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COMPLETE SPECIFICATION.

Improvements in or connected with Apparatus for Measuring and Recording Electric Currents.

We, HERMANN ARON, of No. 6, Lutzowstrasse, Berlin, in the Kingdom of Prussia, in the Empire of Germany, Dr. Philos. and Professor, and ARON ELECTRICITY METER LIMITED, of 46, Upper Thames Street, London, E.C., Manufacturers, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to apparatus for measuring and recording electric currents, of the kind which enables different rates to be charged for the current consumed during different predetermined periods of a day, for instance, during night and during day. According to this improved apparatus the amount of current delivered is automatically recorded on two separate dials, one for each rate to be charged, say one dial for night and one for day, and the recording motion is caused to automatically change between the two dials exactly at predetermined times.

In the accompanying drawings,

Figure 1 is a front elevation of that part of the measuring and recording apparatus, which contains the improvements of this invention, Figure 1^{A}, is a plan of lever s; Figure 1^{B} is a side-elevation of part of the apparatus, as seen in the direction of the arrow 1, in Figure 1. Figure 1^{C} is a horizontal section through the clutch changing motion from one dial to the other. Figure 2 is a section drawn to line Z—Z of Figure 1, and Figure 3 is a front view of the two dials of the apparatus.

Referring to Figures 1 and 2, a is the dial-plate of an apparatus for recording the amount of electricity delivered; at the side of this dial-plate a, another dial-plate b is arranged, belonging to a clock-work driven by the shaft c, carrying the hour-wheel d, which, by means of intermediate gear-wheels $e\,e^1$, and $f\,f^1$ transmits motion to wheels g and g^1, the speed of said gear-wheels $g\,g^1$ being but half the speed of wheel c, and accordingly the said wheels g, and g^1, make but one revolution during 24 hours. The said two wheels g and g^1 are mounted loosely on their respective studs h and h^1 which are screwed to the dial-plate and on which the said wheels g and g^1 have a sliding motion in the longitudinal direction. Into the nave $k\,k^1$ of said wheels $g\,g^1$ annular grooves $i\,i^1$ are cut into which engage levers $l\,l^1$ pivoted as at $r\,r^1$, as clearly shown in Figure 1^{B}. Into the face of said naves $k\,k^1$ notches $m\,m^1$ are cut, one side of which is inclined, as shown in Figures 1^{B} and 2. The said notches are designed to be engaged by catches $n\,n^1$ projecting from the collars of pointers $o\,o^1$ carried by the studs $h\,h^1$. Springs $p\,p^1$, coiled around said studs $h\,h^1$ tend to force the wheels $g\,g^1$ towards the said catches $n\,n^1$.

Supposing, now, that the wheel g be turned by shaft c in the direction of the arrow 2, Figure 2, the notch m, owing to the pressure of spring p, will at length come opposite the catch n and engage the same; the wheel g, accordingly, will be shifted in the direction of arrow 4, Figure 2, and, accordingly, the lever l,

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engaged within the groove *i* will be turned in the direction of arrow 3, Figure 1ª, thereby causing a three-armed lever *s*, Figure 1ª, to turn on its pivot *t*. The said lever *s* by means of a fork u^1 formed on its arm *u* engages the end of a lever *w*, secured on a shaft *v*, on which is secured another lever *x*, pivotally connected to a rod or link *y*, which connects the clock-work to the recording train and which, through the medium of said lever *x* is shifted in the direction of its length.

On the side of the recording apparatus, the said connection rod *y*, acts by means of a stud A and a spring B on a frame D tilting on its axis C; the said frame carries gear-wheels E, F, G, to which motion is imparted from the counting gear by means of wheels H and I. According to the position of the rod *y*, in either of its extreme positions, the wheels F, E, are thrown into gear with the intermediate wheel J, driving the train for recording the amount of electricity delivered by day, or the wheels F, G, are thrown into gear with the intermediate wheel K, driving the train for recording the electricity delivered by night.

