T. C. HOPPER.

Dry Gas-Meters.

No. 149,041. Patented March 31, 1874.

Fig. 1.

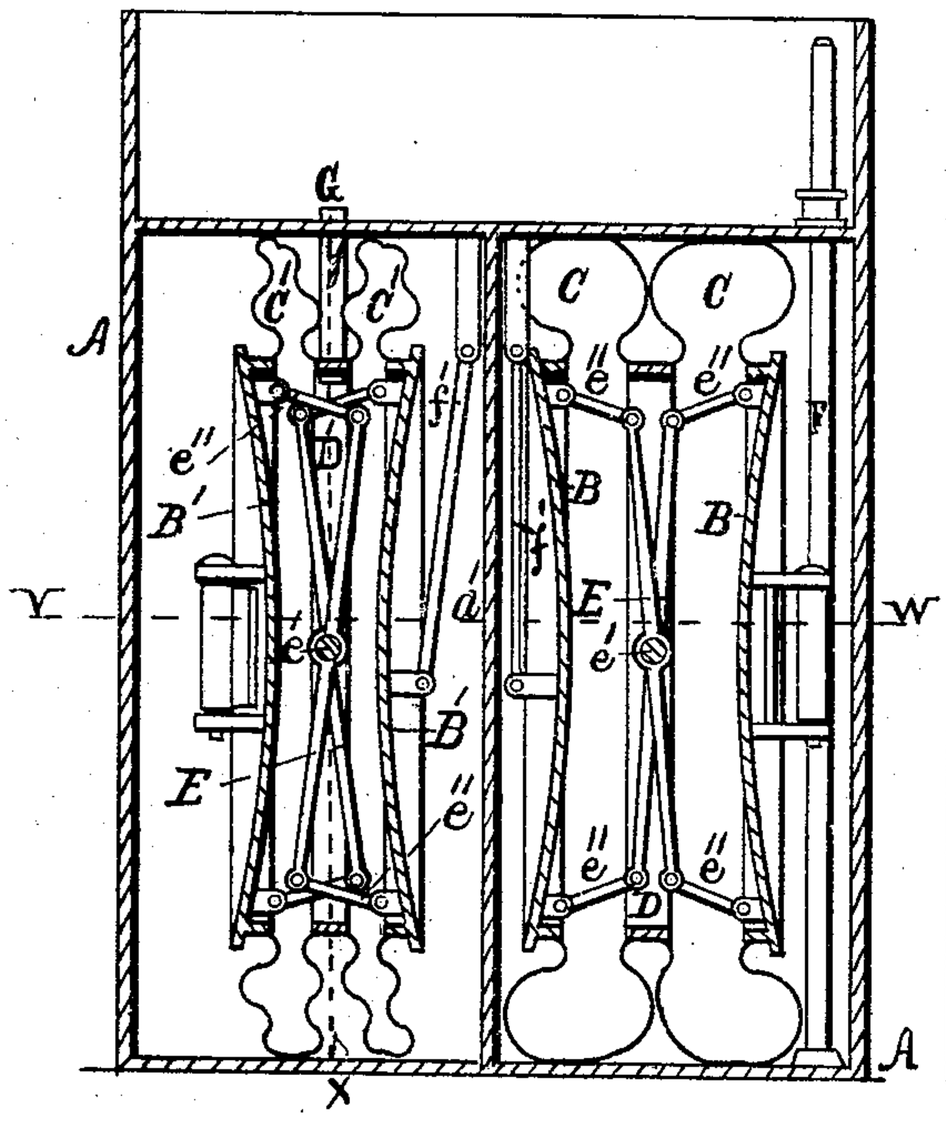
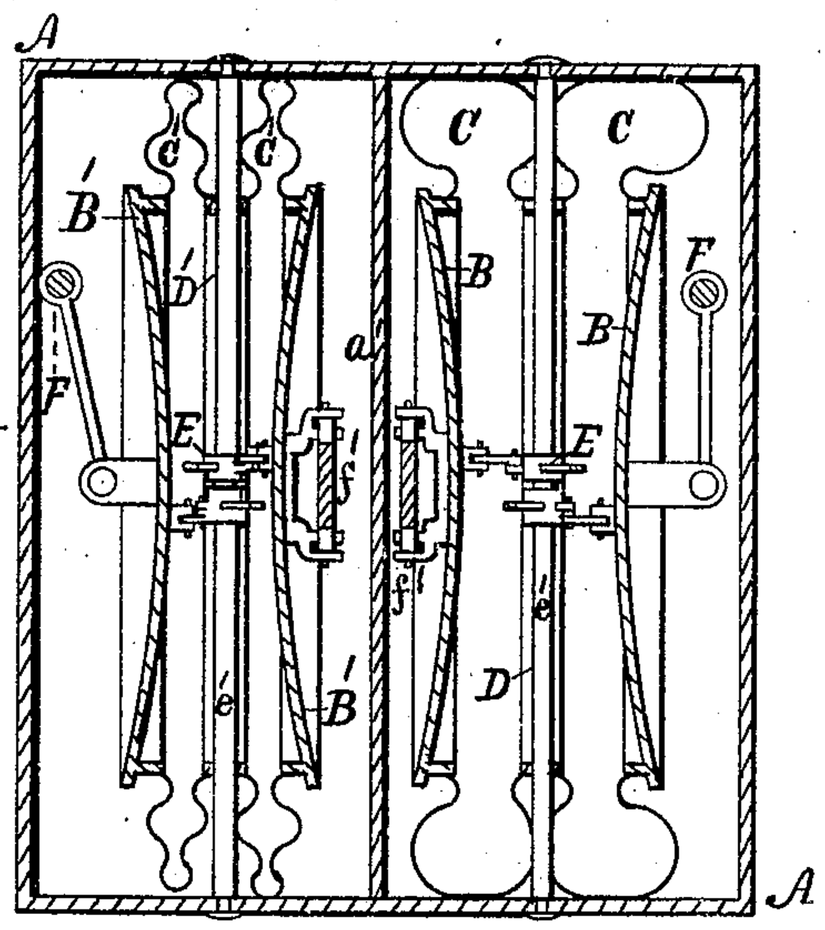


