No. 871,030. PATENTED NOV. 12, 1907.

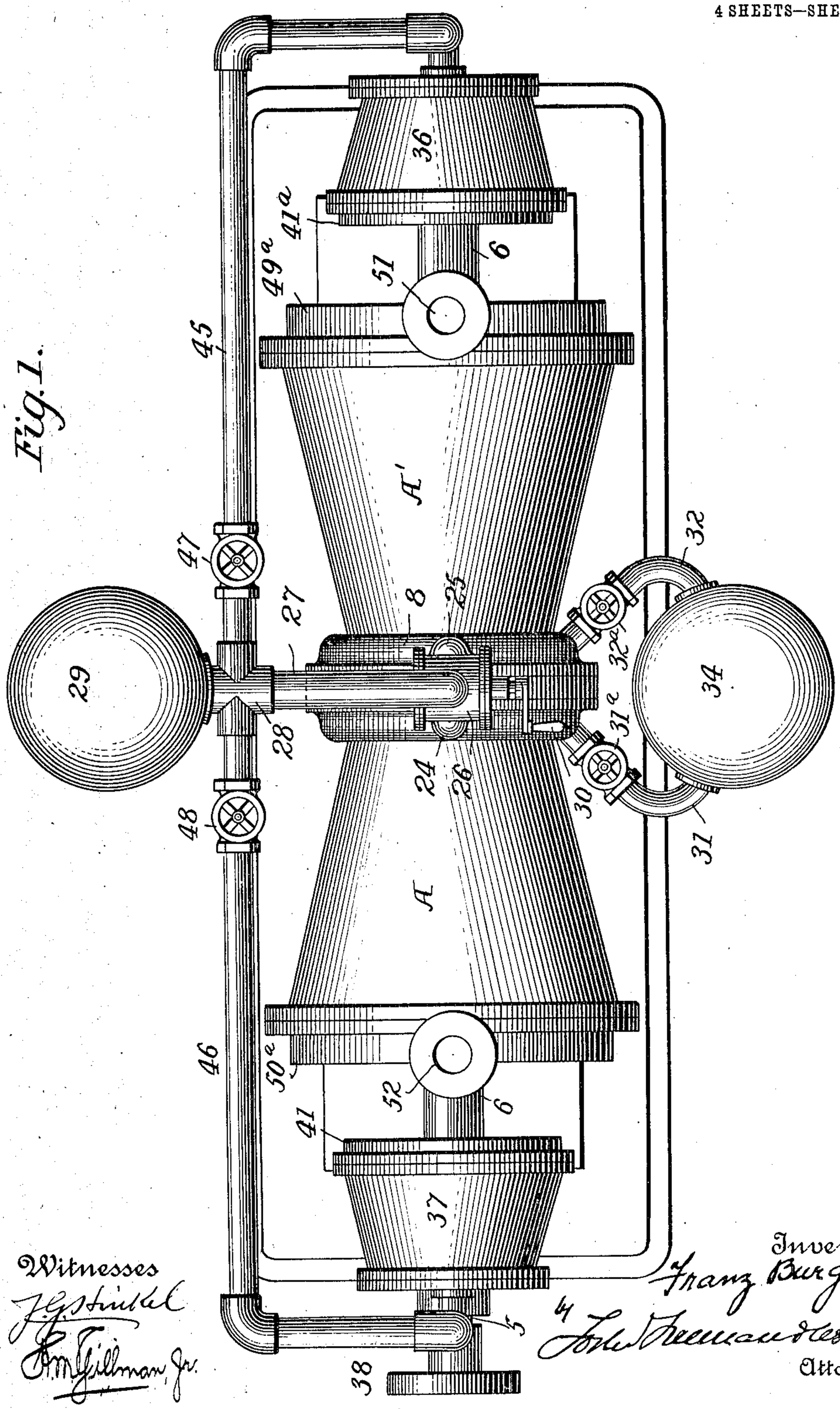
F. BURGER.

ROTARY COMBUSTION ENGINE.

APPLICATION FILED DEC. 17, 1903.

4 SHEETS—SHEET 1.

Fig. 1.



