(No Model.) 3 Sheets—Sheet 1.

G. I. ALDEN.

ABSORPTION DYNAMOMETER OR BRAKE.

No. 464,949. Patented Dec. 15, 1891.

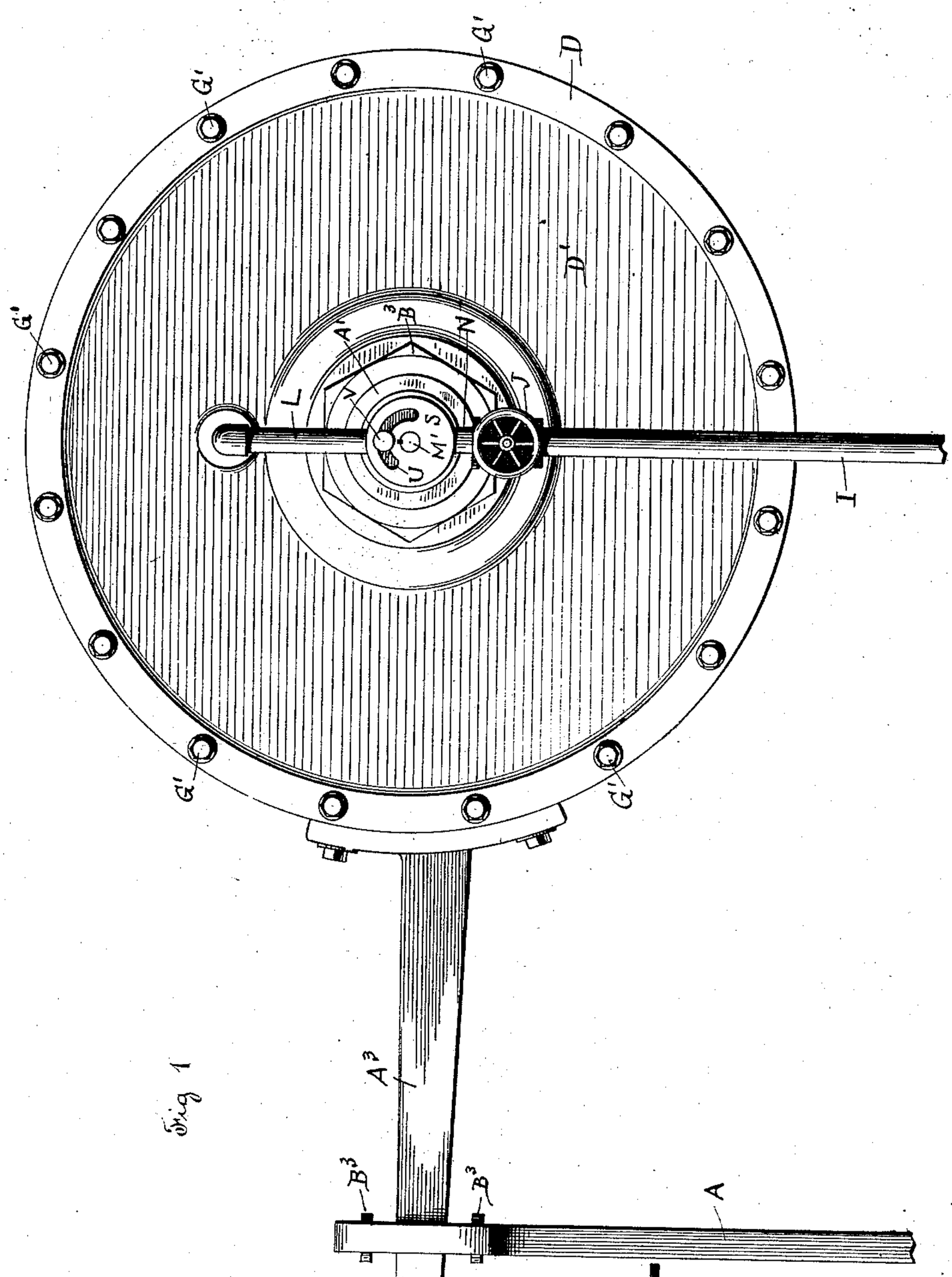

Fig 1

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(No Model.) 3 Sheets—Sheet 2.