Fig. 2.



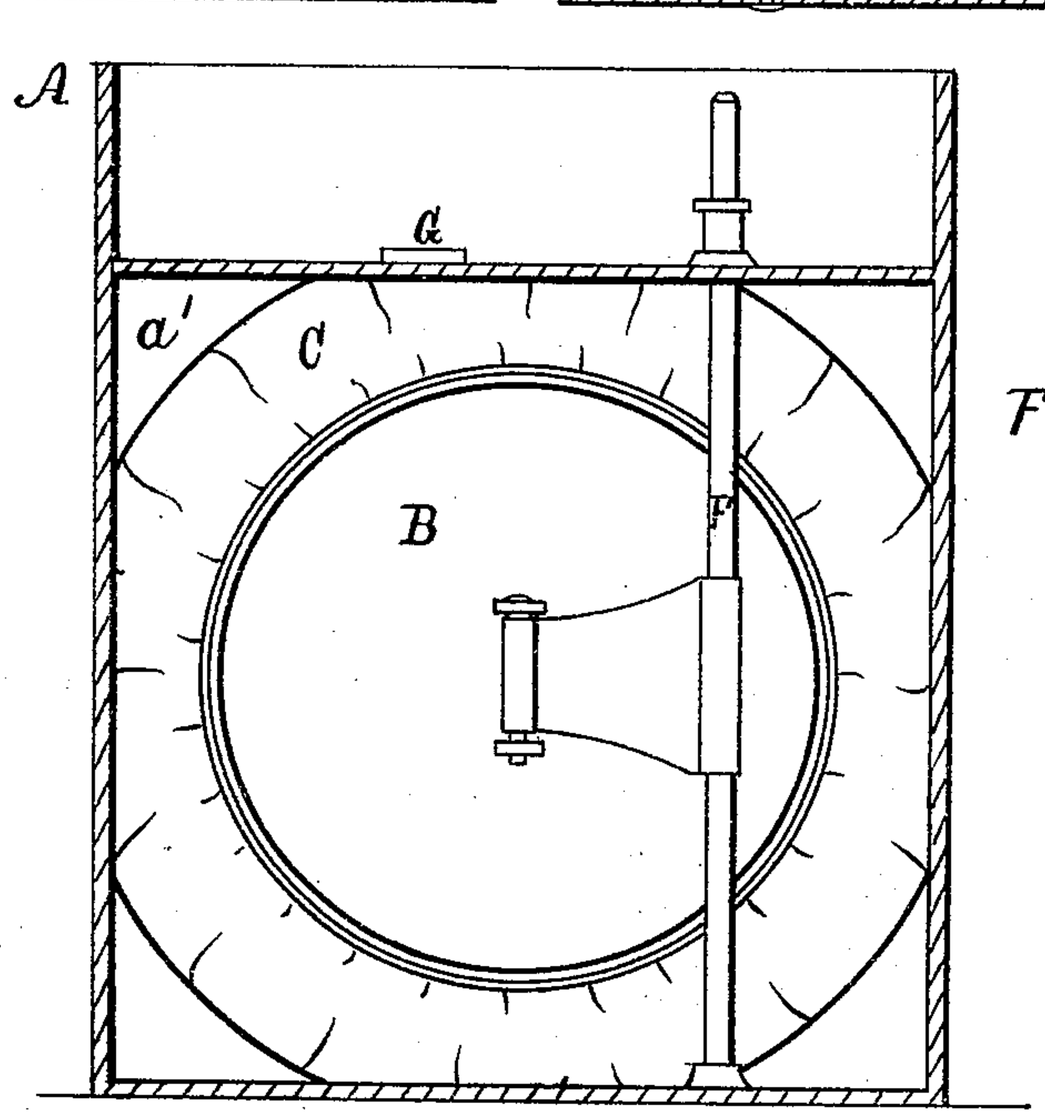


Fig. 3.

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UNITED STATES PATENT OFFICE.

THOMAS C. HOPPER, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN DRY GAS-METERS.

Specification forming part of Letters Patent No. **149,041**, dated March 31, 1874; application filed February 11, 1874.

To all whom it may concern:

Be it known that I, THOMAS C. HOPPER, of the city of Philadelphia, in the State of Pennsylvania, have invented an Improvement in Dry Gas-Meters, of which the following is a specification:

The object of my invention is to increase the working capacity of any of the class of dry gas-meters to nearly double that heretofore afforded, and this increase (of working capacity) at comparatively trifling cost in material; and these advantages I produce by the arrangement and combination of a plurality of moving disks (instead of one, as heretofore,) for each bellows, as will be hereinafter set forth and described.

As my invention relates more especially to the dry gas-meter patented in England, in the year 1844, by Croll and Richards, and known to the trade in this country as the "Glover meter," my improvement will be more readily understood and appreciated by a brief reference, in the first place, to certain peculiarities in the construction and operation of the bellows in said meter. It consists of a sheet-metal case, the lower portion of which is divided into two like compartments by a vertical partition, and secured in each of these two like compartments is a bellows, consisting of one moving disk or diaphragm of tin-plate, provided with a ring which projects inward from its perimeter, and to which ring one side edge of a flexible leather band is secured, and the opposite side edge of said leather band, secured in like manner to another like sheet-metal ring, which is permanently soldered fast to the partition, which, as before stated, divides the bellows portion of the meter into two compartments. These two compartments have not any communication with each other, and each has its own flag-staff connecting its moving disk with its special valve arranged in a separate apartment above the two compartments for the bellows, each valve communicating, by two ports and channels, with its respective bellows-compartment. The moving disk of each bellows is supported upon its respective flag-staff, so as to move inward and outward alternately, from the pressure of the gas, and thus give motion to the flag-staff and its connecting-valve. The two valves are operated by the movements of the respective disks of the two bellows, connected therewith through the mediums of the flag-staffs and their horizontal arms, connected together and to the moving part of each valve, so that, as the gas passes through one port of the valve into its respective bellows, the gas outside of the bellows passes out through another port of the same valve, and vice versa.

