

No. 619,221.

Patented Feb. 7, 1899.

W. E. & E. F. PRALL.
PISTON IMPACT ENGINE.

(Application filed July 27, 1898.)

(No Model.)

3 Sheets—Sheet I.

Fig. 1.

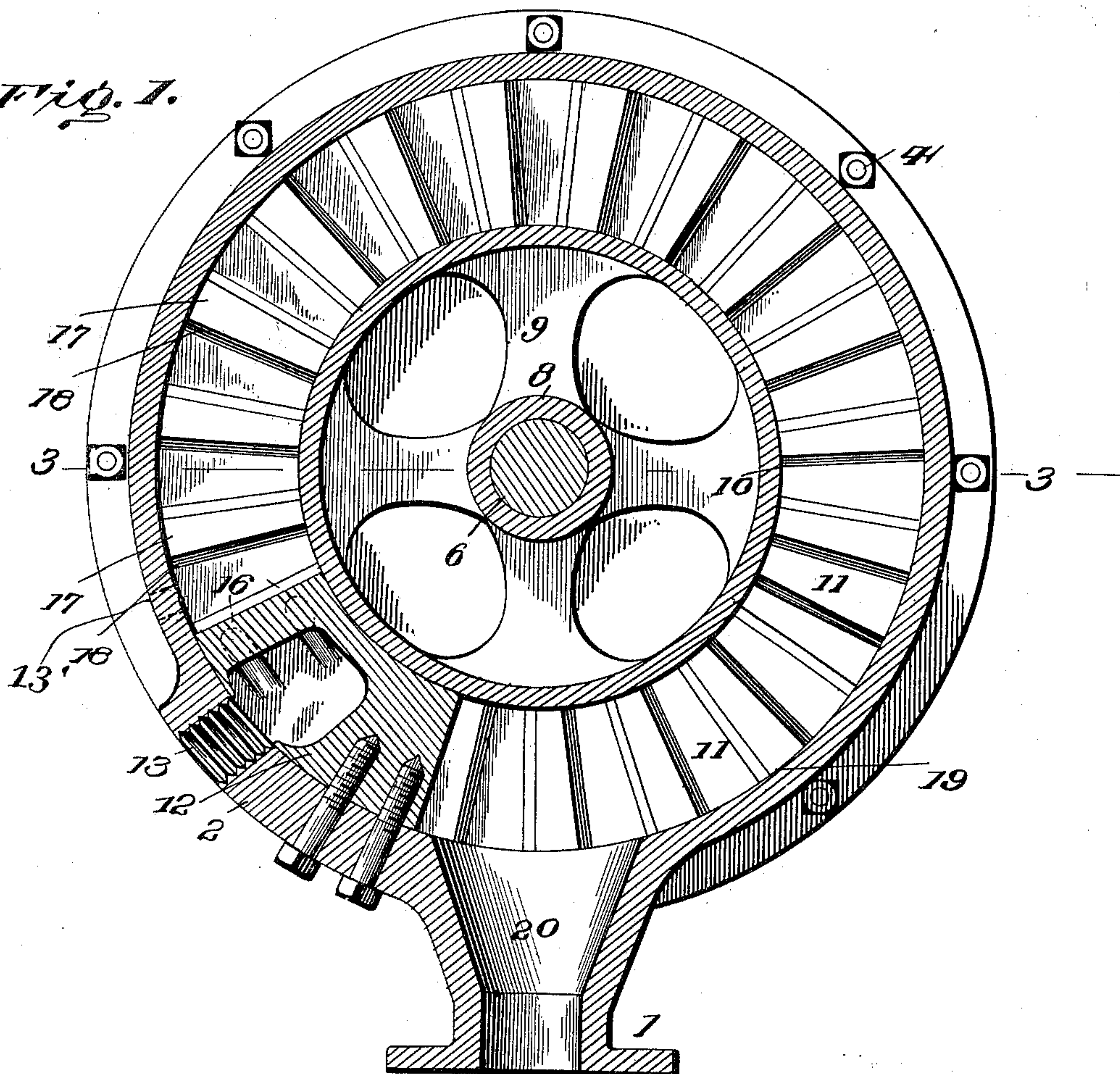


Fig. 2.

