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Patented Jan. 10, 1899.

R. MACRAE.
RECORDING APPARATUS.

(Application filed Feb. 26, 1898.)

(No Model.)

Fig. 1.

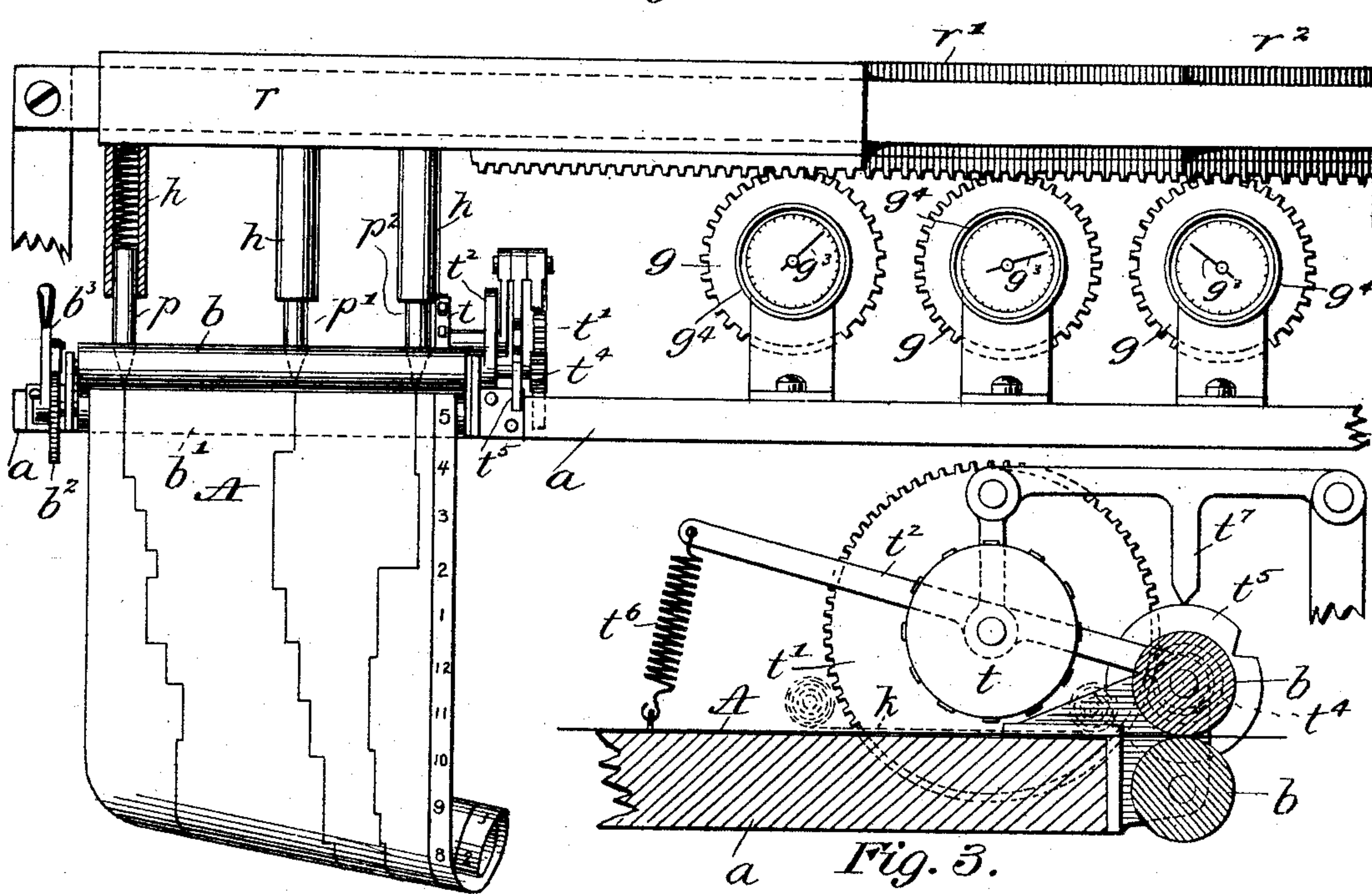
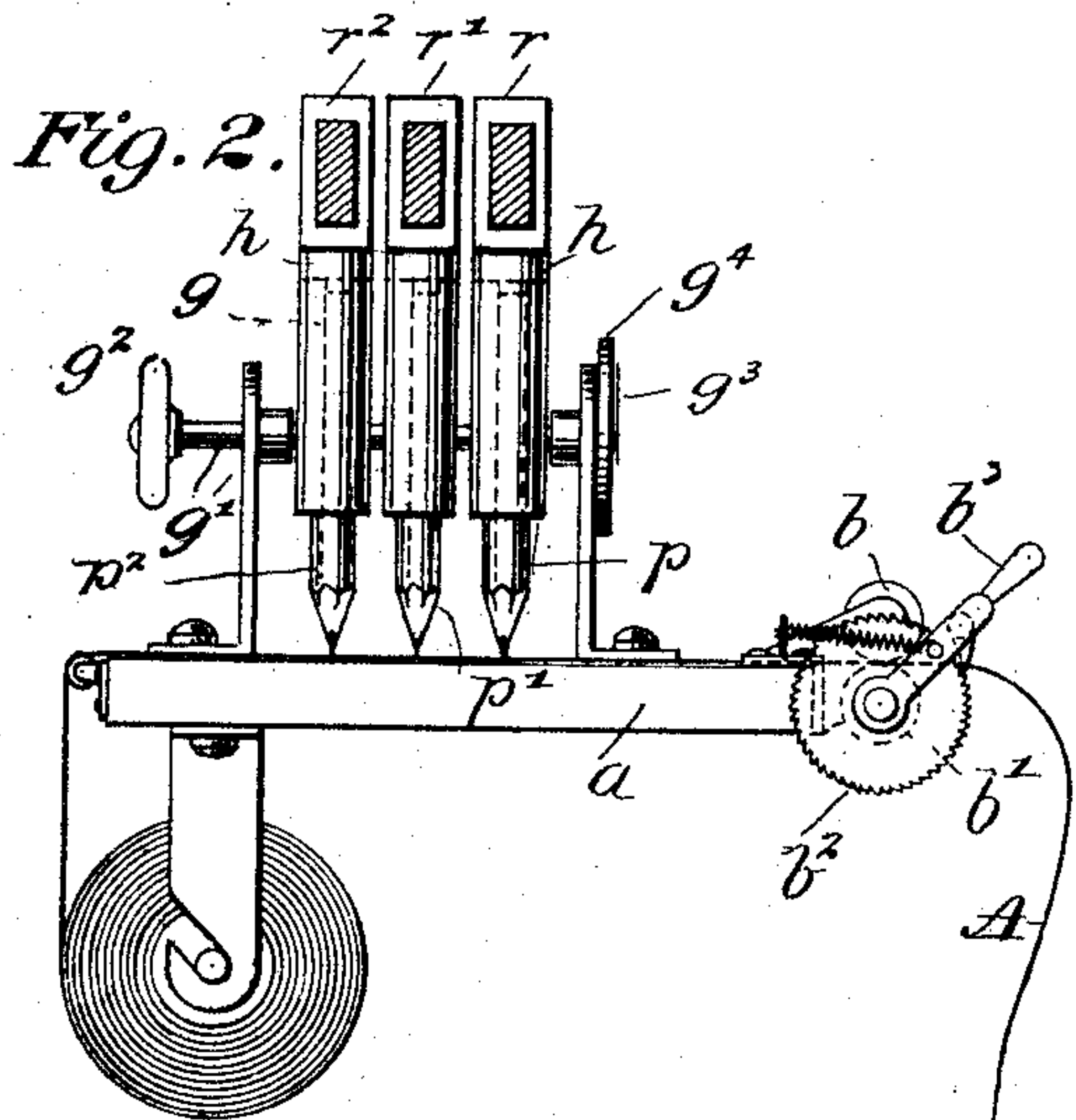