The dry gas-meter just described will be found fully described and shown in "Samuel Clegg's practical treatise on the manufacture and distribution of coal-gas," fourth edition, London, England, 1866, page 333; and also in Hugh's work on the same subject, third edition, revised by Richards, C.E., London, 1866, page 231.

It will be seen that, as the disk can move only through a prescribed space, limited in its inward motion by the projecting ring on the partition, there is nessarily left a useless space equal in depth to the width of said ring, and, consequently the working capacity of the bellows is confined to the shallow space left between said ring and the flag-staff.

I will now proceed to describe my invention with reference to the accompanying drawings, in which—

Figure 1 is a vertical central section at right angles to the partition which divides the case into the two compartments for the respective bellows. Fig. 2 is a horizontal section of Fig. 1, below the dotted line *v w* of the latter figure. Fig. 3 is a front elevation of the outer disk and leather band attached together, of one of the bellows of the meter, in connection with its flag-staff.

A A is that portion of the case which is divided into two equal incommunicating compartments, for the two bellows, by the partition *a'*. B B and B′ B′ are two moving disks of the two respective bellows. C C and C′ C′ are the respective leather bands which connect together the two respective disks of each bellows, and an intermediate ring, D or D′. E is a pair of equal-armed levers, which vibrate on a cross-bar, *e'*, as their common fulcrum, the said bar passing diametrically across the ring D or D′, and through it horizontally into the opposite sides of the case,

where it is permanently fixed. e'' e'' are four connecting rods or bars, which are articulated, respectively, to the four ends of the pair of levers E, and to the disks (B and B′) of each bellows—the one end of each lever being connected to one disk, and the other end to the opposite disk of its respective bellows, so as to maintain a vertical parallelism of the two moving disks as the gas passes through the meter—the outer disk of each bellows being supported, as heretofore, upon its flag-staff, F, and the inner one being supported by a swinging bar, f', attached by a joint to the partition a', or to the top of the case, so that it may swing freely and support the disks.