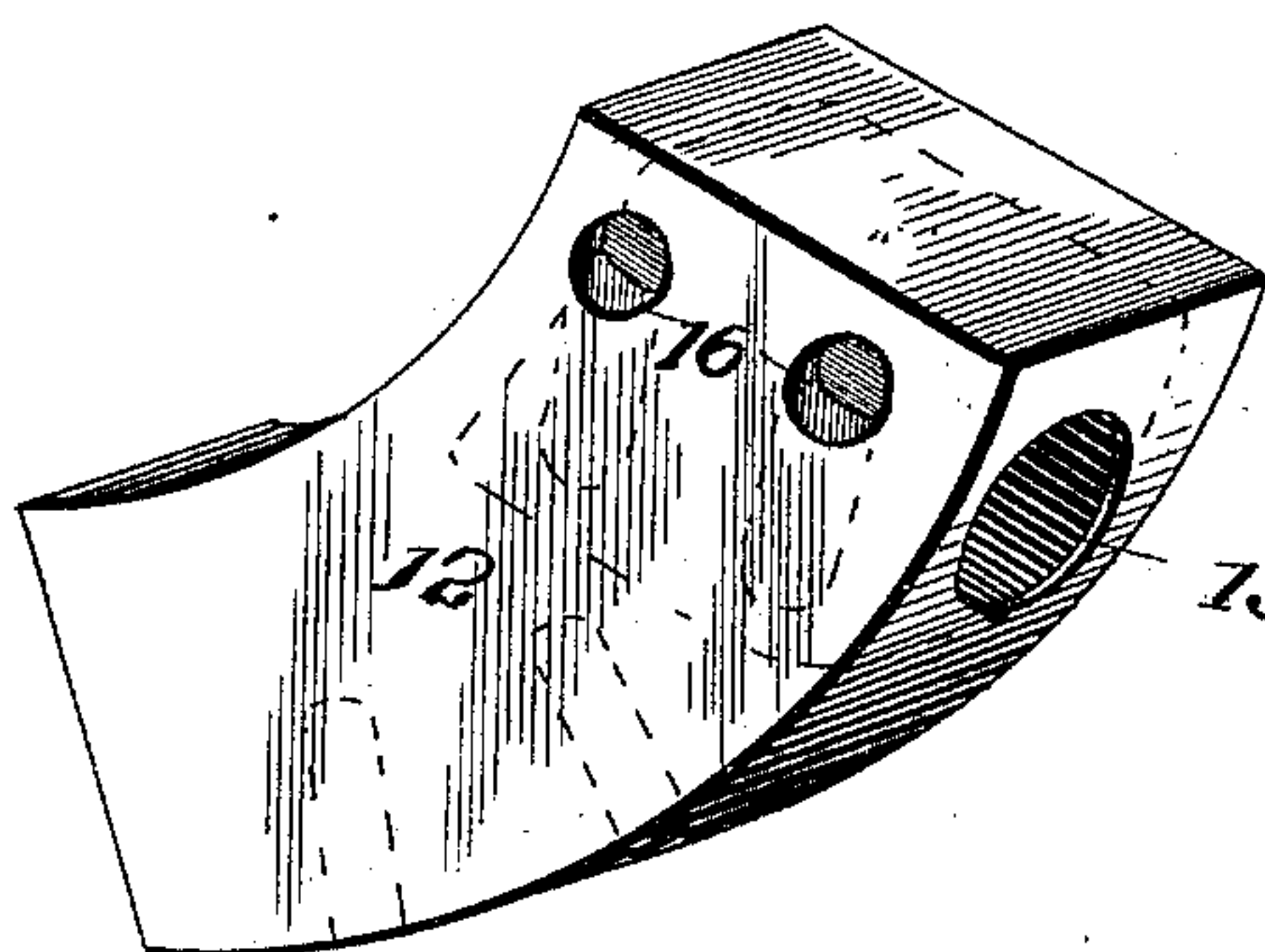