Fig. 3.



WITNESSES:

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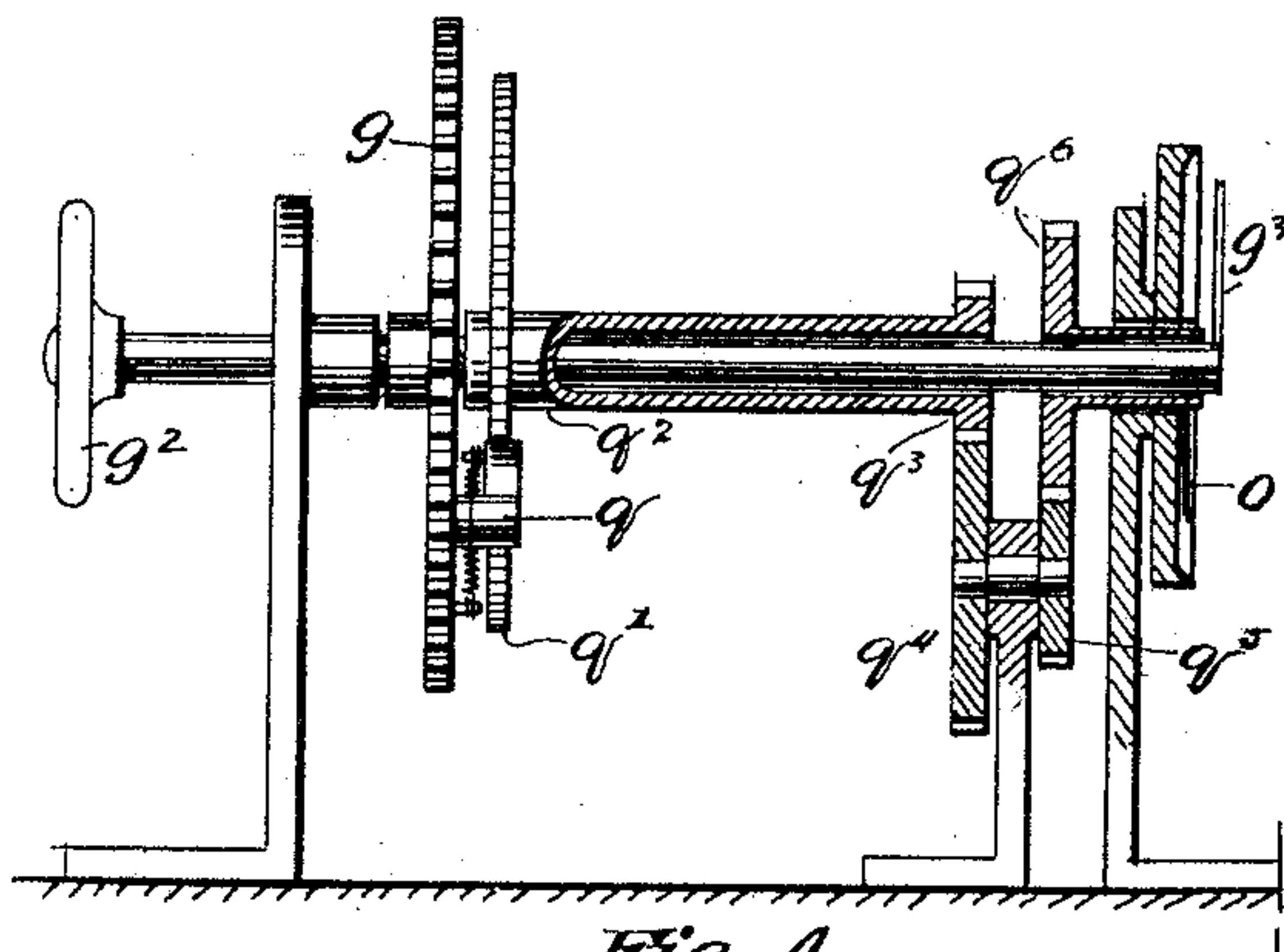


Fig. 4.

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RECORDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 617,534, dated January 10, 1899.

Application filed February 26, 1898. Serial No. 671,811. (No model.)

To all whom it may concern:

Be it known that I, RODERICK MACRAE, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Recording Apparatus, of which the following is a full, clear, and exact description.