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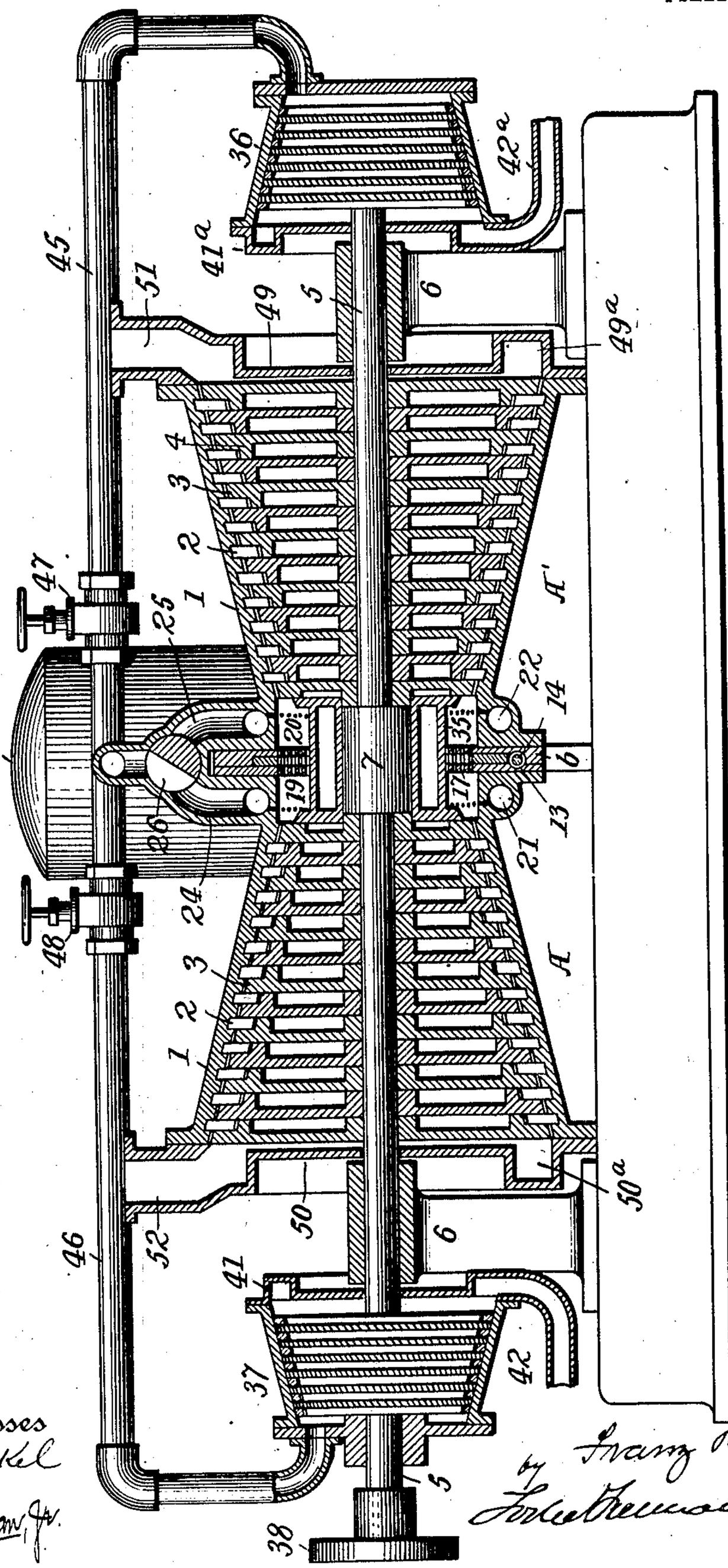
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 4.