The stud A of the connecting-rod *y* is engaged by the fork P of a lever L, which, by means of a bolt M is secured to a finger N. Now, as the rod *y* is shifted in one or the other direction, thereby coupling the driving mechanism of the counting apparatus with the recording train for delivery by day, or with the recording train for delivery by night, the said finger N, will always indicate on the dial-plate *a*, which one of the two recording-trains is working, as clearly shown by Figure 3.

Supposing the electric current delivered during the period from 7 o'clock in the morning up to 7 o'clock of night is to be charged at a lower rate, than that delivered between 7 o'clock of night until 7 o'clock of morning, the finger *o* is adjusted on 7 o'clock of morning on the dial O of 24 hours, while the other finger o^1 is adjusted on 7 o'clock of night on the dial O^1 of 24 hours. To better mark the difference of the hours of day and the hours of night on the two dials O, and O^1, the said dials may conveniently be divided into a half field in black and a half field in white, as indicated in Figure 3.

Owing to the circumstance, that the wheels $g\,g^1$ make but one revolution within 24 hours, and that the naves *k* and k^1 have but one notch $m\,m^1$ it will be seen that but once within 24 hours the said notches $m\,m^1$ will be engaged by the corresponding catches $n\,n^1$ when coming opposite said notches. The finger *o* being adjusted to 7 o'clock of morning on dial O, the notch *m* will be engaged by the catch *n* when the main dial Q shows 7 o'clock of morning, and the rod *y* will be shifted to throw the day recording train into gear with the counting gear. At 7 o'clock of night, then, the notch m^1 will be engaged by the corresponding catch n^1 and the rod *y* will be reversed, thereby throwing the day-recording gear out of connection with the counting gear, and simultaneously throwing the night-recording train into gear.

The notch *m*, being engaged by the catch *n*, and the notch m^1 being engaged by the catch n^1, disengage, as the said notches slide along the inclined face of the corresponding catch, and by disengaging, the naves of wheels *g* and g^1 are pushed back by the levers *l* and l^1, and the springs $p\,p^1$ are again compressed and ready for use. The levers $l\,l^1$ on being pushed back do not affect the lever *s*, but leave it in its place, to be struck by the next forward motion of either of the levers $l\,l^1$.

As indicated in Figure 3, a smaller dial R is arranged to show, whether the main dial Q indicates the hours of day or of night, and a further dial S marks the seconds.

The number of dials to record the electric current delivered, and the number of shifting devices, to throw the said recording dials into and out of gear, might be still increased, if more than two rates are to be charged for different periods of a day; but two recording dials and two shifting devices, at least, are required.

By the same means, which effect the shifting of the rod *y*, mechanism of

other kind could be actuated. For instance, driving wheels of different diameter could be coupled or uncoupled, to make the counting-apparatus go at an accelerated or retarded rate of speed; or contacts could be closed, or electrical resistances be connected or disconnected at the exact, predetermined times, to work such changes of speed, to obtain the effect desired, *viz.* to charge the electric current delivered at different rates during different periods of a day.

We are aware that apparatus for measuring and recording electric currents according to different rates during different periods of a day, are known, but,

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The improvement in apparatus for measuring and recording electric currents, of the kind in which clockwork is employed to automatically change the rate during different periods of a day, which consists in providing the clockwork with two or more wheels adapted to be slid or displaced longitudinally on their axes by said clockwork at predetermined times, and with mechanism for transmitting said sliding motion of the wheels to the recording apparatus for the purpose of changing the rate of recording the current, substantially as hereinbefore described.

2. In apparatus of the kind described for measuring and recording electric currents, the provision of two or more separate dials for recording the electricity delivered during different predetermined periods of a day, said dials having separate recording trains adapted to be thrown into and out of gear with the counting gear by suitable mechanism actuated by the clockwork in such a way that each dial records at a different period substantially as described.

3. In apparatus for measuring and recording electric currents, having two independent recording trains for the purpose described, the means for throwing said trains alternately into gear with the counting gear, which consists of a frame adapted to be tilted by the clockwork at predetermined times, said tilting frame carrying three gear wheels all in gear one with another, of which the central wheel is constantly in gear with the counting gear, whilst the other two wheels are alternately thrown into gear, the one with the one recording train, and the other with the other recording train according as the frame is tilted to one side or the other substantially as described.

