4. Repeat the test at half load and quarter load.

The current should be calculated from the indications of a Siemens dynamometer. If none is available, the wall ampere meter, which should be frequently calibrated, may be used instead.

For an "energy meter" proceed as above, adjusting the voltage carefully to normal as well as the current and use a wattmeter instead of the ampere meter. A stop watch is better for this test. If no stop watch is available, two men should make the test, one counting the revolutions, the other holding an ordinary watch. The case should be on the meter during this test to avoid the disturbing influence of air currents, the rotation of the armature being observed through a small window in the top of the case. The voltage should be quite steady.

There may be a separate master meter for every kind and size of meter if desired, but that is hardly necessary.

Meters can be adjusted by altering the angle between the primary and secondary coils in inductive meters, or by shifting the position of the retarding permanent magnets where these are used.

When it is desired to test a number of meters, examine them and see that the armatures are turning freely and the shafts resting properly in the jewel bearings; hang them upon the testing rack, connect them in series, and put the cases on, then

1. Close the circuit, adjust the voltage and turn on one 5 candle-power lamp and see if meters start. (Meters of ten amperes should start on this lamp, those of twenty amperes on one lamp of ten candle power, those of forty amperes on two similar lamps, and those of eighty amperes on two lamps of sixteen candle-power. Meters that fail to start as above should be tagged for repairs.)
2. All the meters on test being of the same size, adjust current to full load and watch the pointers on the last right hand dials; run the meters, including master meter, cutting them in and out of circuit until all the pointers are exactly over a number in the last right hand dial.
3. Open the circuit and take readings of all the meters.
4. Close the circuit, adjust current to half load and allow the meters to run several hours, after which readings may be taken and the "consumption" compared with that recorded by the master meter.

A meter testing over three per cent. slow or fast should be given a second test to confirm the first.

The advantage of a long run in series with a standard meter is, that it makes it easy to detect and measure very small percentages of error.

When a meter is brought in for any reason it should be tested before it is taken out. When it becomes necessary to test a meter after it has been installed, it is better to bring it to the meter room, putting another one in its place, as no proper test can be made on the consumer's premises. Several methods have been suggested for domestic testing, but none are quite satisfactory, besides it pleases a customer better to change his meter when he has lost faith in it.

INSTALLING.

Meters should be of as small a capacity as may be used without inviting their total destruction. It is better to take chances of an occasional burn-out, than to install meters that will run during seventy-five per cent. of their working hours on less than half load and thirty-three per cent. of the time on one-quarter load or less. Under these circumstances meters, as we know them, cannot be expected to do the supply company justice.

It is impossible to entirely eliminate friction in meters, and they stand on the order of their going as it were. They are also slow on light loads. The most effective remedy is to use small meters It is true that they are also slow on high loads, but the high loads seldom come and never stay long.

The importance of using small meters may be fully realized by reference to an experiment reported by Mr. Lyman C. Reed, where a load varying from one to ten incandescent lamps was passed through two meters in series, one of 7½ amperes capacity, the other of 100 amperes. The small meter registered thirty per cent. more than the large one.

Mr. Duncan suggests the following rule for his meter.

For	3	to	7	lights	install a	5	light meter.
	8	"	14	"	"	10	" "
	16	"	20	"	"	15	" "
	25	"	35	"	"	25	" "
	40	"	65	"	"	50	" "
	70	"	100	"	"	75	" "

No hard and fast rule can be laid down; much depends on the class of consumers to be served. In private residences, for instance, a ten light meter would do up to twenty lights, a twenty light meter up to thirty-five lights, and a forty light meter up to seventy-five lights in the majority of cases.

It has been suggested to put two meters in parallel on large installations, one large and one small meter with a mercury switch actuated by the current and intended to automatically cut out the large meter whenever the load fell below a predetermined amount. The suggestion is worthy of consideration.

Great care must be exercised in carrying meters through the streets. A light express wagon with a box partly filled with straw, wood fibre or other packing, in which the meters may be placed on their backs, is a good thing to move them in. They may be safely carried by hand, also on a bicycle, but in the latter case the rider must be careful to avoid sudden jars.

Whenever a meter is taken out for installation the reading should be taken and left on record in the meter room, in case the reading or "start" is not taken at the consumer's premises.