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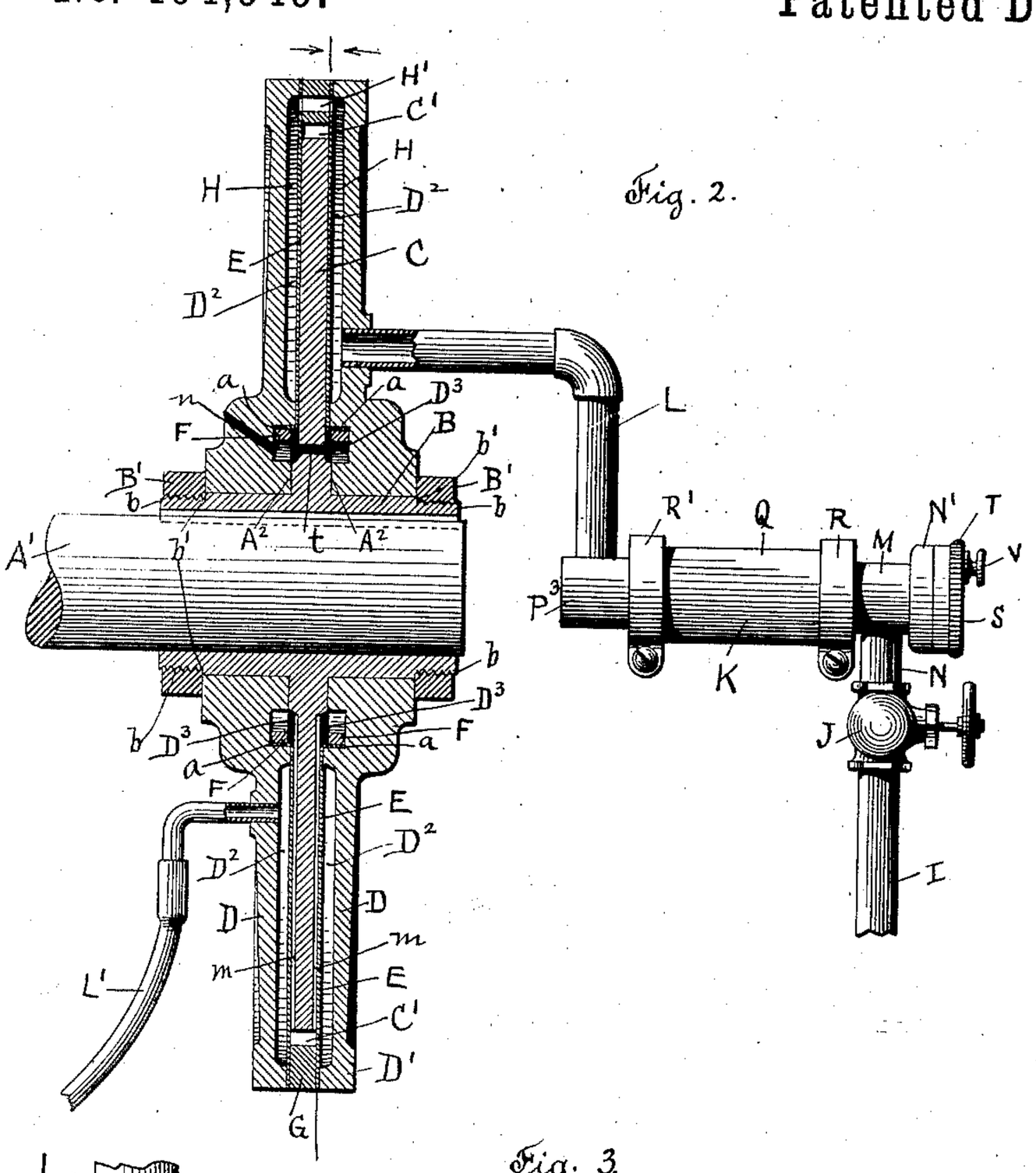

Fig. 2.

