

No. 805,523.

PATENTED NOV. 28, 1905.

E. S. BRYANT & H. J. BERY.

STEAM TURBINE.

APPLICATION FILED MAY 25, 1904.

3 SHEETS—SHEET 1.

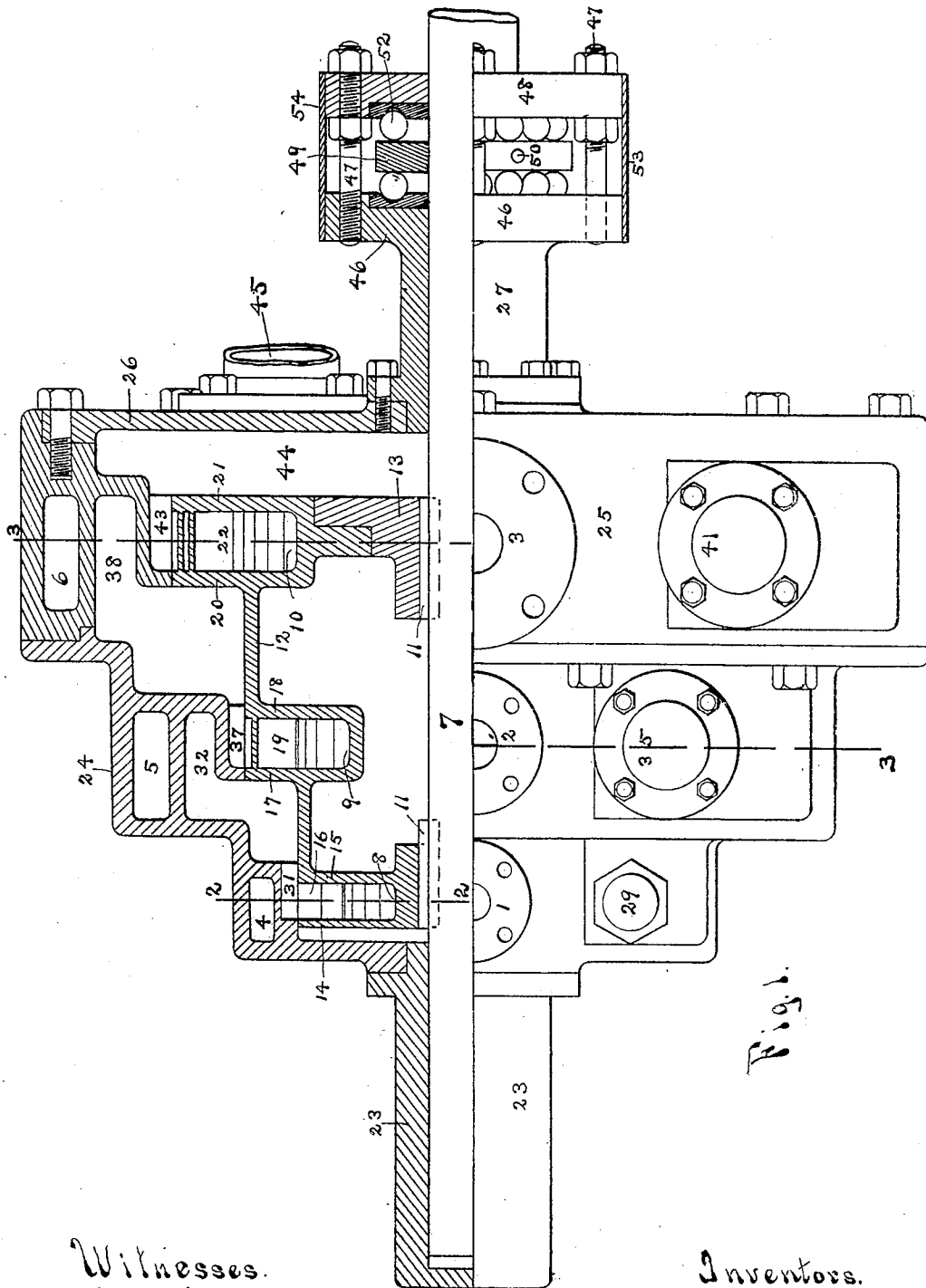


Fig. 1.