4. The general construction and combination of parts taken as a whole forming the improved recording mechanism for apparatus for measuring electric currents substantially as hereinbefore described and illustrated.

Dated this 5th day of April 1899.

W. P. THOMPSON & Co.,
Of 6, Lord Street, Liverpool, Agents for the Applicants.

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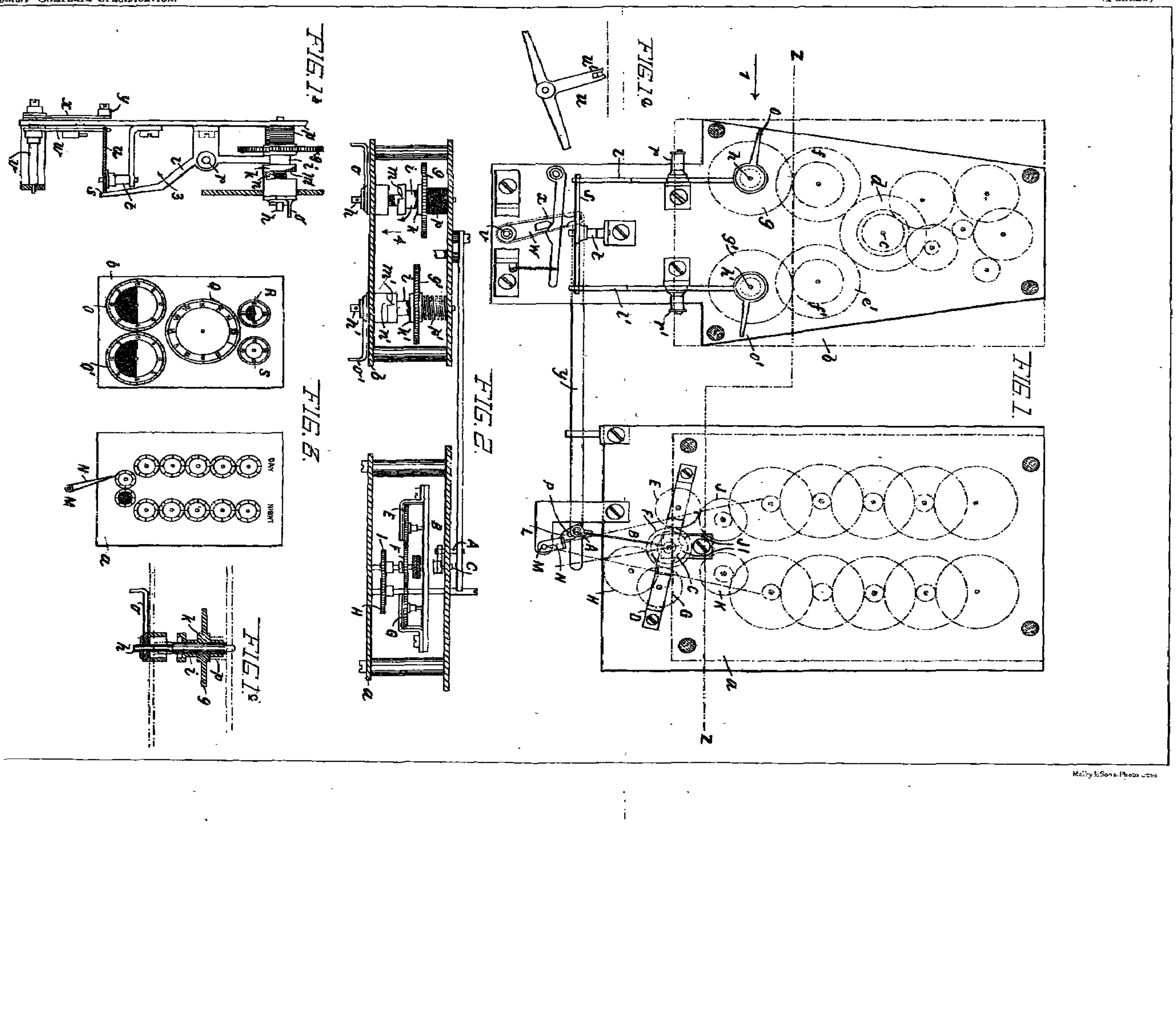

