

W. W. BROGA.
MUFFLER.

APPLICATION FILED APR. 25, 1904. RENEWED JAN. 9, 1906.

2 SHEETS—SHEET 1.

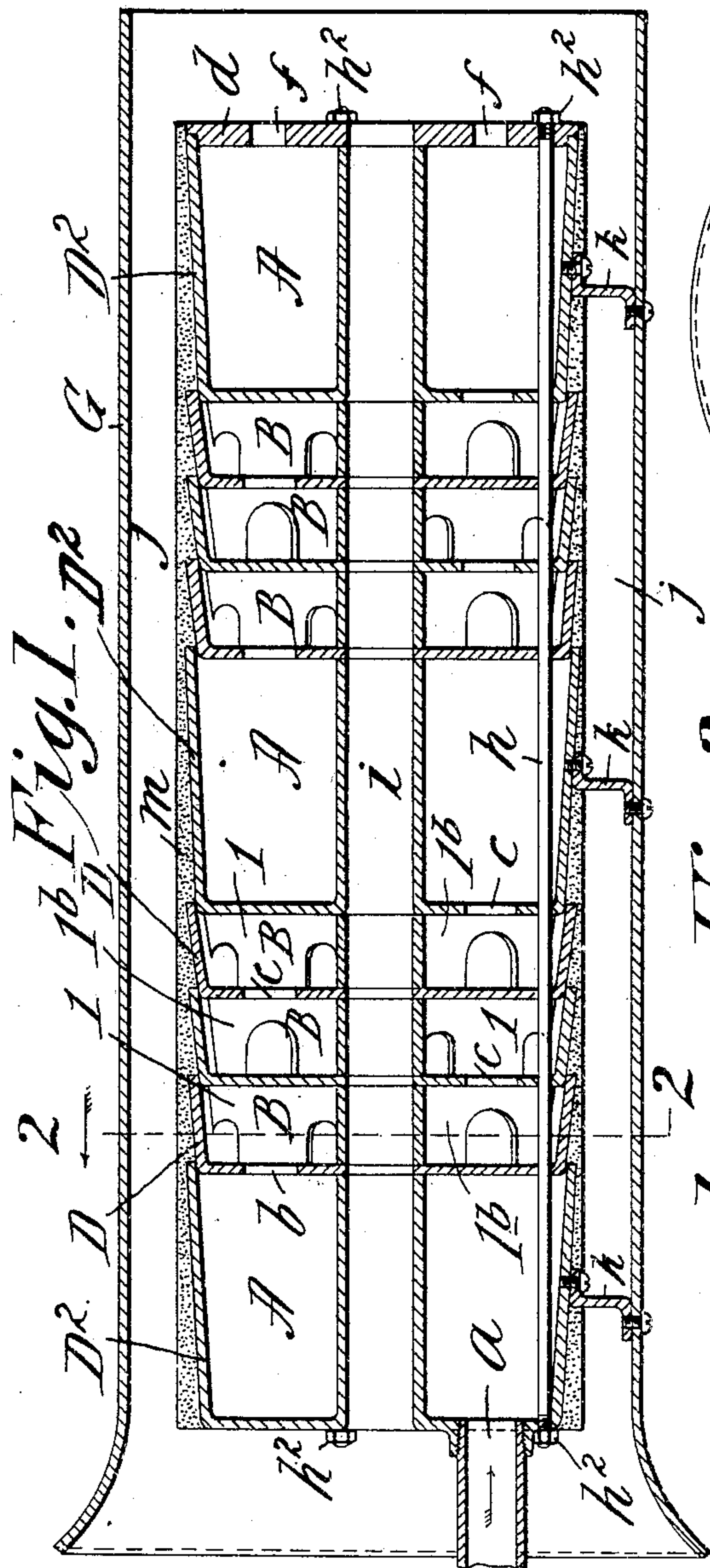


Fig. 2.