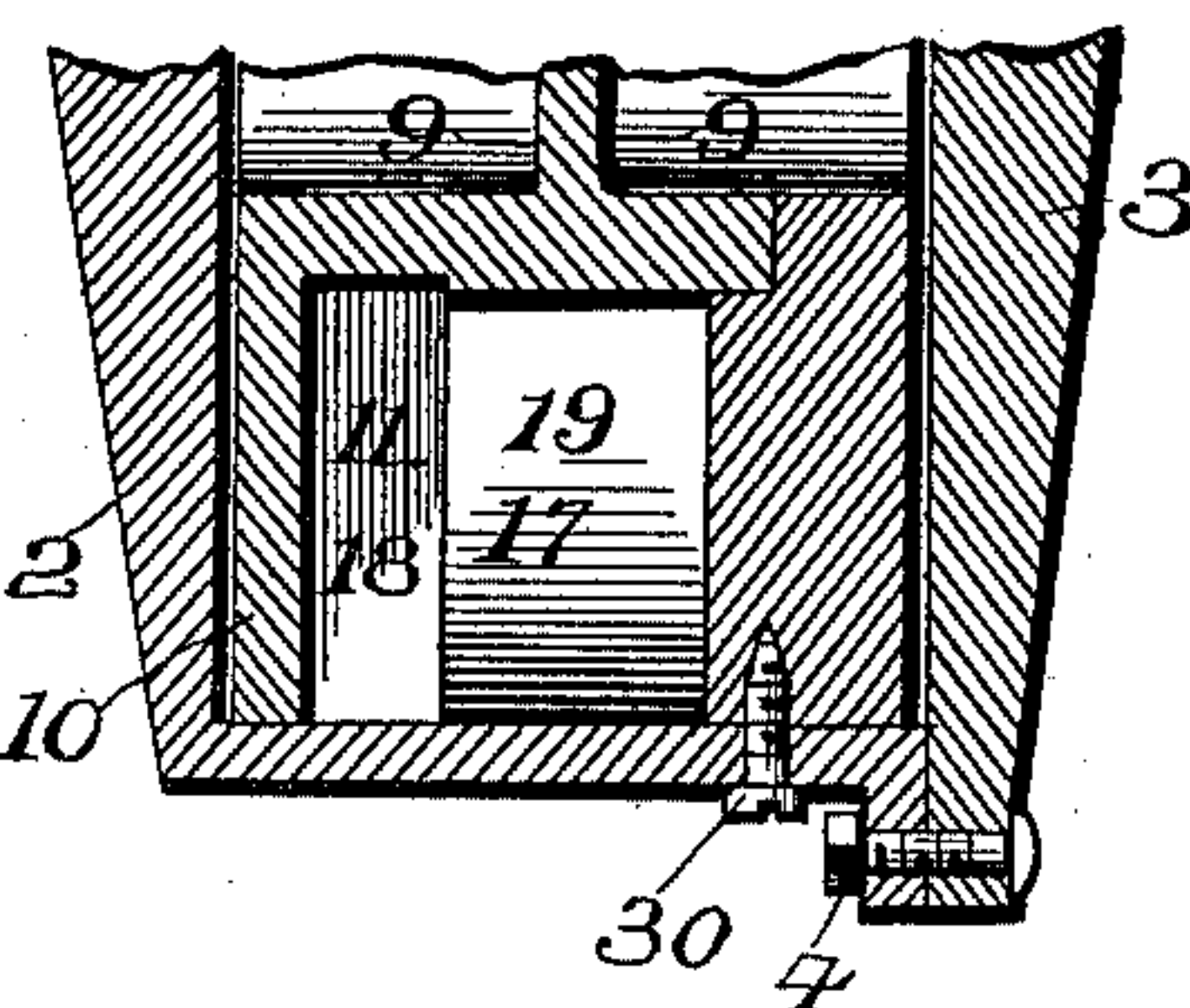