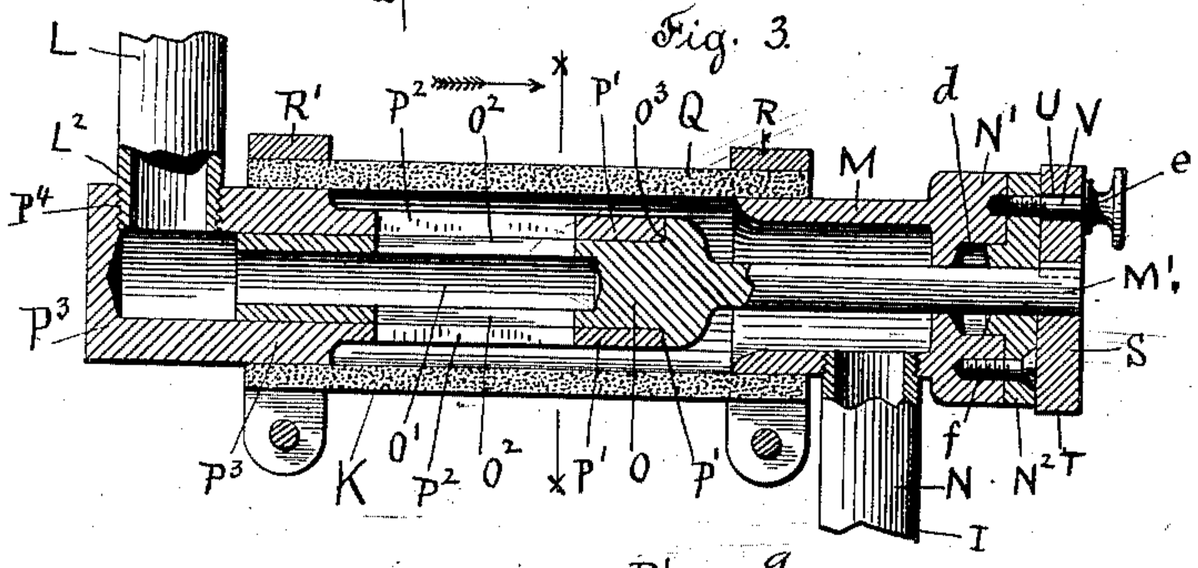

Fig. 3.

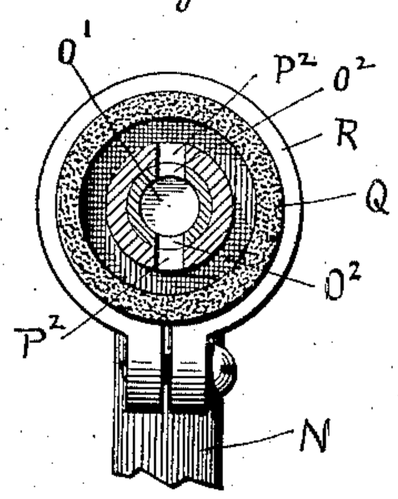

Fig. 4.

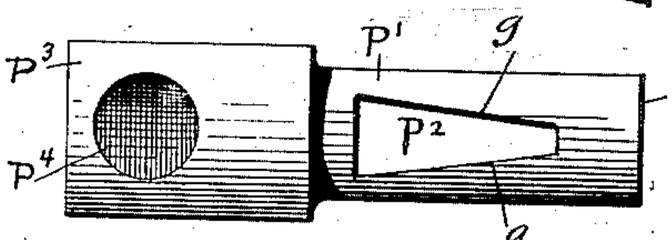

Fig. 5.

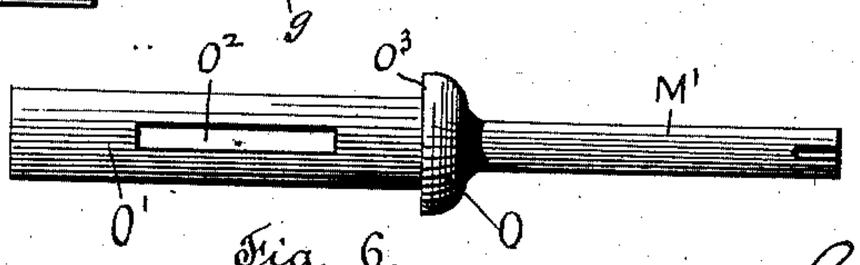

Fig. 6.

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(No Model.) 3 Sheets—Sheet 3.