The difficulty of keeping reliable records of the daily operations and output of electric light and power stations is familiar to every station operator. The usual method of taking readings of the different instruments at regular intervals and entering them into a log-book from which curves are traced on the following day is unsatisfactory for several reasons. With this method the amount of clerical work necessary to be done in order to produce curves that are sufficiently accurate to be of any practical value is so great that in the large majority of stations no attempt is made to keep such records. It is easy to see why too much confidence should not be placed in the accuracy of records kept in this manner when it is considered that usually three or four persons are responsible for the figures from which one day's curves are produced. The fact also that a switchboard operator seldom has much experience in the duties of an accountant and that he is obliged to use writing material one moment and an oil-can or similar piece of apparatus the next is some excuse for manuscript that cannot be deciphered even by the person who has written it. The importance, however, or, rather, the necessity of having trustworthy curves to show how the conditions in an electric light or power house vary from hour to hour is so obvious that it is hardly necessary to dwell upon it. Without such curves it is impossible to gain any definite idea of where losses occur or in what direction improvements should be made in the operation of the plant. In stations where storage batteries are used it is absolutely necessary to keep accurate records if losses in current and injury to the battery are to be avoided. In such stations the switchboard operator should have constantly before him something to show what work has just been done by the battery in order that he may be able to use the battery to the best

advantage. For this purpose curves traced in the usual manner are obviously of no service, as the occasion for which they are needed arrives before the curves are plotted. When one switchboard operator relieves another, he should have the means of becoming thoroughly acquainted with all the conditions existing up to and at the time he comes on duty. This is necessary in order that he may know what has to be attended to. To furnish this information, the records should be complete up to the time he takes charge and arranged in such a manner that a person familiar with the work can understand the whole situation at a glance. This latter point is important, because a switchboard operator usually has so much to attend to that he cannot devote much of his time to finding out what has been done by those who were on duty before him.

My invention was designed for the purpose of diminishing to some extent the amount of bookkeeping necessary to be done in keeping station-records. The apparatus is operated in much the same manner as a cash-register. Its construction will be readily understood by reference to the accompanying drawings, in which—

Figure 1 is a front elevation of the mechanism removed from its case. Fig. 2 is an end elevation of the same. Fig. 3 is a detail view of the time-stamp used in connection with the invention, and Fig. 4 is a detail of one of the operating-shafts.

The instrument I have devised consists of mechanism whereby the readings of the various station instruments may be by very simple mechanical operations at once plotted in curves upon a strip of paper, the several curves indicating volts, amperes, number of battery-cells, &c., all being plotted on a single sheet or strip of paper and the instrument being also adapted to indicate ampere or watt hours.

A strip of paper A is led across a table and passes between a pair of gripping-rollers b b' , one of which is fitted with a ratchet-wheel b^2 and a lever b^3 , carrying a pawl by which it may be manually rotated a certain distance step by step to correspondingly feed the paper. A number of pencils p p' p^2 , &c., rest upon the surface of the paper and are

carried by pencil-holders h , attached, respectively, to a series of rack-bars $r, r', r'',$ &c., arranged in parallel planes closely adjacent to each other and adapted to slide longitudinally in any suitable framework. With each rack engages a pinion g on a shaft g' . The shaft carries a hand-wheel g^2 , by which the pinion may be rotated and the rack connected with it adjusted longitudinally to properly locate the pencil transversely upon the strip of paper. The shaft g' carries on its front end an index g^3 , moving in front of a dial g^4 , upon which the division-marks represent, in one instance, volts, in another amperes, and in another the number of battery-cells, and so on.

The operation of the instrument so far described is as follows: The readings of the various instruments in the station are supposed to be taken at regular intervals through the day of, say, an hour. When the indication of a certain instrument has been noted, the index corresponding to that instrument is turned to the position corresponding to the reading. For instance, if the volt-meter indicates "490" the index of the recording instrument corresponding to the volt-meter is turned to "490" on the dial. This throws the corresponding pencil to a certain position on the strip of paper. Likewise the ampere-pencil is set to correspond with the reading of the ampere-meter and the operation is repeated for each instrument whose reading is to be recorded. When the pencils have all been set, the handle b^3 , operating the ratchet-wheel of the gripping-rollers, is pulled and allowed to go back under the action of its spring, thus feeding the strip of paper forward a short distance, the pencils dragging and recording their positions by a short mark upon the paper. An hour hence when the readings are again taken the pencils are adjusted transversely upon the paper, which movement is accompanied by a transverse mark and the paper fed forward the same distance as before to record the new positions of the pencils. Thus the records are made each time the readings are taken.