Fig. 10.



Witnesses

for true
D. W. Gould

Inventors
William E. Prall,
Edgar F. Prall,
by Ruy. R. Catlin
Attorney

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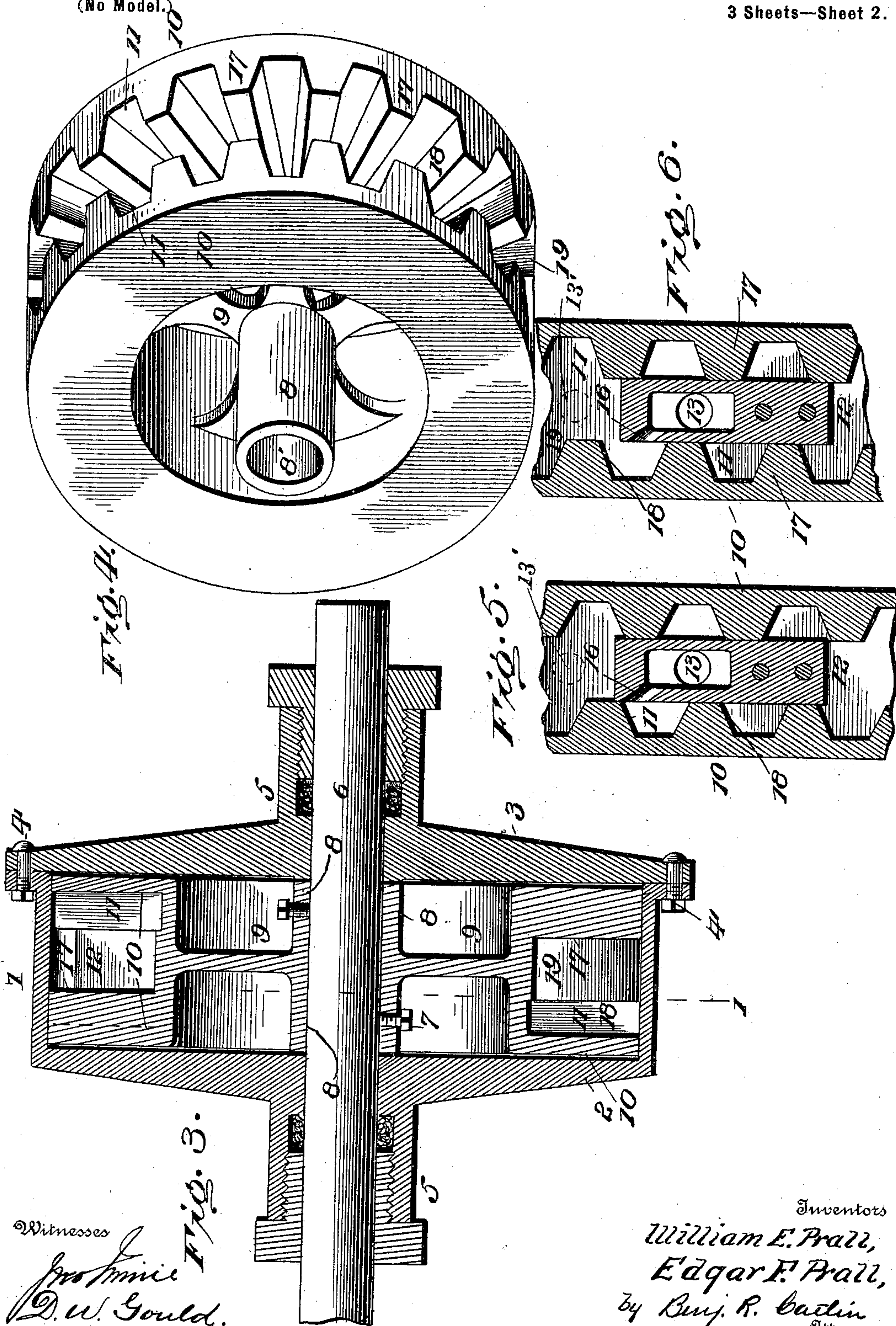
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Witnesses
for Inve
D. W. Gould.