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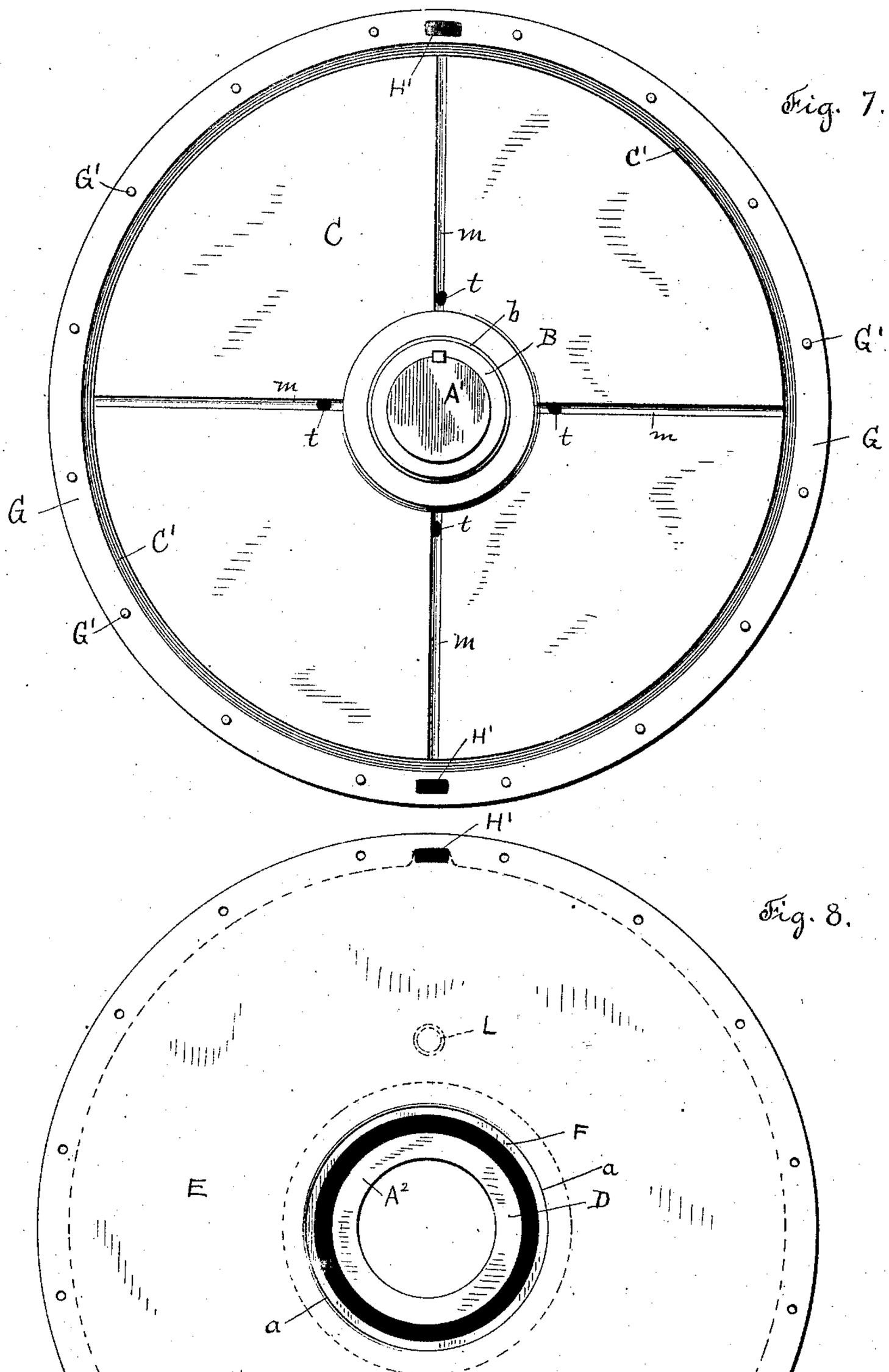

Fig. 7.

Fig. 8.

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UNITED STATES PATENT OFFICE.

GEORGE I. ALDEN, OF WORCESTER, MASSACHUSETTS.

ABSORPTION DYNAMOMETER OR BRAKE.

SPECIFICATION forming part of Letters Patent No. 464,949, dated December 15, 1891.

Application filed June 19, 1891. Serial No. 396,868. (No model.)