In order to indicate the intervals at which the records are made, a time-stamp is used which prints the hour. This consists of a type-wheel t , having the type arranged on its periphery and mounted on a shaft with a gear-wheel t' and supported in a frame t^2 , pivoted on the center t^3 . This center is the axle of one of the gripping-rollers which moves the strip of paper, and on it are mounted a pinion t^4 , engaging with the gear t' , and a notched disk t^5 . The pivoted frame t^2 is pulled in one direction by a spring t^6 , and a projection t^7 on the frame, resting against the periphery of disk t^5 , normally prevents the movement of the frame; but when a notch in the disk is presented to the projection the frame is allowed to swing inward quickly and carry the type-wheel against the edge of the strip of paper opposite which it is placed and impress thereon the figure which by the rotation

of the gearing has been brought into position. An inking-ribbon k is interposed between the type-wheel and the paper. There may be a notch in the disk to correspond with each movement of the gripping-rollers, which would probably be the case if the readings were taken at long intervals; but obviously by a proper arrangement of the notches in the disk the printing device may be caused to act at any desired intervals. The figure indicating the time is printed opposite that portion of one of the curves which was made at the same time; but as the pencils are in different planes obviously only one curve could correspond exactly with the time; but slight allowances can be easily made for such discrepancies.

When, as in the case of ampere and watt hours, a time factor enters into the quantity of which a record is desired, the dials are provided with two indexes, as shown in Fig. 4, represented, respectively, by g^3 and o . g^3 moves at the same speed as the shaft, but o is made to move at a speed proportionate thereto, determined by the number of readings taken per hour. This difference of motion is obtained by the train of gears shown in Fig. 4. The gear g , which engages with the rack, is tight on the shaft and carries a pawl q , engaging with a ratchet-wheel q' on a loose sleeve q^2 . The hub has a pinion q^3 , giving motion to the train of gears q^4, q^5 , and q^6 , the last of which carries index o . When the hand-wheel g^2 is turned forward, the pawl engages the ratchet-wheel and the index o is carried forward a certain distance proportional to the distance traveled by the index g^3 ; but when shaft g' is rotated in the opposite direction the pawl slips on the ratchet and index o remains stationary, while index g^3 travels backward. The proportion existing between the movements of the two indexes when they travel together depends upon the number of readings taken per hour, as above stated. For instance, if four readings per hour are taken the index o will travel at one-fourth the speed of the index g^3 . Index g^3 shows the position of the pencil, which is tracing the ampere-curve, while index o indicates ampere-hours. The operation is as follows:

Suppose ampere readings are to be taken every quarter of an hour and that we start with both indexes at zero. Let the first reading be, say, twenty amperes. Index g^3 is moved up to "20," while index o moves to "5," being one-fourth of the distance traveled by the index g^3 . Let the second reading be twenty-four amperes. Index g^3 is moved back to zero, during which operation index o does not move. Index g^3 is then moved up to "24," and at the same time index o moves up six more points, bringing it to "11." Let the third reading be thirty-six amperes. Then, as before, index g^3 is turned back to zero and then forward to "36." This will bring index o nine points farther or to

“20.” Let the reading at the end of an hour be twelve amperes. The same operation being repeated, index o will read twenty-three amperes, and as the hour is finished it indicates twenty-three ampere-hours.

Without the reducing-gearing between the two indexes—that is, when the two indexes travel forward together—if the readings are taken at every quarter of an hour the indication of the index o would have to be divided by four to indicate ampere-hours.

The strip of paper on which the curves are traced may be torn off at the end of each day and filed away; but it furnishes at all times from the moment the readings are taken the amount of work done and being done by the station.

Having thus described my invention, I claim—

1. In a recording apparatus the combination of a plurality of pencil-holders, a plurality of rack-bars carrying the same, a plurality of shafts carrying gears respectively engag-

ing with said racks, means for rotating said shafts, and indexes also carried by said shafts, substantially as described.

2. In a recording device, the combination of feeding devices for a strip of paper, shifting pencil-holders arranged to move the pencils from one position to another upon the paper, and a time-stamp operated by the paper-feeding device, substantially as described.

3. In a recording apparatus, a shaft, two indexes moved thereby, one of said indexes traveling in both directions with the shaft and means whereby the other index travels in one direction only with the shaft, all in combination with a movable pencil-holder having a motion corresponding to one of the indexes, substantially as described.

In witness whereof I subscribe my signature in presence of two witnesses.

RODERICK MACRAE.

Witnesses:

WM. C. GILL,

H. K. SUBENECK.