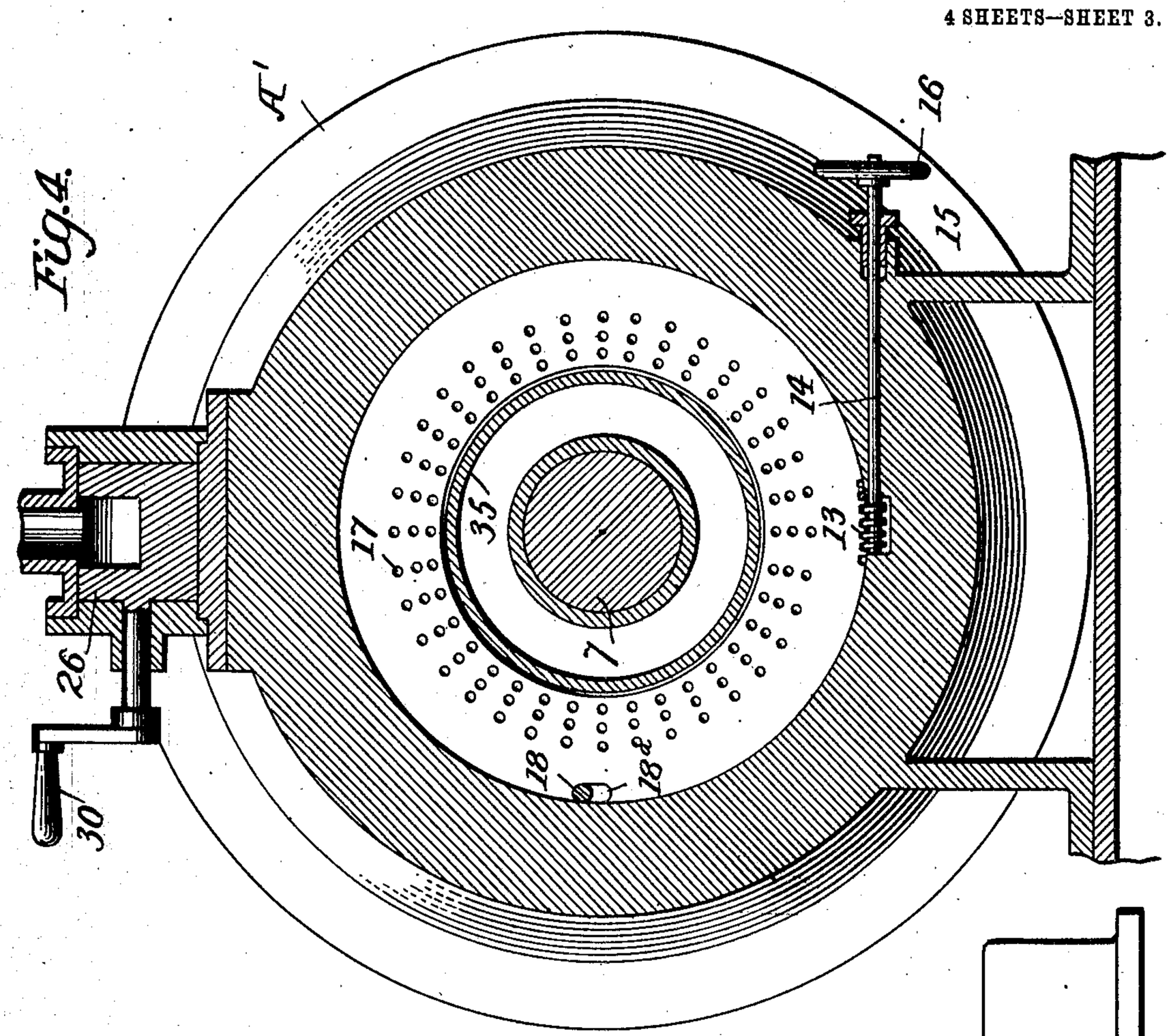