Inventors
William E. Prall,
Edgar F. Prall,
by Benj. R. Catlin
Attorney

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Fig. 7.

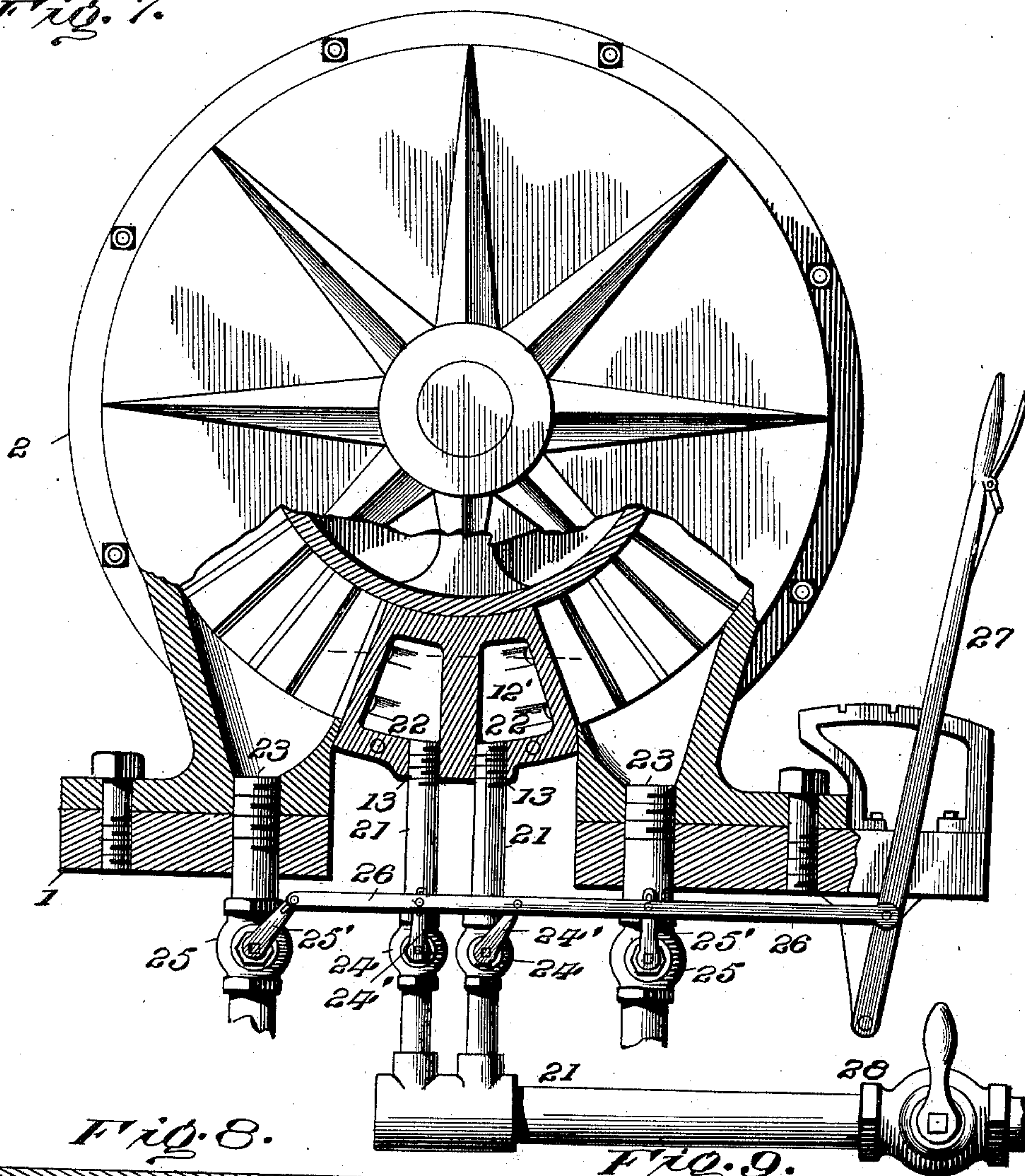


Fig. 8.

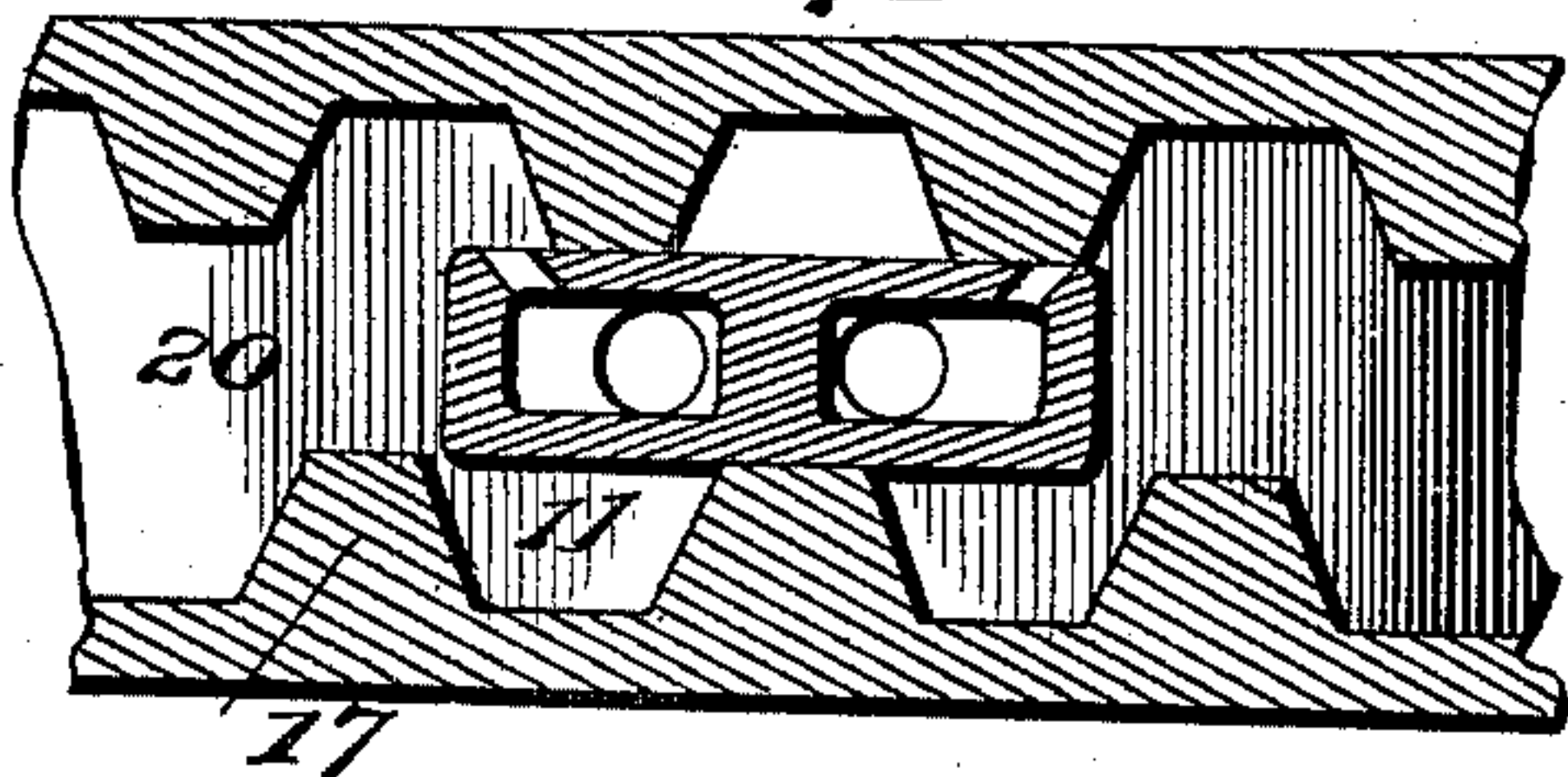
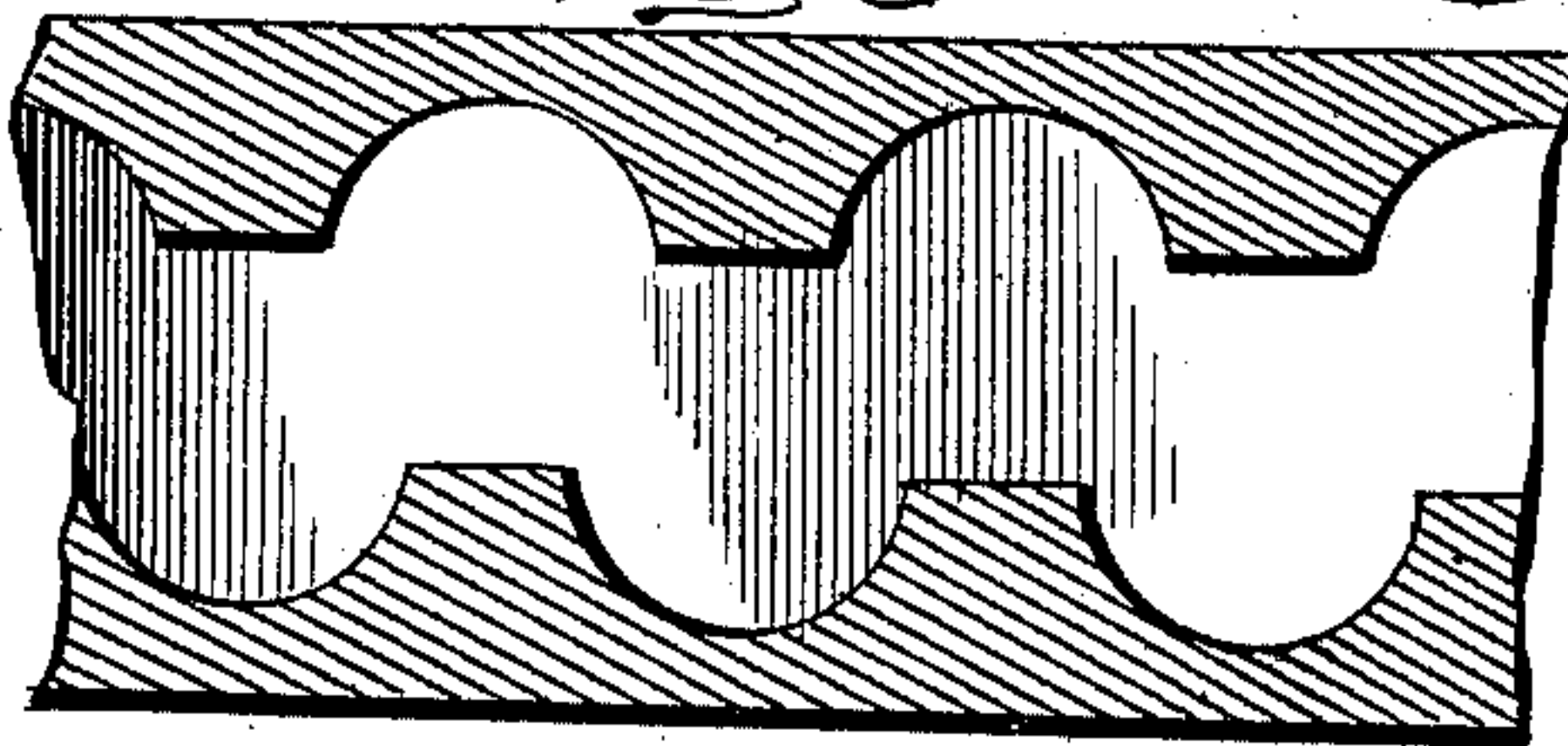