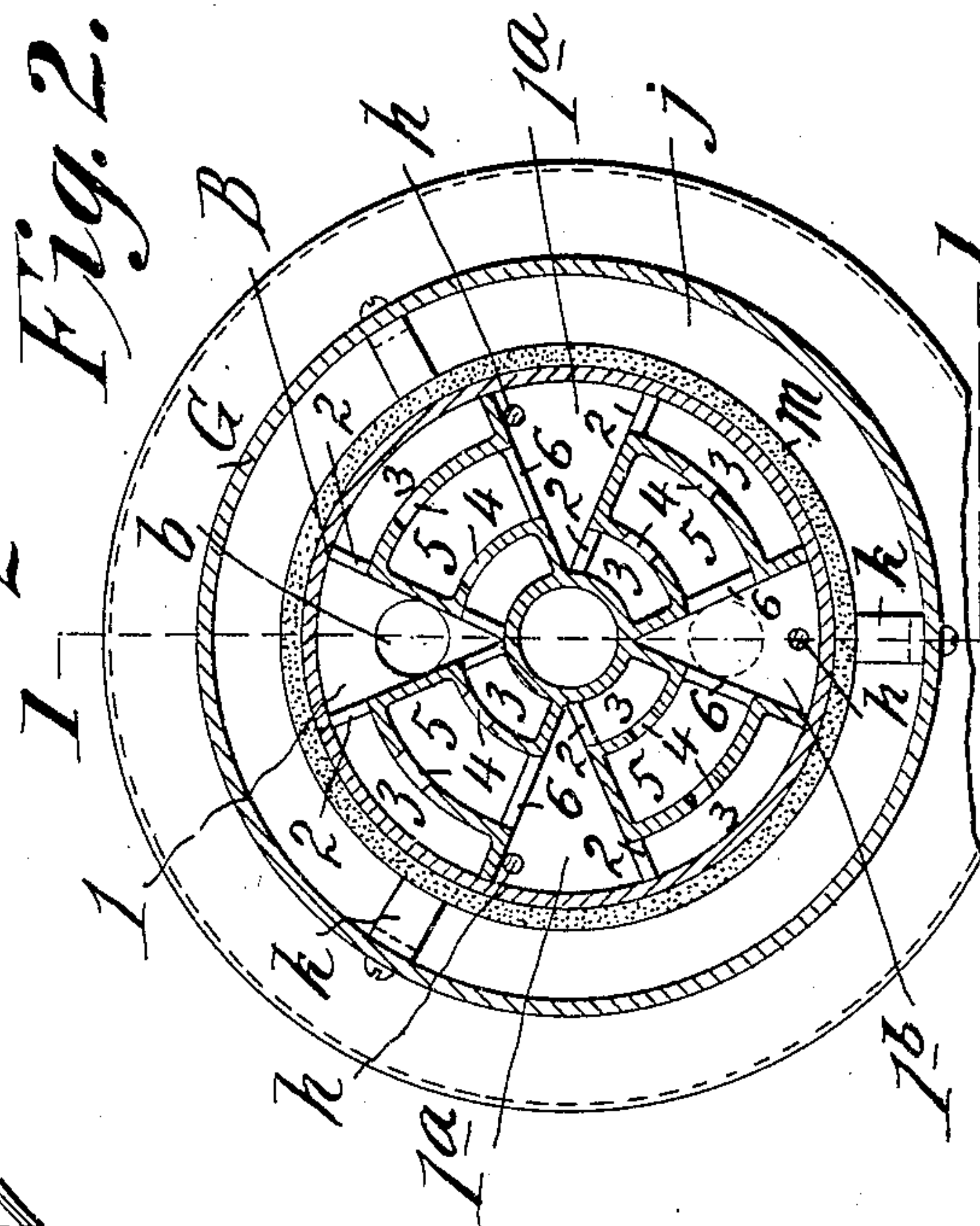