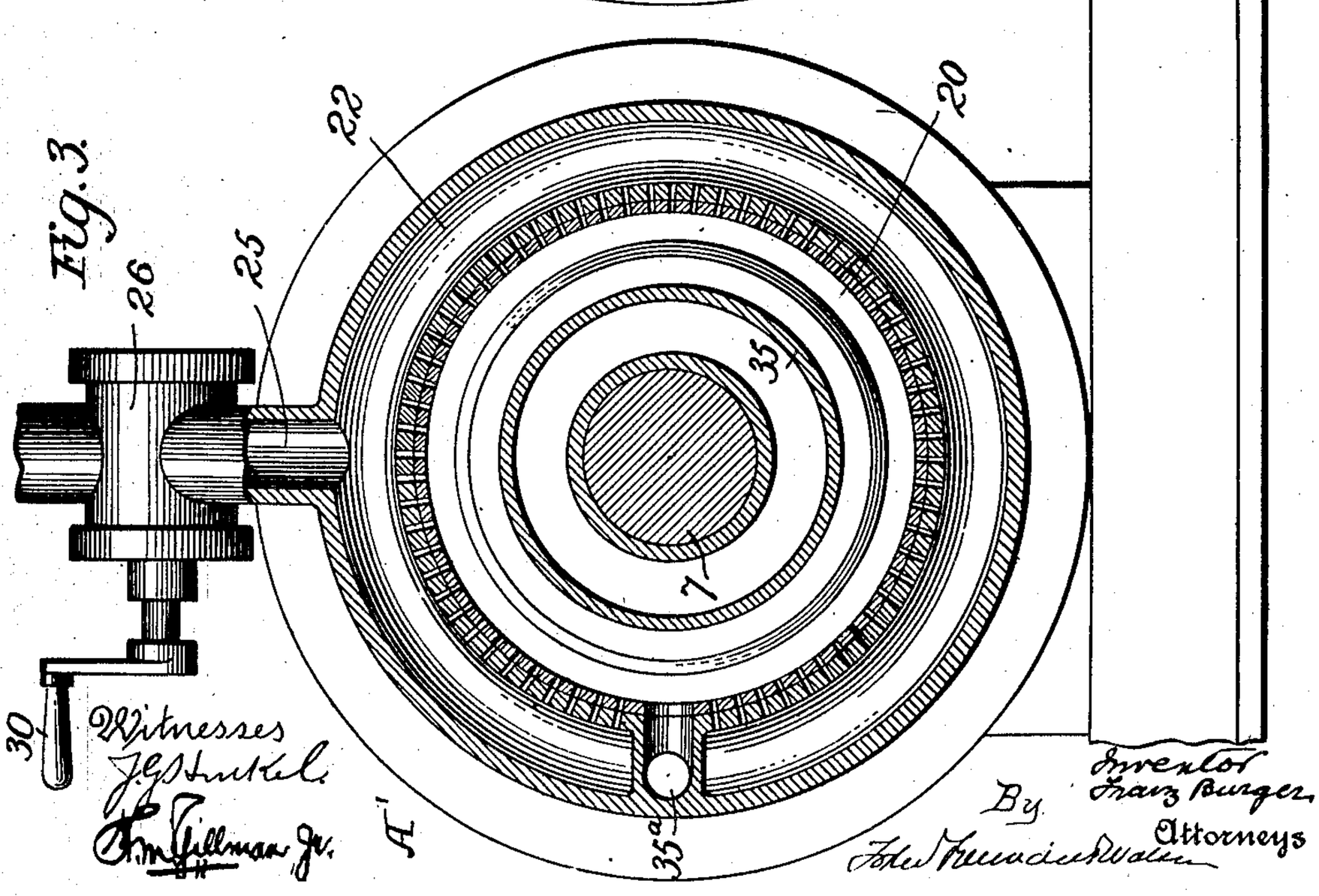