To all whom it may concern:

Be it known that I, GEORGE I. ALDEN, of the city and county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Dynamometer or Brake; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings and the letters marked thereon, forming a part of this specification, and in which—

Figure 1 represents a side view of the machine complete. Fig. 2 represents a longitudinal vertical central section of some of the parts shown in Fig. 1. Fig. 3 represents upon an enlarged scale a longitudinal vertical central section of the automatic regulating-valve. Fig. 4 represents a cross-section on line *x x*, Fig. 3, looking in the direction indicated by the arrow. Fig. 5 represents upon a like enlarged scale a top view of a part of the regulating-valve detached. Fig. 6 represents upon the same scale a top view of another part of the automatic regulating-valve. Fig. 7 represents a side view of the revolving disk, end view of the shaft, and side view of outer ring, one of the side pieces and its copper disk being removed; and Fig. 8 represents an inside view of one of the copper disks or plates after it has been attached at its center to its side piece, as will be hereinafter described, a portion of the lower parts being shown broken away.

To enable those skilled in the art to which my invention belongs to make and use my said improvements in dynamometers or brakes, I will proceed to describe the invention more in detail.

My invention relates to that class of dynamometers or brakes known as "absorption dynamometers" or "absorption brakes." The function of such a dynamometer or brake is to transform energy into heat, usually by means of friction, the heat thus developed being absorbed and carried off by a stream or current of water. When used as a dynamometer, the machine measures the energy or power which it transforms into heat. When the dynamometer is used to produce a load for or to measure the power developed by an engine or other motor, it is important that the dynamometer have great steadiness and also an automatic regulation. To produce the above results in a high state of perfection has been my aim in the production of the present invention, and I believe that I have at last overcome the serious objections to all previous similar inventions while obtaining the desired results by simple and inexpensive means, using, as I do, the pressure of the cooling-fluid to produce the pressure or friction required.

Those skilled in the art will readily understand and appreciate the invention from the following description.

In Fig. 1 a side view of the dynamometer complete is shown, the lower end of the guide-standard A and lower end of the inlet water-pipe I being shown broken off.

Fig. 2 shows a cross-section of the main portion of the machine, and in which A′ is the revolving shaft through which the power to be measured or the energy to be absorbed is transmitted to the dynamometer.

B is a hub or sleeve which carries a disk C, and this disk and hub B are shown in this instance in one piece, but they may be made in separate pieces and the disk keyed or otherwise securely fastened to the sleeve. The sleeve B is keyed to shaft A′, and consequently shaft A′, sleeve B, and disk C revolve together. The sides or faces of disk C are both finished smooth. An outer case D′ is made of two pieces D D, cast from iron or other metal, from considerations of cheapness and greater convenience of construction; but they can be turned or constructed from wrought metal, if preferred, in any case. They are formed in disk shape and have their inner sides chambered out, as seen at D^2 D^2, and they are also provided with circular grooves D^3 D^3, which receive their respective copper flanges *a a* turned or spun out from the center parts of the copper disks or plates E, which are as large as the pieces D D, between which they are arranged, as fully indicated in Fig. 2 of the drawings, and held in such positions by rings F F, which are driven into their respective grooves D^3 D^3 after the copper flanges *a a* have been inserted in said grooves; and after the inner flanged edges of the copper pieces or disks E E have been thus securely fastened to their respective pieces D D the latter are arranged upon hub

B, one piece D with its copper disk on each side of the disk C, when nuts B′ B′ are screwed on the threaded ends *b b* of hub B and up against shoulders *b′ b′* on hub B, whereby the inner parts A^2 A^2 of the pieces D D will be retained in position, as shown in Fig. 2, but not so close to the base of disk C as to interfere with its free revolution, while the parts D D remain stationary. A ring G is arranged between the outer edges of the copper disks E E, and bolts G′ are passed through holes in both pieces D, copper disks E, and ring G, and with suitable nuts on their ends. All of said parts through which bolts G′ pass are rigidly and securely fastened together by water-tight joints. (See Fig. 1.) The ring G is of the same thickness as disk C. By this construction and arrangement of parts a water-tight chamber or compartment H is formed between the inside of each side piece D and its copper disk or plate E, and between which chambers are communicating passage-ways H′ H′ for the water.

A water-pipe I, connected with the city main or other proper source of water-supply, is provided with cock J, whereby water can be let on and shut off from the automatic regulating-valve K at pleasure, and the water, after it passes through the automatic regulating-valve K, passes up through pipe L, connected with one of the pieces D, and into the first chamber H, and thence through the water-passage ways H′ H′ into the second water-chamber H, and thence out on the opposite side through the outlet-pipe L′, connected with the left-hand piece D, as fully indicated in Fig. 2.