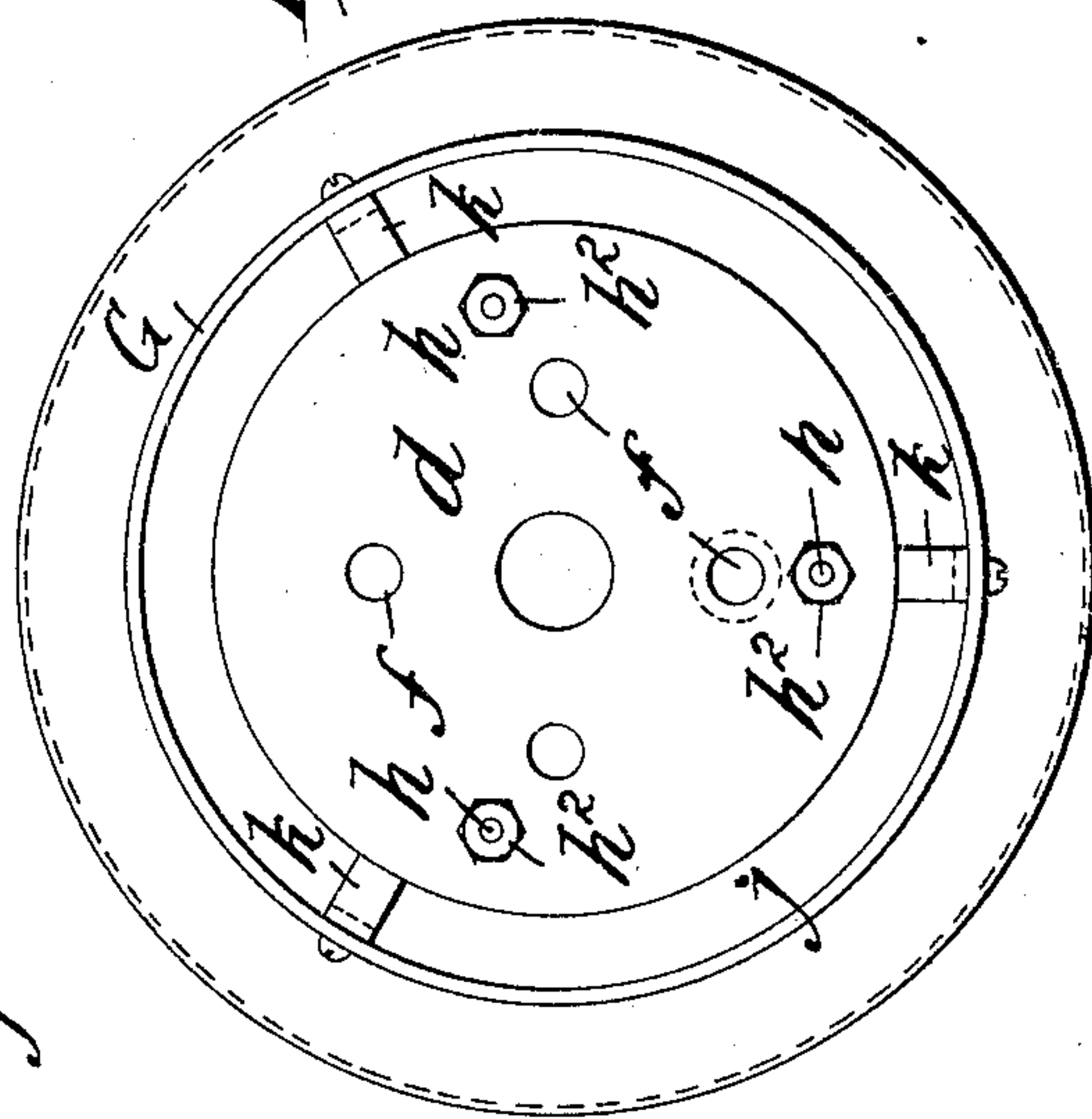