Fig. 9.



Witnesses

W. W. Gould.
D. W. Gould.

Inventors

William E. Prall,
Edgar F. Prall,
by *Benj. R. Eastin*
Attorney

UNITED STATES PATENT OFFICE.

WILLIAM EDGAR PRALL AND EDGAR FREDERICK PRALL, OF NEW YORK,
N. Y., ASSIGNORS TO JULIA L. PRALL, OF SAME PLACE.

PISTON IMPACT-ENGINE.

SPECIFICATION forming part of Letters Patent No. 619,221, dated February 7, 1899.

Application filed July 27, 1898. Serial No. 687,053. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM EDGAR PRALL and EDGAR FREDERICK PRALL, citizens of the United States, and residents of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Piston Impact-Engines, of which the following is a specification.

10 The invention relates to engines of the turbine type, and has for its object to increase their efficiency and the economy of manufacture.

15 It consists in the construction hereinafter described and pointed out.

In the accompanying drawings, Figure 1 is a horizontal section of the improved engine on line 1 1, Fig. 3. Fig. 2 is a perspective of a detail. Fig. 3 is a section on line 3 3 of Fig. 1. Fig. 4 is a partial perspective of bucket-rings. Figs. 5 and 6 are partial sections showing different positions of movable parts. Fig. 7 is a broken elevation of a reversible engine with the improvement applied thereto. Fig. 8 is a partial section of the same. Fig. 9 is a partial section indicating a modification, and Fig. 10 is a partial section indicating a modification.

20 Numeral 1 denotes the engine-base, and 2 a cylinder or case, which is closed by a detachable head 3. Means for connecting these parts are indicated at 4.

5 5 denotes bearings, including a stuffing-box, and 6 is a rotary-shaft bar driving any desired machinery. To this shaft is fixed by screws 7 or any suitable means a hub 8, provided with extensions 8'.

10 The hub in the present instance comprises concentric cylindrical parts joined by a web 9. To the hub are fixed by any suitable means and in steam-tight manner one or more annular disks, rings, or flanges 10, having on their proximate or inner faces buckets or inclined fluid-deflecting planes 11, adapted to receive the impact of superheated water, steam, or other fluid and constituting a bucket-wheel. Each bucket has two oppositely-situated and practically similar faces, except that they are oppositely inclined to provide for reversal, as hereinafter described. The annular disks or rings 10 may have a

close joint with the inner surface of the cylinder.

12 denotes a stationary abutment or piston-head fixed to the cylinder between the rings 10 and fitted between them with close joints. The abutment is cored out to provide an admission-port 13, which receives steam or other agent. The port 13 admits steam to the buckets 11 through one or more ports 16.

60 The partitions 17 between the buckets in each ring are separated by a distance less than the circumferential length of the abutment 12, so that the escape of steam back past these partitions on either side is precluded, as indicated in the drawings.

70 The impact of the motive fluid on the surface of the buckets causes them to advance until they are moved beyond the abutment, whereupon there is an exhaust into the annular space 19 and out through port 20. Steam or other agent is continuously admitted to the port 13 and acts upon the buckets in succession, being successively exhausted as the bucket-faces are driven beyond the abutment and a communication with the exhaust-port thereby opened. The steam expands according to the distance between the partitions, the cut-off being effected by the partitions following that whose inclined face has just received impact and the pressure of expanding fluid. Obviously the cut-off can be varied by providing bucket-rings having partitions of greater or less dimensions circumferentially, and provision for this may be made by detachably connecting the rings to the hub, so that different bucket-rings can be used as desired. The particular form of buckets and impact-faces is not essential, except as hereinafter pointed out. Some of the advantages of the improved construction comprising the open steamway separating the oppositely-situated series of buckets and the stationary abutment situated in and terminating the said way are independent of the particular inclination of the bucket-faces, though the forward or operative faces should not be backwardly inclined.

100 In Fig. 7 is shown a reversing-engine embodying our invention. 21 denotes a steam-inlet pipe, and 22 inlet-ports, and 23 exhaust-ports. 24 and 25 indicate, respectively, ad-

mission and exhaust rocking valves, and 24' and 25' are crank-arms fixed to the stems of the valves. 26 is a connecting-rod, and 27 a reversing-lever, the construction being such
 5 that steam can be admitted to either port 13 of the abutment 12' and exhausted through the corresponding exhaust-valve. 28 denotes a valve in the steam-supply pipe for regulat-
 10 ing or wholly closing off steam admission. This valve may be automatically controlled by a governor, if desired.

The exhaust may connect with a vacuum-chamber, and a condenser and pump may be provided, if desired, but such devices being
 15 well known description is unnecessary.

It is not in every case necessary to admit all or any of the propelling fluid through port 13, and another admission port or ports, such as 13', (indicated by dotted lines in Figs. 1
 20 and 5,) may, if desired, be used solely or in co-operation with a port, such as 13. In case a port, such as 13', is used the admission will be in the arrangement shown directly to the steamway, and means should be provided to
 25 direct the steam against the forwardly-inclined bucket-faces.

It will be understood that a propelling fluid will by its expansive force be thrown against the faces 11 in zigzag course and that exhaust
 30 occurs after the impact on the face adjacent port 20. Obviously this port may communicate with other bucket-rings in one cylinder suitably prolonged to further utilize the steam, and multiple expansion is also con-
 35 templated.

The principles of construction and operation would be illustrated were the rings 10 made separate and one of them fixed to the cylinder, as by a screw 30, (see Fig. 10;) but
 40 such construction is not preferred and would not ordinarily be employed.

The improvement involves the employment of a series of buckets having impact-faces inclined toward the mouths of the buckets and
 45 forwardly in the direction of the plane of rotation, so that steam is thereby deflected in said direction and compelled to take a zigzag course. The buckets have an exhaust com-
 50 mon to them, and the steam has no escape from work until it has acted upon the last face in the series, thereby differing from that class of engines in which a plurality of exhausts is necessary and also from that class in which there are buckets or pockets inclined back-
 55 wardly toward the steam-inlet.