The construction of the automatic valve K is as follows: The hollow piece M receives the upper end N of the water-pipe I, and has its outer enlarged end N′ recessed, as shown at *d*, to receive a packing for the stem M′ of the stationary part O of the automatic valve K. The inner portion O′ of the part O is hollow, open at its end, and is provided with a rectangular slot or opening O^2 on two opposite sides. It is also provided with a shoulder O^3, which fits against the end P of the movable part P′ of the valve K. The front part, which is hollow or in shell form, is provided with two trapezoidal slots P^2 on opposite sides, as indicated in the drawings. The part P′ is closed on its inner end P^3 and is provided on its upper side with an opening P^4, which is screw-threaded to receive the screw-threaded end L^2 of the inlet water-pipe L, as indicated in Figs. 2 and 3 of the drawings. Of course the inlet and outlet water-passages may be formed in different parts of the case D′, when found desirable.

The parts M and P′ are united by a rubber or other flexible hose Q, hose Q being secured at one end to the part M by a hose-clamp R, and at its other end to the end P^3 by a hose-clamp R′. Any other equivalent mode of connecting the parts may be adopted.

S is a disk having a milled periphery T, and which disk is keyed to the stem M′ of the part O, and has also a curved slot U, through which a thumb set-screw V, having a shoulder *e*, passes, its threaded part screwing into the stuffing-box piece N^2, all as fully indicated in Figs. 1, 2, and 3 of the drawings. Stuffing-box piece N^2 is held in place by screws *f*, one being shown in Fig. 3.

From the above description it will be seen that the piece O and its stem M′ can be turned independently of the piece P′ and its slots O^2 set in any relative position to the slots P^2 in part P′ desired, and securely set or fixed in such adjusted position by turning up the thumb-screw V, thereby enabling the operator to increase or decrease the water-passage at pleasure. This enables the dynamometer or brake to be used for testing a wide range of force or power, as occasion may require. The parts being adjusted so that slots O^2 will stand centrally as respects slots P^2, a passage for the water will be had as large as slots O^2, and as the flexible hose or tube Q permits pipe L and part P′ to turn or move slightly around while the part O and its stem M′ remain stationary, the water-passage O^2 will be closed in proportion to the extent one of the angular sides *g* of slot P^2 is moved over the slot O^2, and the operator can readily adjust the part O by means of the disk U^2 and thumb-screw V, so that the slots O^2 in the part O will be partially closed by being turned under the angular sides *g* of slot P^2, and thereafter, as the part P′ is turned by the turning of pipe L with the rotary movement of the pieces D D the water-passage will be opened or closed still more, depending upon the direction in which the parts D D are moved.

Disk C is provided with grooves *m m m m*, and more or less may be used on each side, and these grooves *m* extend from the base of disk C to its periphery, and consequently oil turned into the hole *n* in the hub of left-hand piece D, as shown in Fig. 2, will run down into groove D^3 on that side of disk C, and from thence pass out along the grooves *m* to the space C′ between the periphery of disk C and the inner surface of ring G, and as there is an oil-hole *t*, one or more may be used, from groove D^3 through disk C to the groove D^3 on the opposite side, the oil passes into grooves *m m m m* on the opposite side of disk, and consequently both sides of disk C and the friction sides of the copper disks or plates E E are all kept well oiled and lubricated. If preferred, an oil-hole *n* may be used on each side, although I have found one to answer well.

To one edge of the case D′, formed from the side pieces D, is fastened a scale beam or arm A^3, the outer end of which passes through a slot in the upper end of the standard A and can move up and down between the stops B^3 B^3, and it is also provided on its outer end

with a proper weight-support S′ S², made in the form shown, or in any other convenient and well-known form. In this case the weights used are placed in the pan T′, and various weights may be used to weight the scale-beam down, as desired.

The metallic parts of valve K are preferably made of brass and the disks E of copper; but any other suitable metal may be used in lieu thereof. The metal disks should be at least slightly flexible, so that the pressure of the fluid in chambers H H will press them against disk C.