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 5.

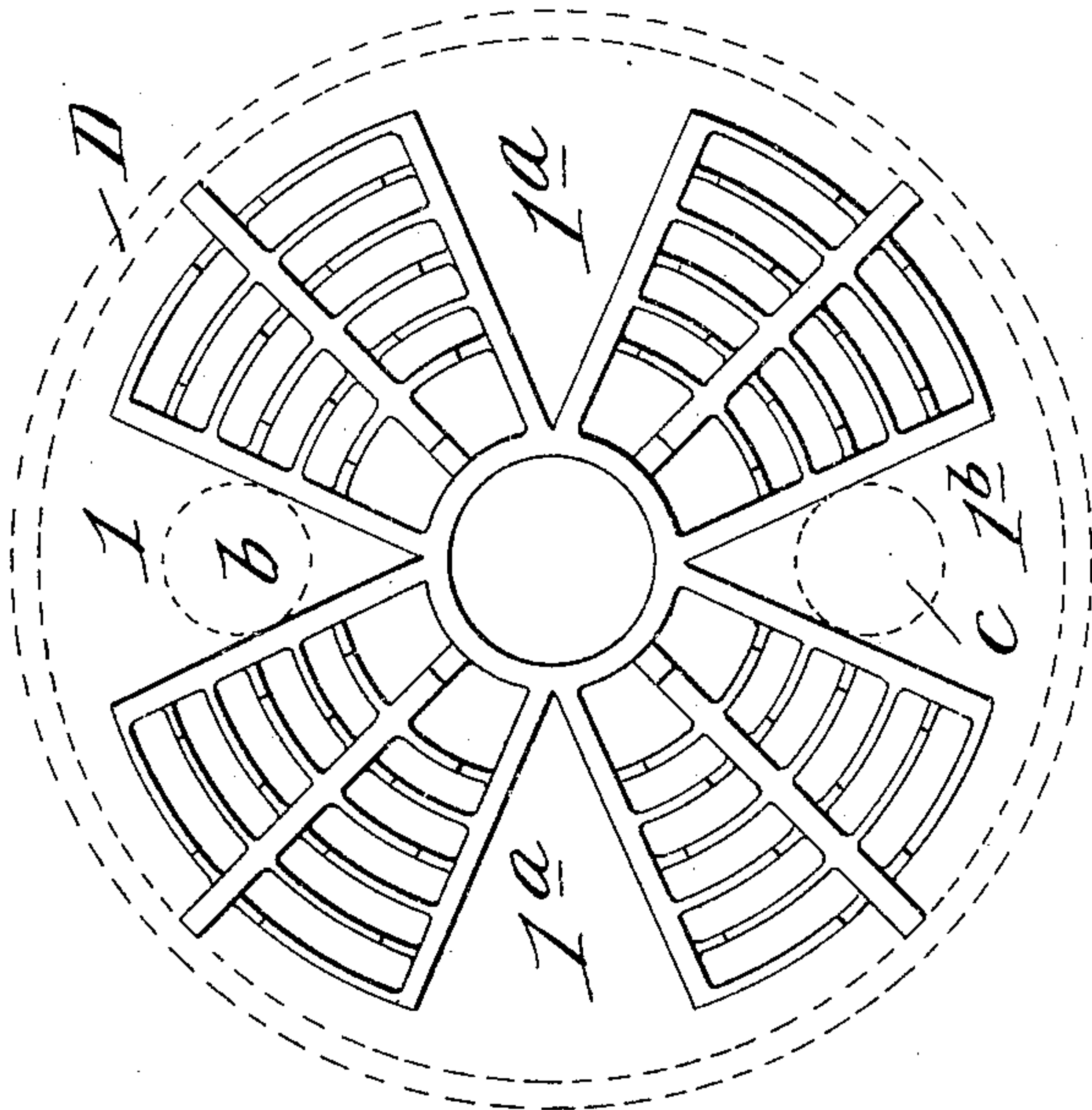
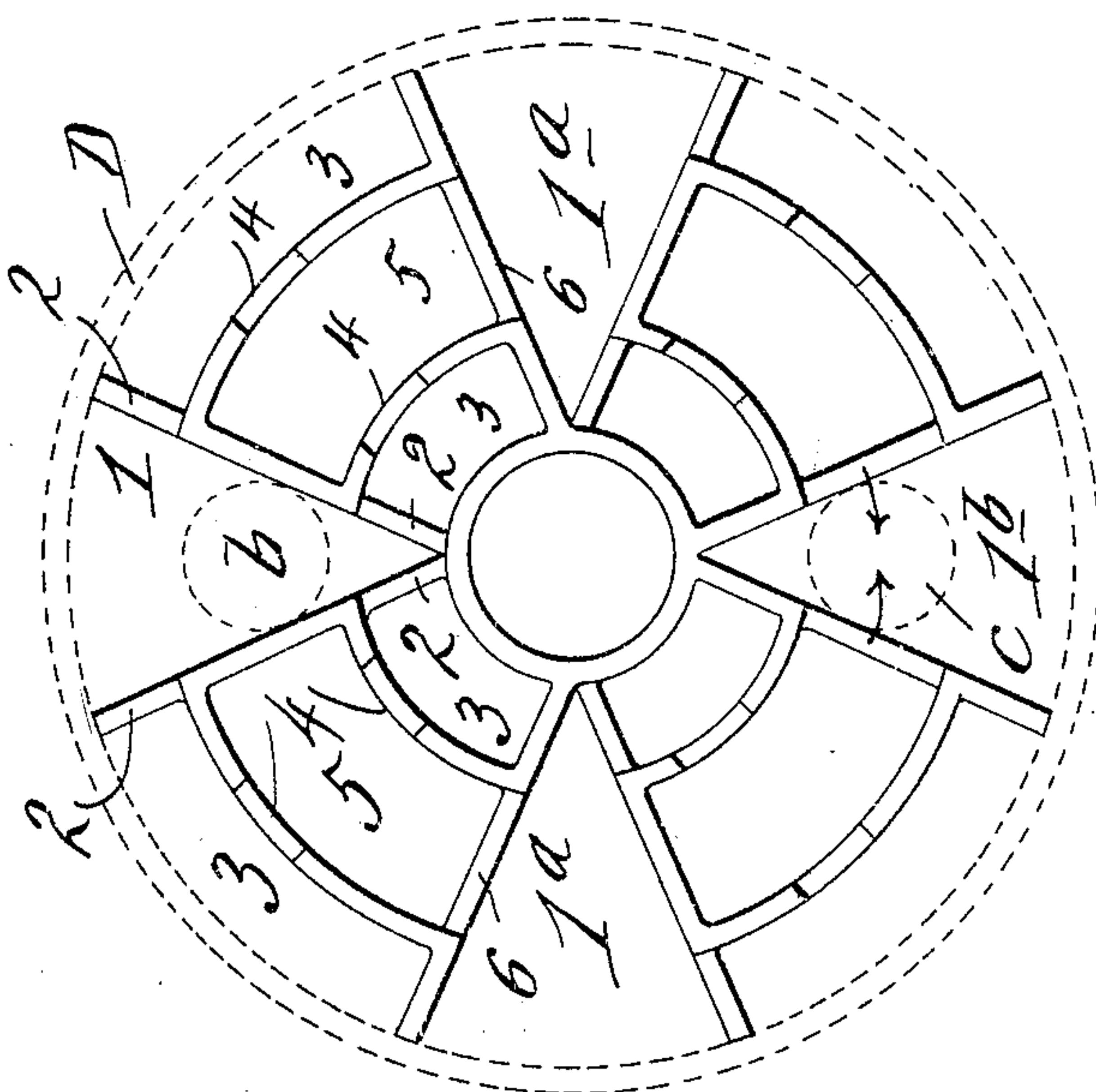