As there are two moving disks (B B or B′ B′) in each of the two compartments of the meter, the depth of each of said compartments is necessarily made about one-fifth greater than the depth of the Glover meter of the same size, and this slight increase in the depth is all the increase required in the comparative size of the case, because, by dispensing with the ring which is attached to the partition a' in the Glover meter, I utilize the space which the width of said ring rendered useless, and thus, with the additional space obtained, by adding about one-fifth to the depth of the compartment for each bellows, as before stated, I obtain ample space for the backward and forward movement of both of the moving disks B B or B′ B′ of my improved meter; or, in other words, I obtain double the working capacity obtainable by the Glover meter of nearly the same size of case.

The port G is one of two channels through which the gas enters and passes out alternately to and from the interiors, respectively, of each of the two bellows, extends from its valve down through the top of the case and through the middle ring D of the respective bellows, and thus operates between the two moving disks of the same, while the gas outside of the two moving disks of the respective bellows passes out through another channel and port of the valve, and vice versa, during the operation of the meter.

It will therefore be evident that, by said invention, the Glover meter is increased in working capacity to nearly double its former ability, at comparatively a very small increase in size, and in the cost of construction and material used, because at each pulsation or vibration of each or either of my double-disk bellows a definite quantity of gas will pass through the meter, exactly in proportion to the areas of the two moving disks B B or B′ B′, the leather bands C C or C′ C′, in part, and the distance traveled or length of the stroke.

The two disks of either bellows being closed together, as shown by B′ B′ in Figs. 1 and 2, the action of the gas upon them will be as follows, viz: The gas, passing inward through the port G, acts on the inner sides of the two disks B′ B′ and causes each to move outward from its former position about three-fourths of an inch, and this motion is communicated, through the flag-staff, arms, &c., to the valve, thus opening the opposite port of the valve, and, through a respective channel, admitting gas to the outer sides of the two disks B B, and causing them to move toward each other or back to their former positions, which was precisely like that represented by B′ B′; or, in other words, the gas passing through one port of a valve is caused to act on two disks, so as to cause them to move at one and the same time, and thus give double the extent of the motion that is effected by the bellows in the Glover meter, and consequently pass double the amount of gas at each pulsation or vibration of the bellows. By the addition of an extra valve or channel to each any desirable number of such double-disk bellows may be used in one compartment, thus securing the largest amount of work from a given space, and also economy in material used. Probably the most economical form of meter case for such increase of work would be the hexagonal; but, by preference, I intend using the rectangular form of the Glover meter.

As a modification of my double-disk bellows when applied to very large meters, in which greater strength is of course required, I contemplate a division of each bellows into two equal apartments by a partition which will divide the whole space surrounded by the middle ring D and the space within the channel-port G, so that the gas will be divided into two equal portions in entering the bellows and again united before entering the outlet-port of the valve. (See dotted line x y in Fig. 1.) A hole may be made through the said partition x y to allow an open communication between the two apartments thus produced by the said dividing partition, if desirable. By thus dividing each bellows into two compartments the levers E E must be removed from the inside of the bellows, and the required parallelism of the disks maintained by any of the well-known devices used for the same purpose, applied on the outside of the same; as, for instance, a supplementary flag-staff connected to the inner disk and coupled to the primary flag-staff by respective arms connected by articulation with a coupling-bar.

I claim as my invention—

1. In a dry gas-meter, the combination of two moving disks, B B or B′ B′, in each of the bellows, either with or without the dividing partition x y, substantially as and for the purpose set forth and described.

2. In a dry gas-meter, the fixed or stationary ring D between the two moving disks B B or B′ B′, in combination with the open channel or port G of the respective bellows through which the gas passes alternately into and out of the latter, substantially as and for the purpose hereinbefore set forth and described.

3. In a dry gas-meter, the combination of a

bellows having two moving disks, B B or B′ B′, in each compartment, divided by a partition, *a′*, as set forth, with a single channel or port for the outside of the bellows and a single channel or port for the inside of the same, substantially as hereinbefore set forth.

4. In a dry gas-meter, the combination of a plurality of bellows having two moving disks, B B or B′ B′, operating in respective apartments, substantially as described.

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Witnesses:

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