



# UNITED STATES PATENT OFFICE.

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## METERING ELECTRIC ENERGY.

SPECIFICATION forming part of Letters Patent No. 671,273, dated April 2, 1901.

Original application filed January 18, 1899, Serial No. 702,506. Divided and this application filed January 26, 1901. Serial No. 44,777. (No model.)

*To all whom it may concern:*

Be it known that I, WALTER C. FISH, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Metering Electric Energy, (Case No. 2,040,) of which the following is a specification.

Until very recently it has been the custom to charge consumers of electrical current or energy supplied from central stations a certain specified price, depending upon the amount of current or energy used by each particular consumer. Each consumer has been supplied usually with a recording-wattmeter acting to integrate the product of current by electromotive force from instant to instant, and the charges were proportional to the readings of this instrument. Later, however, it began to be realized that this system of charging was unfair both to the consumer and to the station. The cost of supplying electrical energy to a particular consumer depends not only on the amount of energy which he actually does take during a given month, but also on the maximum demand which he makes upon the station. To speak more accurately, the cost of supplying energy from a station is the sum of two quantities—first, the cost of being ready to supply a certain maximum load, and, second, the cost of actually supplying a certain definite load for a certain definite time. The first item contains such matters as, for example, the interest on the cost of the generators, engines, &c., and the salaries of the general officers, engineers, superintendents, &c., while the second item takes account of the increased amount of coal, oil, &c., used when a large load is carried for a definite time. It has therefore been proposed to place in circuit with each wattmeter a maximum-recording meter, which shall indicate the maximum demand made by the consumer upon the station during a specified time and to charge the consumer a certain amount for the maximum demand which he makes and a certain additional amount for the energy which he actually uses. This system is exceedingly just and satisfactory

in all cases where the maximum demand is sure to occur during the heavy-load hours; but evidently it is possible that a certain consumer may take his maximum load for a given month during the daytime, and it is unfair that in such a case he should be charged heavily, since during the day the station is usually capable of supplying a load far in excess of that which it actually carries, and, in fact, is usually glad to sell current at a reduced rate. Another solution of the difficulty has been to install meters which were adjusted to read at one rate during the full-load hours and at another rate during the low-load hours. This is satisfactory in certain special cases, but is sometimes objectionable, since it fails to take account of the fact that a consumer may use lights for only a very few hours each month, and thus pay only a very small bill, though his load when it does come is such as to cause great difficulty and annoyance to the station. An example of such a consumer would be a theater in a country town, which might be open only once a week, but which, nevertheless, would take a heavy load when the station was least able to furnish it, without running up a bill in any way large enough to compensate for this objection.

My present invention contemplates overcoming the difficulties above mentioned by integrating the load at different rates during different parts of the diurnal period corresponding to marked changes of the load-curve of the supply-station and recording the maximum load of the consumer during the periods corresponding to a definite rate.

The invention involves, besides the novel mode of measuring energy consumed just set forth, a new system for carrying it out.

The present application is restricted to the improved method of operation, the system being claimed in a separate application, Serial No. 702,506, filed January 18, 1899, of which the present application is a division.

The accompanying drawing represents a system of distribution arranged in accordance with one form which my present invention may take.



A is a source of electric current—as, for example, a generator at a central station—from which extend lines B C. Branch circuits leading to individual-consumption circuits are shown at D E and D' E'. Translating devices, such as lamps L L and motors W, are arranged, as indicated, in the consumption-circuit.

Referring particularly to the first of the stations shown, it will be seen that a recording-wattmeter F, of the usual construction, is inserted, with its field-coils in series with the mains D and its armature in multiple between the mains D and E. The usual resistance R is placed in series with the armature, and an additional resistance S, capable of being cut out by a switch G, is inserted in series with the resistance R. In series with the main D, I also insert a maximum-meter H. This instrument is indicated here only conventionally as consisting of an arm *a*, carrying a pencil *b*, moving over a scale *c*. A solenoid *d* attracts the core *e* and pulls the arm *a* downward against the action of an adjustable spring *f*. Evidently the pencil *b* will trace a line, as indicated at *g*, upon the scale *c*, whose length will indicate the maximum load taken by the consumer since the scale was renewed. Any other suitable recording instrument may be used in place of the one shown. The maximum instrument is shunted by a switch K in such a way that when the switch is closed the instrument will cease to operate.

It is obvious that by suitably manipulating the switches G and K the method above outlined may be carried out. As an illustration of one manner in which this may be accomplished, I have shown an additional wire M, extending through the system, with branches N N' at the particular consumption-circuits. Each of these branches leads through a solenoid O, which solenoid actuates an insulated rod P against the action of a spring Q. In the central station I arrange a switch T, which is capable of supplying current to the wire M, preferably through a resistance U.

The operation of the system thus described is as follows: During the hours of heavy load—for example, from five o'clock p. m. until midnight—the switch T is closed. Current thus flows from the main B through the resistance U, switch T, and wire M to the wire N, and thence through the solenoid O to the wire E and back to the station. The

solenoid thus energized closes the switch G and opens the switch K. The result is to cut out the resistance S in series with the resistance R in the armature-circuit of the recording-meter and to open the shunt around the maximum-meter. The two-rate meter now runs on the high rate and the maximum-meter becomes operative. Under such conditions the customer will naturally use as little current as possible and will avoid taking a heavy load for even a short time. As the load goes off from the station the switch T will be thrown to the position shown in the drawing. This will open-circuit the coil O, and the spring Q will close the switch K and open the switch G. The recording-meter F will now run on the low rate and the maximum-meter will be inoperative. This will encourage customers to use current freely at the time when the station is best able to furnish it.

It will be obvious that my invention is not restricted to the particular two-rate meter apparatus shown nor to the particular method of control shown, as I may use, for example, any of the arrangements now well known in the art devised by Kapp, Barstow, and Oxley.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The method of measuring current or energy taken by a consumer from a system of electrical distribution, or central station, which consists in integrating the load at two different rates during different hours of the day, and recording the maximum load during the period of high rate only.

2. The method of measuring current or energy taken by a consumer from a system of electrical distribution or central station, which consists in integrating the load at two different rates during different hours of the day, and recording the maximum load during a part only of each day.

3. The method of checking the demand of a consumer of electrical energy, which consists in recording the maximum load taken during a part only of each day, and in integrating the load during the whole day.

In witness whereof I have hereunto set my hand this 22d day of January, 1901.

WALTER C. FISH.

Witnesses:

DUGALD MCK. MCKILLOP,  
JOHN J. WALKER.