The operation is as follows: Shaft A′ being set in motion and revolving in the direction indicated by arrow 2, Fig. 1, the water-supply-pipe valve J is opened to admit a proper supply of water to regulating-valve K, and through that to the water-chambers H H, and the pressure of the water upon the flexible plates or disks E E causes them to press upon their respective sides of disk C, which revolves with shaft A′, thereby causing friction between the sides of the disk C and the flexible metal plates E E in proportion to the pressure of the water in chambers H H, and this pressure is to be sufficient to raise scale-arm A³, with its weight-supports S′ S² and the desired weights thereon, and which will be done when the friction between the flexible metallic disks or plates E E and disk C is sufficient to turn case D′, to which the scale-arm A³ is rigidly attached. As case D′ commences to turn, water-pipe L is turned, and, that being connected to the piece P′, is also turned, and which motion of said last-named part results in the partial closing of the water-passage O², until the water-pressure has been so reduced in chambers H H as to cause the rotary forward motion of case D′ to cease, and as the water is allowed to escape through the outlet-pipe L′ as it becomes heated a fresh supply of cooling-water is always passing through valve K into the pipe L and from that into chambers H H to absorb, take up, and carry off the heat generated by the friction between the flexible metallic disks or plates E E and the disk C, and the construction and arrangement of the parts, as hereinbefore described, are such that valve K can be so set or adjusted as to admit just sufficient water to cause the desired pressure to make the necessary friction and to absorb and carry off the heat developed by the friction, and when so adjusted the scale-arm A³ will remain between the stops B³ B³, as indicated in Fig. 1 of the drawings. The rubbing-surfaces of disks E E and C being in a bath of oil all the time and being kept at nearly a uniform temperature by the constant flow of water through the dynamometer, the friction is very steady and the automatic regulation very perfect.

It will be understood that the invention is capable of a wide application, since the heated water after passing out of the machine may be utilized for heating and other purposes, and when the brake is used to communicate power solely with only an instant of time, in which the friction is a "slipping one," the invention can be used in lieu of a friction-clutch, provision being made for the necessary pressure of fluid, gas, or air upon the flexible disks E E to press them against the sides of disk C. By having an elevated pipe connected with the chambers H H at their upper ends the water as it is heated will rise, and by having a return-pipe connected with the lower ends of said chambers the water after giving off its heat will return by gravitation and enter said chambers to take up heat again, and thus a constant circulation of the same water will be obtained.

The desired pressure on the fluid in chambers H H may be from the use of a fall or head, air, gas, or steam in the well-known ways of using such agents to produce any desired pressure, circumstances governing in each particular case, valves being combined with the inlet and outlet pipes I and L by which to regulate the flow of the liquid or material employed to produce the friction by pressure on the disks E E.

If found desirable in any case, a duplication of disks C and E E and cases D′ may be employed in combination with a single shaft A′.

The practical advantages and utility of my said invention have been tested and approved by some of the most eminent scientific institutions in the United States.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with case D′, of revolving disk C and friction disks or plates E E, substantially as and for the purposes set forth.

2. The combination, with revolving disk C and friction plates or disks E E, of a current of liquid to produce the desired friction and absorb the heat.

3. The combination, with case D′, provided with chambers H H, disk C, and flexible disks or plates E E, of the automatic regulating-valve K, substantially as and for the purposes set forth.

4. The combination, with case D′ and inlet-pipe L, rigidly attached thereto, of the outer valve-piece P′ and inner valve-piece O, constructed and arranged for joint operation, substantially as and for the purposes described.

5. The combination, with the hollow stationary part M, movable part P′ of regulating-valve K, of the flexible connection Q, substantially as and for the purposes set forth.

6. The combination, with the movable valve part P′, provided with trapezoidal slots P², of the stationary valve part O, provided with stem part M′, shoulder O³, and rectangular slots O², substantially as and for the purposes set forth.

7. The combination, with stem M′, of the stationary valve part O, the disk S, provided with curved slot U, and set thumb-screw V, substantially as and for the purposes set forth.

8. The combination, with chambered side pieces D D, ring G, and flexible metallic disks or plates E E, of disk C, and inlet and outlet liquid-passages, substantially as and for the purposes set forth.

9. The combination, with disk C, provided with grooves *m* and disks or flexible plates E E, of oil-passages *n* and *t*, substantially as and for the purposes set forth.

GEORGE I. ALDEN.

Witnesses:
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