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MUFFLER.

SPECIFICATION forming part of Letters Patent No. 788,242, dated April 25, 1905.

Application filed April 25, 1904. Renewed January 9, 1905. Serial No. 240,191.

To all whom it may concern:

Be it known that I, WILLIAM W. BROGA, a citizen of the United States of America, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Mufflers, of which the following is a full, clear, and exact description.

This invention relates to improvements in mufflers especially adapted for employment in conjunction with explosion-engines, although also available for use in conjunction with the exhaust-conduit of other engines or motors.

The object of the invention is to produce a muffler having such internal construction that the current or discharge blast is compelled to pursue a peculiarly devious or tortuous course through the muffling apparatus and also such that the current is divided so that portions thereof follow diverse courses, coming together again to be again divided and diversely directed, this action being repeated within the muffler a sufficient number of times to entirely deaden and prevent any sound, a result incidental to the construction and operation being that an entirely efficient muffler is produced which is of comparatively small size and is consequently not cumbrous. Another highly-desirable accomplishment is found in the entire absence of pressure in a backward direction from the muffler on the engine, and a further object is to construct a muffler so that it is composed of a plurality of cheaply and easily assembled sections and which may be separated one from another for the purpose of cleaning out the muffler or reducing the length thereof in cases where by reason of the conditions of use a comparatively long muffler is not required.

A leading characteristic in the present improved muffler is found in the inclusion therein of a circular casing having one or more chambers or passages therein, devious and having a course about the axis of the casing and having endwise-located inlet and outlet ports.

A further characteristic is found in the inclusion in the muffler of passages devious about the axis of the casing and having endwise-located inlet and outlet ports alternated

with other chambers having the series therein unobstructed and endwise in connection with the aforesaid devious passages.

A further novel peculiarity consists in a muffler having annular casings internally of cellular form with oppositely-located inlet and outlet ports and having internally-located ports connecting the cell-chambers one with another, and, further, new peculiarities and advantageous results consequent thereupon will be pointed out in connection with the description hereinafter given in connection with the accompanying drawings.

In the drawings, Figure 1 is a central longitudinal sectional view through the muffler. Fig. 2 is a cross-section as taken on the line 2 2, Fig. 1. Fig. 3 is a view at the discharge end of the muffler. Fig. 4 is a face view of one of the cast sections, of which in the muffler there are a series. Fig. 5 is a face view of a cast section somewhat different in specific design from the one shown in Fig. 4, but susceptible of carrying out the object thereof.

Similar characters of reference indicate corresponding parts in all of the views.

In the drawings the muffler as a whole is shown as including circular chambers A A and preferably annular, alternated with series of chambered casings B B, having passages there-through which are devious or tortuous in a direction around the axis of the muffler, the chamber at the initial end of the muffler having an inlet-opening *a* for the blast or exhaust current, and the initial chamber A has a port *b*, which leads into one of the chambers B, each chamber B having a port *c*, which is the outlet thereto and also the inlet to the next succeeding chamber. The annular space within each chamber A is entirely free and unobstructed, while the chambered casings B are formed cellular with a chamber 1, into which the inlet-port pertaining to such chambered casing leads, and, as seen in Fig. 2, oppositely-located pairs of ports 2 2 lead into a pair of cells or small chambers 3 3, which by ports 4 4 connect with chambers 5 5, which by ports 6 6 connect with chambers 1^a, similar to the chamber 1, and diametrically opposite from the chamber 1 and in the same plane right-angular to the axis of the casing is a chamber 1^b