Fig. 3.



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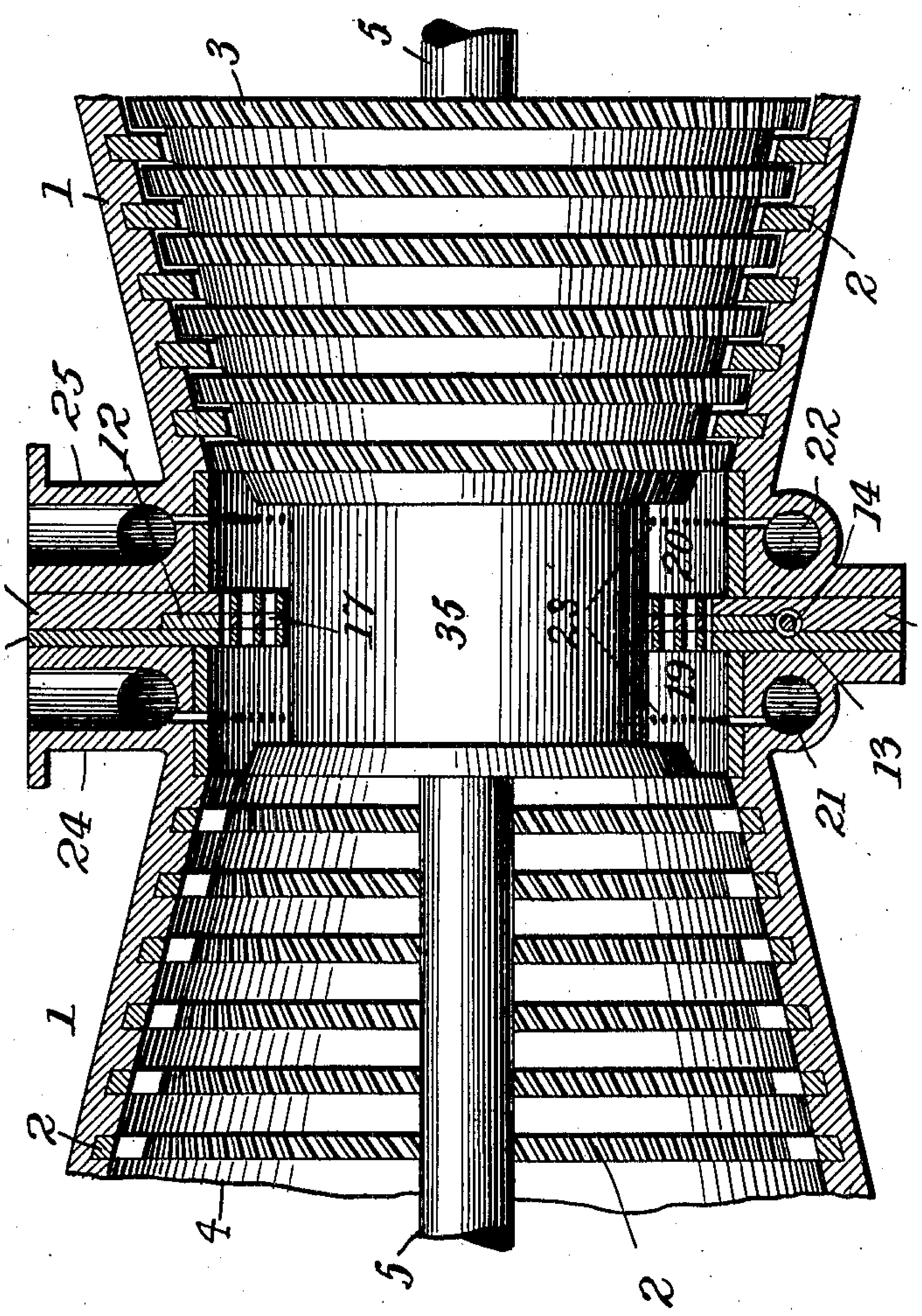
4 SHEETS—SHEET 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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ROTARY COMBUSTION-ENGINE.

No. 871,030. Specification of Letters Patent. Patented Nov. 12, 1907.

Application filed December 17, 1903. Serial No. 185,508.

To all whom it may concern:

Be it known that I, FRANZ BURGER, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Rotary Combustion-Engines, of which the following is a specification.

This invention relates to turbine engines adapted to be run by air under pressure or by a mixture of air and gas or other combustible fluid under pressure.

In carrying out my invention, I propose to employ two similar turbines, one of which will act as a motor and the other as an air compressor, both connected to the same shaft. A combustion chamber is located between the turbines and communicates with both and the combustible fluid is admitted to and burned in this chamber. The compressing turbine forces air under pressure into the combustion chamber where it meets the burning fluid and is expanded and passes into the motor turbine to operate it and thereby drive the shaft carrying both turbines.

I also propose to provide a reservoir for the combustible fluid and one for compressed air, each having valved communication with the combustion chamber, and means are provided for charging these reservoirs by the operation of the engine.

The invention will be fully described hereinafter, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of my improved turbine engine; Fig. 2 is a vertical longitudinal section; Fig. 3 is a transverse section through one of the combustion chambers; Fig. 4 is a similar view through the partition between the combustion chambers; Fig. 5 is a plan view of a portion of each turbine, with the casing removed showing the arrangement of the vanes.

The turbines A and A′, each consists of a tapering cylindrical shell 1 provided with interior annular grooves into which are fitted the stationary vane rings 2. The revolving vanes 3 are carried by wheels 4 secured to a shaft 5. The wheels 4 abut against each other and gradually increase in diameter and the vanes 3 work freely between the vane rings 2. The shaft 5 is supported to rotate in pillow blocks 6 and at its central portion is provided with an enlarged portion 7 against which the smaller of the wheels 4 in each turbine abuts. As shown, the smaller ends of the tapered cylinders oppose each other and each of these ends is provided with an enlarged extension 8, which may be integral with the shell or rigidly connected to it, and each extension is provided with an interior annular channel, that in one being indicated by 21 and in the other by 22. A series of holes 23 lead from these channels to the interior of the extensions 8. The turbines A and A′ are identical in construction except that the vanes 3 in one extend at a reverse angle to the vanes 3 in the other, so that when A is used as a motor the shaft 5 will turn in one direction and when A′ is the motor, it will turn in the opposite direction.