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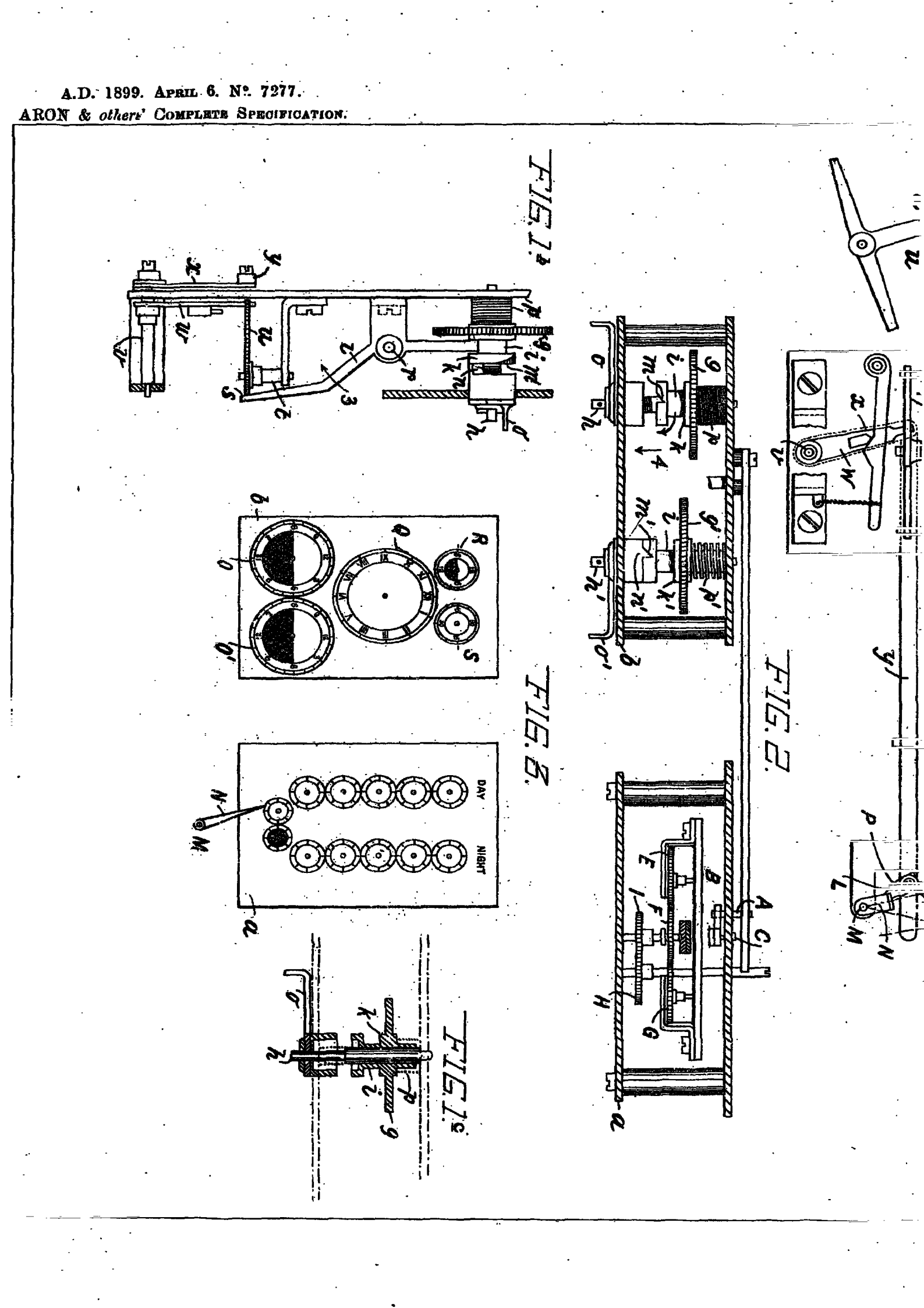

FIG. 1.