of similar shape and dimension to the chamber 1 and also to the chambers 1^a 1^a, and between the latter chambers 1^a 1^a and the chamber 1^b is a second series of small cells or chambers 3 3 and 5, for which communicating ports 2 2 and 4 4 and ports 6 6 are provided in similar arrangement as carried out in respect of the series of cells and connecting openings hereinabove just described, and from the chamber 1^b the exhaust-port *c* opens into the chamber 1 of the next casing, section B having the similar interconnecting cellular formation. In the present illustration series of three of the said chambered casings B being arranged next to and in communication with each other and between the endwise oppositely-located chambers A, the annular spaces in which are unobstructed, and the muffler, as shown in Fig. 1, includes three of the annular unobstructed chambers A A A and two relatively intermediate series of three each of the cellular casings B, the tortuous passages therethrough extending around and in courses following planes which are at right angles to the axis of the muffler, and the final chamber A has through the end wall *d* thereof discharge-apertures *f f*. The numbers and succession of the unobstructed and cellular chambers may be varied in the production of a muffler of any required size or capacity.

As an expedient or convenient and economical make-up of the muffler of the internal construction having the characteristics hereinbefore set forth the cellular parts may be constituted by an open-work spider-like cast-iron frame, as represented in Fig. 4, the several thereof being arranged axially coincident and assembled in conjunction with sheet or cast metal cups D, the annular flanged portions of the latter being slightly flaring, so that one may be nested into the other, while the plane circular or annular portions of these flanged or cup-like sections, against which the edges of the spider-like castings are abutted to constitute the end walls of the cellular chambers, and the large annular and unobstructed chambers are constituted by deep annular cup-shaped castings or sheet-metal fittings D², with which the other sections are nested, all as clearly shown in the drawings, the whole series being adjustably confined by the longitudinal tie-rods *h h*, having confining-nuts *h²* at the opposite end heads of the muffler. By making the parts annular, as shown, the central longitudinal passage *i* is formed from end to end through the muffler, and the muffler has an outer cylindrical shell G of greater diameter than the chamber-sections A and B, so as to provide a surrounding annular space *j*, also extending from end to end of the muffler, such outer cylindrical shell being supported from the inner structure by the bracket-lugs *k*.

Now considering the utilization and action of the muffler the exhaust-current enters the

comparatively large and unobstructed annular chambers A with considerable force and passes through the port *b* into the cell or chamber 1, which in Fig. 2 is of V form, and it becomes divided in its passages through the opposite pairs of ports 2 2 and through the various cells, the currents entering in opposition to each other the chamber 1^b, (after having passed the repeated series of cells 3 3 and 5 and the intermediate cells 1^a 1^a), and the divided currents having the noise-producing potentiality thereof diminished in their courses as aforesaid, and, furthermore, by striking each other again preparatory to passing through the port *c* into the next succession of annularly-arranged cells become further dissipated, the diminution of the capability of the currents to make noise continuing until the current softly enters a further one of the expanding chambers A, the force for the passage therefrom into the series of interconnecting cells next therebeyond being reduced to a minimum, and by making the muffler of a capacity proportionate to the violence of the blast or exhaust current from the engine it becomes possible not only to render the exhausting without noise, with no impact or reverberation, but also with little or no force of exit at the final discharge-ports *f f* of the muffler.

The cylindrical muffler may have a covering of asbestos, as represented at *m* in Figs. 1 and 2, which serves both as a noise-deadener and also as a non-conductor of heat.

Fig. 5 represents a modified form of the casting or open-work spider-frame having partitions or cell-forming walls to insure the tortuous course of the current through the chambered section comprising such spider for the effect assured by the form described in detail in conjunction with Fig. 4, the purpose of this view being to indicate that the invention is not limited to the employment of the chambered casing of a particular design.

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

1. A muffler comprising an annular casing having a plurality of transverse partitions dividing the casing into a plurality of annular chambers having positions variously along the length of the muffler, one or more of such chambers having the opening or passage therein devious around, and with a course generally perpendicular to, the axis of the casing, with communicating openings or ports leading into the primary divisional chamber, and endwise from the one to the next-succeeding chamber, and with an outlet-opening.