Upon the enlarged portion 7 of the shaft 5 a collar 35 is fitted and abuts at each end against the inner end wheels 4 of the turbines. A partition indicated as a whole by *b* fits loosely over the collar 35 and, when the parts are assembled, is clamped between the extensions 8, and two combustion chambers 19 and 20 are thus formed at the ends of the respective turbines with which the channels 21 and 22 respectively communicate through the holes 23. From the channels 21 and 22, pipes 24 and 25 lead to a three-way valve 26, and a pipe 27 leads from the valve to a four-way coupling 28, which is connected to a compressed fuel tank 29. The plug of the valve 26 is provided with a handle 30, and fuel can therefore be admitted from the tank 29 to either of the channels 21 or 22 as desired.

The partition *b* is made up of three disks 10, 11 and 12. The disk 11 is recessed to receive the disk 12 which is flush with it and the disk 10 covers the disk 12 and holds it in the recess. Each disk is provided with a series of perforations 17 which are adapted to register and thereby establish communication between the combustion chambers 19 and 20. The disk 12 is provided with a series of teeth on its periphery which are engaged by a worm 13 carried by a shaft 14 extending through a tangential bore in the disk 11 and provided with a hand wheel 16 at its outer end. Preferably, a stuffing box 15 is provided for the shaft 14 to prevent leakage of air or fuel. The disk 12 is also provided with a slot 18^a into which a fixed pin 18 extends, and acts as a stop to limit the movement of the disk 12. By operating the worm 13, the disk 12 can be turned to bring its openings 17 into or out of register with the similar openings in the disks 10 and 11 and thus establish or cut off communication between the chambers 19 and 20.

Pipes 31 and 32 lead from the channels 21 and 22, respectively, to a compressed air tank 34, and these pipes are provided with valves 31^a and 32^a respectively. These pipes extend through the channels 21 and 22 and open into the combustion chambers 19 and 20, as indicated at 35^a in Fig. 3.

The turbines A and A′ are respectively provided with heads 50 and 49 secured to the larger ends of the tapered casings 1 and these heads have internal annular channels 50^a and 49^a, respectively, from which pipes 52 and 51 lead.

The shaft 5 extends beyond the pillow blocks 6 and carries two smaller turbines 36 and 37, each adapted to work as a compressor. Gas supply pipes 42 and 42^a, respectively, lead to channels 41 and 41^a in the casings of the turbines 37 and 36, and pipes 46 and 45 lead from

them to the four-way coupling 28. These latter pipes are respectively provided with a valve 48 and 47. One of these turbines is constructed to compress gas when the shaft 5 revolves in one direction and the other to compress it when the shaft 5 revolves in the opposite direction. The shaft 5 extends beyond the turbine 37 and is provided with a coupling indicated by 38 from which power may be conveyed. Such being the general construction of the machine, its operation is as follows:—

The tanks 29 and 34 having been respectively charged with gas and air under the desired pressure, and assuming that the turbine A is to be the motor and the turbine A′ the air compressor, the disk 12 will be turned to close communication between the chambers 19 and 20. The valve 26 will be turned to the position indicated in Fig. 2 and gas, or other combustible fluid, will then flow under pressure from the tank 29 to the channel 21 through the openings 23 to the chamber 19 where it will be ignited by any suitable means, not shown, and burn continuously as long as the fuel is supplied. The valve 31ª is also opened and air from the tank 34 will flow through the pipe 31 into the chamber 19 and meeting the burning fuel will be expanded and pass through the turbine A acting on the vanes 3 to rotate them and the shaft 5. As the wheels 4 gradually increase in diameter toward the outlet 52, which in this case forms the exhaust port, the leverage of the successive vanes 3 will be correspondingly increased, and substantially in the proportion of decrease of the expansive force of the air. The vanes 3 in the turbine A′ will also be rotated and draw air in through the opening 51 and compress it into the chamber 20. As soon as sufficient speed is attained, the disk 12 is turned to bring the openings 17 in the disks 10, 11 and 12 into register, and the air compressed by the turbine A′ into the chamber 20 will flow through the openings 17 into the chamber 19 and be expanded through the turbine A to operate the shaft 5.