FIG. 1a.

FIG. 2.

FIG. 3.

FIG. 1b.

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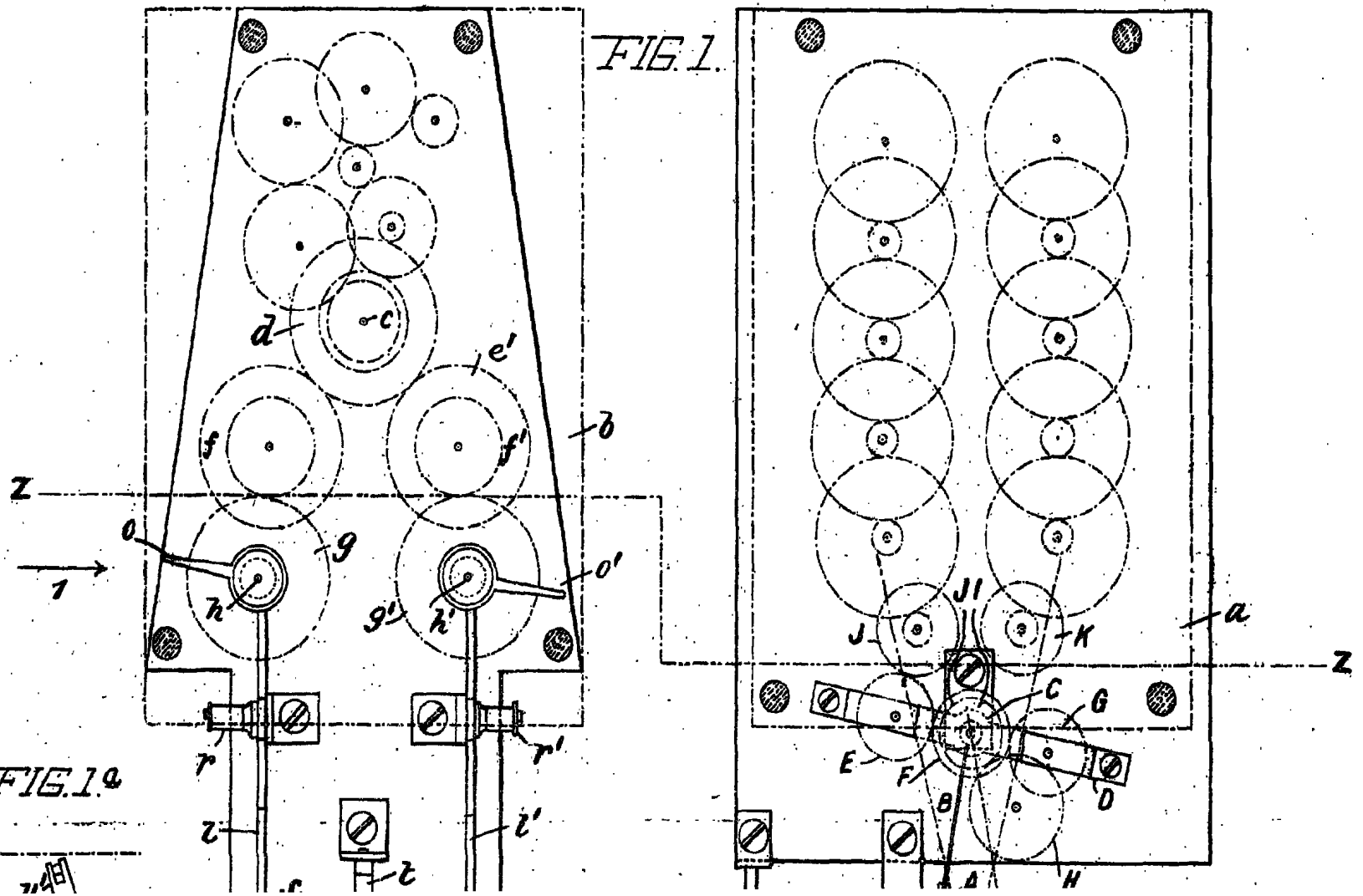

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