2. A muffler consisting of a casing having a plurality of annular chambers, one endwise beyond the other, each having the passage therein, devious about, and with a course substantially perpendicular to, the axis of the casing, and having endwise-located and longi-

itudinally-directed inlet and outlet openings, the outlet of one chamber constituting the inlet for the chamber next endwise therebeyond.

3. A muffler comprising a plurality of annular transversely partitioned and separated chambers, certain thereof having the passages or openings therein devious around and having a course substantially perpendicular to the axis of the muffler, and certain of said chambers having the areas therein non-devi-
ous and unobstructed, each chamber having an opening leading in a longitudinal direction into the succeeding chamber, and the first and last chambers, in the endwise-extended series thereof, having respectively inlet and discharge apertures.

4. A muffler comprising annular chambers, one endwise beyond another and having the openings therein devious around, and with a course generally perpendicular to, the axis of the muffler, and having endwise-located inlet and outlet openings, alternated with other and relatively intermediate chambers having the spaces therein unobstructed and of greater area than that of each of the first-named chambers, and in endwise communication therewith.

5. A muffler comprising a series of annular axially-alined casings having the chambers or passages therein devious about the axis of the casings, and having endwise-located inlet and outlet openings leading from one to another of the chambers, said series of such chambers being endwise in connection with annular expansion-chambers, and a cylindrical shell surrounding the alined chambers, with an intermediate annular cooling-chamber.

6. A muffler comprising a series of annular axially-alined casings having the chambers or passages therein devious about the axis of the casings, and having endwise-located inlet and outlet openings leading from one to another of the chambers, and annular expansion-chambers with which the first-named chambers are endwise in connection, the central axial space within the several chambers being open from end to end, and a cylindrical shell surrounding the alined chambers, of greater diameter than such chambers, and open at both ends thereof.

7. In a muffler, a circular casing having in the end thereof an inlet-opening, and oppositely - extending passages leading partially around within the casing, and having ports or openings arranged in opposition, and an outlet-passage leading from the space in the casing between said oppositely-arranged ports.

8. A muffler comprising a circular casing having in the end thereof an inlet-opening,

and oppositely - extending passages leading partially around within the casing and having ports or openings arranged in opposition, and an outlet-passage endwise leading from the casing, adjacent said opposite ports, and a chamber to which said endwise-located outlet leads having the space therein unobstructed throughout the entire area thereof, and provided, also, with an outlet-opening.

9. In a muffler, a series of annular casings each being internally of cellular form, with opposite endwise - located inlet and outlet ports, and having internally-located ports connecting the cell-chambers one with another.

10. A muffler comprising one or more communicating annular casings, each being of annular cellular form, with an endwise-located inlet-port, a space to which such port leads, and series of cells, arranged at opposite sides of the said space, having ports or openings leading one to the next, a compartment opposite the inlet-connected space, at which the tortuous passages through the opposite cell-chambers are approached, and an outlet-opening leading from the said compartment.

11. A muffler comprising a casing having therein a succession of intercommunicating chambers, certain thereof having the space or passage therearound and therewithin devious or tortuous, and along planes substantially perpendicular to the axis of the device, and relatively intermediate ones having the spaces therein unobstructed and non-devi-
ous and of increased area, said chambers having locations variously of the lengths of the muffler and partitioned by walls transverse of the length of the muffler.

12. A muffler comprising a series of annular axially - alined casings having the chambers or passages therein devious about the axis of the casings, and having endwise-located inlet and outlet openings leading from one to another of the chambers, and annular expansion - chambers with which the first-named chambers are endwise in connection, the central axial space within the several chambers being open from end to end, the series of axially-alined casings having covering of asbestos or like heat-non-conducting material, and a cylindrical shell surrounding the alined chambers, of greater diameter than such chambers, and open at both ends thereof.

Signed by me at Springfield, Massachusetts, in presence of two subscribing witnesses.

WILLIAM W. BROGA.

Witnesses:

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A. V. LEAHY.