By the present improvement steam under pressure can act against successive faces on the side of a wheel without exhaust until it has made nearly an entire circuit, the admis-
 60 sion-port and impact-faces being suitably arranged and inclined, so that the steam pursues a zigzag course and precludes a direct exhaust, notwithstanding the fact that there is a direct open space extending all the way
 65 from the admission to the exhaust port.

By our improvement the opposite buckets are arranged in a stepped or zigzag order.

This arrangement is important in connection with other features of construction. The im-
 70 provement is further characterized by an open steam-passage extending from the abutment having the admission-port to the exhaust and between the proximate parts or vertices of the buckets or between the so-called "parti-
 75 tions" constituting the buckets. It is also im- portant that steam be admitted transversely to a forwardly-inclined bucket-face to insure a deflection across the steamway. The de-
 80 flections in our construction do not interfere with each other. Such a construction insures that the steam will not blow directly through the open passage, and the object of
 85 such open passage is to provide sufficient space for steam expansion and also for the proper action and reaction of its impacts from side to side. The cross-currents produced by the faces arranged and combined as set forth
 90 constitute an effective barrier to the direct escape of steam to the exhaust notwithstanding the fact that the way is otherwise open and the passage direct. The action is in this
 95 respect unlike that of a steamway made circuitous without means for avoiding successive interfering deflections of steam, such as would be caused by similar buckets or faces situated
 100 exactly opposite each other, which construction is disclaimed, and also an engine with a steam-coil provided with overlapping faces or partitions and a coil having movable admis-
 105 sion and exhaust ports.

Having described our invention, we claim—

1. In an engine the shaft, the fixed cylindrical casing, a wheel fixed to said shaft, oppositely-situated series of buckets, an open
 105 steamway separating the series and extending in a right plane circumferentially of the wheel, an abutment situated in and terminating the steamway, said abutment having an admission-port adapted to direct steam
 110 against a bucket-face, and an exhaust-port leading out through the casing.

2. In an engine, the shaft, the fixed cylindrical casing, a wheel fixed to the shaft said wheel having a steamway and a series of buckets with impact-faces inclined to the said way
 115 and from their bottoms toward their mouths or open sides in the direction of rotation, a fixed abutment in the steamway to preclude the backward passage of steam, an admission-port in the abutment and an exhaust-port, all
 120 substantially as set forth, whereby steam is deflected across the steamway and drives the wheel-faces from the abutment.

3. In an engine the shaft, the fixed cylindrical casing, a wheel fixed to said shaft, oppositely-situated series of buckets, an open
 125 steamway separating the series and extending in a right plane circumferentially of the wheel, an abutment situated in and terminating the steamway, an admission-port and
 130 an exhaust-port leading out through the casing, the admitted steam being directed against a bucket-face.

4. In an engine, the shaft, the stationary

casing, the wheel fixed to the shaft, said wheel having a series of buckets with impact-faces inclined from their bottoms toward their mouths or open sides in the direction of rotation and containing an open steamway, a stationary abutment in the steamway to preclude the backward passage of steam, an admission-port in the abutment, and an exhaust-port, the admission and exhaust ports being in communication with the steamway, and the admission-port directed against a forwardly-inclined face, all substantially as set forth.

5. In an engine, the shaft, the stationary casing, the wheel comprising the disks fixed to the shaft and containing an open steamway, said wheel having a series of buckets with impact-faces inclined from their bottoms toward their mouths or open sides in the direction of rotation, a stationary abutment in the steamway to preclude the backward passage of steam, admission-ports in the abutment, and exhaust-ports, the admission and exhaust ports being in communication with the steamway, and the buckets of each disk situated in a stepped or zigzag order with respect to those of the opposite disk, all substantially as set forth.

6. In an engine, the shaft, the fixed cylindrical casing, a wheel fixed to the shaft said

wheel having a steamway and a series of buckets with impact-faces inclined to the said way and from their bottoms toward their mouths or open sides in the direction of rotation, a fixed abutment in the steamway to preclude the backward passage of steam, a plurality of admission-ports, a plurality of exhaust-ports, and reversing-valves whereby the steam may be admitted to either admission-port and exhausted from a corresponding port to drive the engine in reverse directions, substantially as described.

7. In an engine, the shaft, the fixed cylindrical casing, a wheel fixed to the shaft said wheel having a steamway and a series of buckets with impact-faces inclined to the said way and from their bottoms toward their mouths or open sides in the direction of rotation, a fixed abutment in the steamway to preclude the backward passage of steam, a plurality of admission-ports, a plurality of exhaust-ports, and a reversing-valve, each bucket having impact-faces similar but oppositely situated to provide for reversal of the engine.

WM. EDGAR PRALL.

EDGAR FREDERICK PRALL.

Witnesses:

JOSEPH OATMAN,
L. J. CARY.