver-magnet h^{7}, a spring h^{8} retaining the said armature normally in its retracted position.

The receiver-magnet h^{7} is connected in circuit by branches from the wire 26 and by the wire 27 with the circuit-changing device d of the transmitter, closure of the circuit by the latter on the stopping of the machine acting to energize the magnet h^{7} and cause the latter to attract its armature and thereby draw down into its dotted position the marker h to leave a record upon the recording-sheet, such as illustrated in Fig. 5. The wire 26 is common to the circuits for both magnets f^{14} and h^{7}, it having branches leading to the magnets and to their respective circuit-changing devices.

Referring now to Fig. 5, I have illustrated the preferred form of dial or recording-sheet and have indicated thereon a typical record, such as would be made upon the same by a twenty-four hours' run of a paper-making machine. Referring to the said figure, the dial or recording-sheet m is shown as provided at its periphery with division-lines $m^{\times}$, suitably marked to indicate the twenty-four hours of the day, each hour-division being subdivided by other lines to indicate minutes, seconds, &c. The dots or punctures m' represent the punctures made by the measuring marker or needle f during the twenty-four hours' rotation of the recording-sheet, and by noting the varying distances between successive punctures the various periods of time consumed in running off the specified number of yards between one puncture and another may be determined. For instance, assuming that the machine is adjusted to produce six hundred yards of paper of a specified weight for each complete rotation of the cam a^{9}, that is, six hundred yards between each two punctures upon the sheet, by reference to Fig. 5, between the hours twenty-four and one, it will be seen that there are seven punctures, indicating that in that hour four thousand two hundred yards and a fraction over were produced by the machine, whereas, referring to the hour nineteen to twenty, it will be seen that there are only four punctures, indicating that only two thousand four hundred yards were produced during that hour, which would show the superintendent that the workmen had readjusted, or stopped, or slowed down the machine so that it had not produced the maximum quantity of paper. It will thus be seen that the production of the machine for any hour or fraction thereof during the day or night is permanently recorded upon the recording-sheet. Within the series of punctures m' will be seen an unbroken line, marked n, made by the marker h' to show the times and duration of the various stops. When, for instance, the paper or web breaks, the stop device at the transmitter will act to close the circuit through the circuit-changing device d, and will thereby energize the magnet h^{7} and cause its marker h' to be drawn down toward the axis of the recording-sheet carrier E and make a short radial mark, such, for instance, as shown at n', showing that the machine had stopped or the web broken, and the line being a single line would indicate that the machine had been again started up or the web brought over again before the sheet had moved any perceptible distance in its travel. Should the machine require new wires, however, it would necessarily require the machine to be stopped for a considerable time, and in that case a break, such as indicated at n^{2}, would be made upon the sheet, the length of the break indicating the number of hours or fraction thereof during which the machine was stopped.

The record is simply and clearly made and in such manner as to be quickly grasped by the one in charge, and it requires the simplest form of mechanism.

I am aware that various apparatus have been devised for permanently recording upon a rotating sheet, by means of a marker moving out and in with relation to various circles upon the dial, variations in speed of rotating bodies; but so far as I am aware I am the first to indicate upon a recording-sheet the completion of certain predetermined quantities of work or web produced by suitable marks or impressions made with relation to hour and minute divisions or other characters to indicate the times at which the marks or impressions were made, and, further, to provide a stop-recording mechanism to indicate the times and duration of various stops.

The construction of apparatus herein shown and described is simple and efficient, and, as

before stated, I prefer to operate the same through the medium of electricity, though I desire it to be understood that my invention is not necessarily limited to the particular construction of apparatus shown, nor is it restricted to use in connection with paper-making or any other particular type of machine, for it is evident that my invention embodied in suitable mechanism suggested to those skilled in the art may be adapted for recording the operations of various machines or machinery.

Having described one embodiment of my invention and without limiting myself as to details, what I claim, and desire to secure by Letters Patent, is—

1. An apparatus of the class described, containing a prime actuator, journal-bearings therefor, product-measuring mechanism operated by and during movement of the said prime actuator, and a stop-recording mechanism normally inactive, but operated upon and by stopping of the said prime actuator, substantially as described.

2. In an apparatus of the class described, a pime actuator; a product-measuring marker; connections intermediate the same and said prime actuator, whereby the former is moved by the latter at the completion of predetermined measurements of product; and an independent stop-marker, and connections between it and the said prime actuator, whereby said marker is actuated only upon stopping of the said prime actuator and again upon its resumption of movement, substantially as described.

3. An apparatus for recording the operations of a web-producing machine containing the following instrumentalities, viz: a rotating prime actuator in contact with and rotated by the traveling web, a circuit-changing device actuated by and at the end of a predetermined number of rotations of said prime actuator, a receiver containing a moving recording-sheet, a coöperating recorder, and a receiving-magnet therefor electrically connected with and controlled by said circuit-changing device, substantially as described.

4. An apparatus of the class described containing the following instrumentalities, viz: a rotating prime actuator, a circuit-changing device actuated by and at the end of every predetermined number of rotations of the said actuator, a receiver containing a recording-sheet, a coöperating recorder, and means to produce a uniform relative movement of said sheet and recorder and a magnet for said recorder in circuit with and controlled by said circuit-changing device, and a stop-marker and its actuating-magnet electrically connected with and controlled by the stopping of said prime actuator, substantially as described.

5. An apparatus of the class described containing the following instrumentalities, viz: a prime actuator, a measuring circuit-changing device connected with and operated at the end of every predetermined number of movements of the said actuator, and a stop-indicator operated by stopping of the said actuator, and a circuit-changing device operated by said stop-indicator, a receiver containing a recording-sheet, measuring and stop markers and actuating-magnets therefor connected in circuits respectively with the said measuring and stop circuit-changing devices and means to impart a uniform relative movement to said recording-sheet and markers independent of the movement of the latter by said magnets, substantially as described.

6. In an apparatus of the class described, a receiver containing a plane recording-sheet, a measuring-marker adapted to make a series of independent marks upon the said sheet and in a circle thereon, the distance between successive marks indicating variations in operating of the machine or mechanism, a stop-marker adapted by its marks made at different radial distances from the axis of said sheet to indicate stopping of the machine or mechanism, transmitting devices connected with and operated by the machine the record of which is to be kept, said transmitting devices being connected with and to operate the said markers and means to impart to said recording-sheet and markers a relative circular movement, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PETER DILLON.

Witnesses:
FREDERICK L. EMERY,
JOHN C. EDWARDS.