The turbines 36 and 37 will both be running but only one, say 36, will operate as a compressor. If therefore gas be admitted through the pipe 42ª, it will be compressed into the pipe 45 and through the valve 47, which will be opened, into the tank 29 and the chamber 19. The valve 48 will be closed when the turbine 36 is acting as a compressor. When the engine has fairly started, the valve 31ª may be closed and the valve 32ª opened at any time during the running of the engine whereupon a portion of the air compressed into the chamber 20 by the turbine A′ will flow through the pipe 32 into the tank 34 and the necessary pressure in this tank can be obtained for the next starting of the engine.

To stop the engine, the flow of gas through the pipe 42ª must be cut off and the valves 47 and 26 be closed. Valves 31ª and 32ª must also both be closed.

To reverse the engine, turbine A′ will be used as a motor and turbine A as a compressor, and by operating the several valves properly the operations already described will take place with the result that the shaft 5 will be rotated in the opposite direction. In this case the turbine 37 will be the gas compressor. The opening 52 will be the inlet for air to the compressing turbine A, and the opening 51 will be the exhaust for the motor turbine A′.

Without limiting myself to the details of construction illustrated and described, I claim:

1. The combination with a shaft, of two turbines connected therewith, a combustion chamber communicating with both turbines, means for supplying compressed gas to said chamber, and means for directing the gas to either one of the turbines so that either one will operate as a motor while the other will operate as an air compressor supplying air to said combustion chamber, substantially as set forth.

2. The combination with a shaft, of two turbines connected therewith, a divided combustion chamber communicating with both turbines, means for delivering fuel to either compartment of said chamber, and means for delivering air to either compartment of said chamber, substantially as set forth.

3. The combination with a shaft, of two turbines connected to said shaft, a combustion chamber between the opposing ends of the turbines communicating with both, a partition in said chamber, means for delivering fuel under pressure to said chamber on either side of the partition, and means for delivering air under pressure to said chamber on either side of said partition, substantially as set forth.

4. The combination with a shaft, of two turbines connected to said shaft, a combustion chamber between the opposing ends of the turbines communicating with both, a perforated partition in said chamber, means for closing the perforations in said partition, means for delivering fuel under pressure to said chamber on either side of the partition, and means for delivering air under pressure to said chamber on either side of said partition, substantially as set forth.

5. In a reversible turbine engine, the combination with a shaft, of two tapered turbines connected to said shaft with their smaller ends opposing each other, the moving vanes of one turbine extending at angles reverse to those of the other, a combustion chamber between the opposing ends of the turbines communicating with both, a partition in said combustion chamber means for admitting fuel under pressure to either side of the partition, and means for admitting air under pressure to either side of said partition, substantially as set forth.

6. In a reversible turbine engine, the combination with a shaft, of two tapered turbines connected to said shaft with their smaller ends opposing each other, the moving vanes of one turbine extending at angles reverse to those of the other, a combustion chamber between the opposing ends of the turbines communicating with both, a perforated partition in said combustion chamber, means for closing the perforations in said partition, means for admitting fuel under pressure to either side of the partition, and means for admitting air under pressure to either side of said partition, substantially as set forth.

7. The combination with a shaft, of two turbines connected to the shaft, a combustion chamber between the two turbines and communicating therewith, means for supplying compressed air and gas to the combustion chamber, and means for directing the gas to either one of the turbines so that either one will operate as a motor while the other operates as an air compressor supplying compressed air to the combustion chamber.

8. In a reversible turbine engine, the combination of a shaft, two turbines connected to said shaft, the moving vanes of one turbine extending at angles reverse to those of the other, a combustion chamber between the opposing ends of the turbines communicating with both, a perforated partition in said chamber, a pair of gas compressing turbines on the shaft, means for conveying gas from one gas compressing turbine to one side of said partition; means for conveying gas from the other gas compressing turbine to the other side of said partition, and means for supplying air under pressure to either side of said partition, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANZ BURGER.

Witnesses:
GEO. D. CRANE,
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