Meters should not be installed on shaky partitions or those containing doors liable to slam, or on walls subject to vibrations. They should be in a dry place, easy of access and open to daylight or otherwise lighted, and, if possible, they should be protected from extremes of temperature. Meters should not be placed on or too near the floor, nor too high. You cannot expect your meter reader to stand on his head or to carry a step-ladder. In such cases he will attempt to get the reading at a distance and probably get it down wrong.

A little missionary work among electric wiremen and contractors will lead, in time, to the practice of arranging a place for the meters in accordance with the above recommendations.

Before connecting the meter it is well to try lamps here and there about the place, leaving meter loop open, to make sure that there are no branches taken off outside of the meter.

Meters should be levelled and rigidly fastened to the wall. After installing the meter, one or more lamps should be turned on to ascertain that the meter starts readily. For this purpose meter cases should have a window through which the movements of armature or shaft can be seen.

No openings should be left between the cover and the back of the meters where insects may go in. They seem to find comfortable quarters there, and spiders weave their webs around the moving parts, retarding and sometimes stopping the meter. This is more likely to happen where houses are vacated during the summer holidays. The writer has used a stick of pine wood about four inches long, one-quarter inch wide and one eighth inch thick between the cover and back casing of Schallenberger meters, at the top, with good success. It has been suggested to squirt soft putty with a syringe, so as to practically seal the cover to the back, but this is seldom necessary. It is a commendable thing, however, as it excludes dust as well as insects.

The connecting wires should be pulled through the binding posts until no bare copper is accessible from outside the meter case. The cover over the binding posts should be sealed with a lead seal bearing the mark of the meter department. It should be the duty of employees installing meters to see that there are no bare places or cut-outs on the mains between the meter and the service switch and main cut out, and to see that the latter is supplied with copper tipped fuses of the right size properly put in.

READING.

Meters should be read monthly if practicable, as "short accounts make good friends," but the large amount of clerical work involved in this practice often makes it preferable to have only quarterly readings. However, this makes very heavy bills in winter, which is objectionable. A good plan is to divide the six summer months, May to October, inclusively, in two periods of three months each, and the six winter months in three periods of two months each. The shorter winter periods will make the difference in the bills less pronounced and facilitate the collection of accounts. This compromise is confidently recommended as one that works well and gives satisfaction to consumers.

The dates of the readings should appear on the bills, as they will show the number of days covered by the amount and frequently explain apparent overcharges.

Reading meters correctly is not as easy as it looks. Men should be trained in the work and not changed unnecessarily. An unreliable meter reader is dear at any price. Errors in reading are mostly due to the fact that each dial is read by itself. Experience teaches that when a pointer is near a number, it is necessary to consult the next lower dial to determine whether the first pointer is short of or past the number. That is because the pointers are sometimes blunt, improperly set, or have a little side play. A plan which has been very successful in preventing errors, is to furnish the reader with books printed with fac-similes of the dials of a meter. The reader does not read in the ordinary sense, he merely copies in his book the position of each pointer, which is represented by a pencil stroke. The reading is done in the office.

A great saving of time may be made by using numbers to designate customers. Thus the meter reader would enter a reading taken at "A. G. Richardson, 319 Waverley street west as "958, Richardson." The number is the page of Mr. Richardson's account in the ledger, and the addition of the surname makes identification of the reading more certain.

The clerk entering the readings in the meter ledger should make each day a list of all readings which appear quite wrong from his knowledge of customers and their previous record in the ledger. This list would then be sent to the meter department with instructions to re-read the meters. Many errors will be corrected in this way before the bills are sent out, and meters that stop will be detected.

Consumers sometimes complain that their bills are too high, and some have been known to express the opinion that the meters ran too fast, but the writer once encountered a consumer who said his meter was too slow; that was in Ottawa.

When complaints are made, it is a good practice to get an extract from the complainant's account showing the total net cost of the light for a year. This will often be a pleasant surprise to him, as he has likely figured it out in his mind by taking his highest bill and multiplying it by the number of readings in the year, forgetting the summer bills.

The period complained of should be compared with the corresponding period of the preceding year, if possible, and the preceding period should be investigated to see if meter was not underread. In any case, offer to re-read the meter. If the first reading is confirmed and the bill really seems wrong, it is better to change and test the meter.

When a customer makes general statements as to the small quantity of light he has used, you should get him down to details. Figure out with him the probable use of each lamp or group of lamps separately. Hold him down to facts. When you come to