Witnesses.
A. M. Alex.
Emma Petersen.

Inventors.
E. S. Bryant and H. J. Bery.
by *Edward N. Pagelsen.*
their Attorney.

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3 SHEETS—SHEET 2.

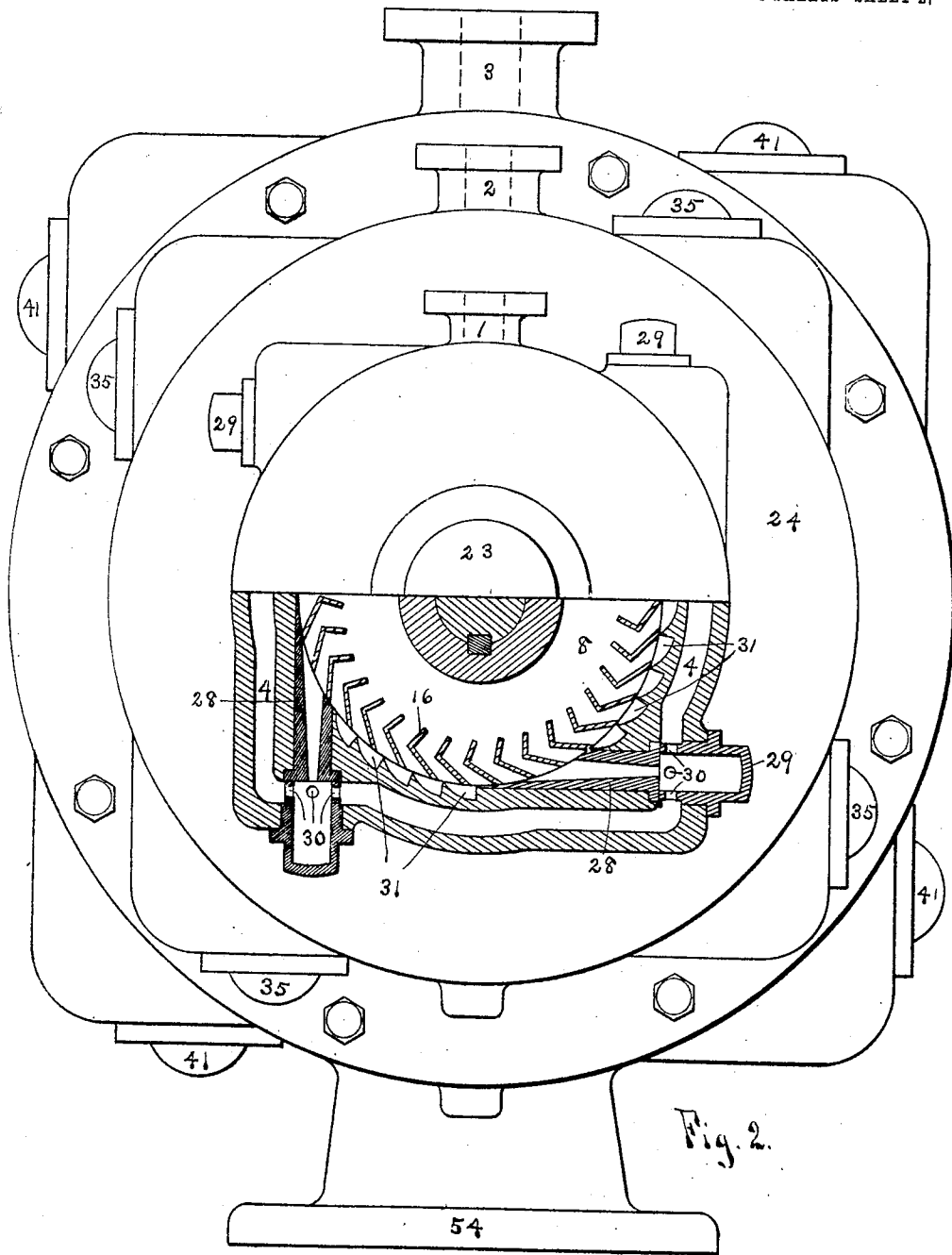


Fig. 2.

Witnesses.

A. W. Miles

Emma Petersen.

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H. J. Bery & E. S. Bryant.

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3 SHEETS—SHEET 3.

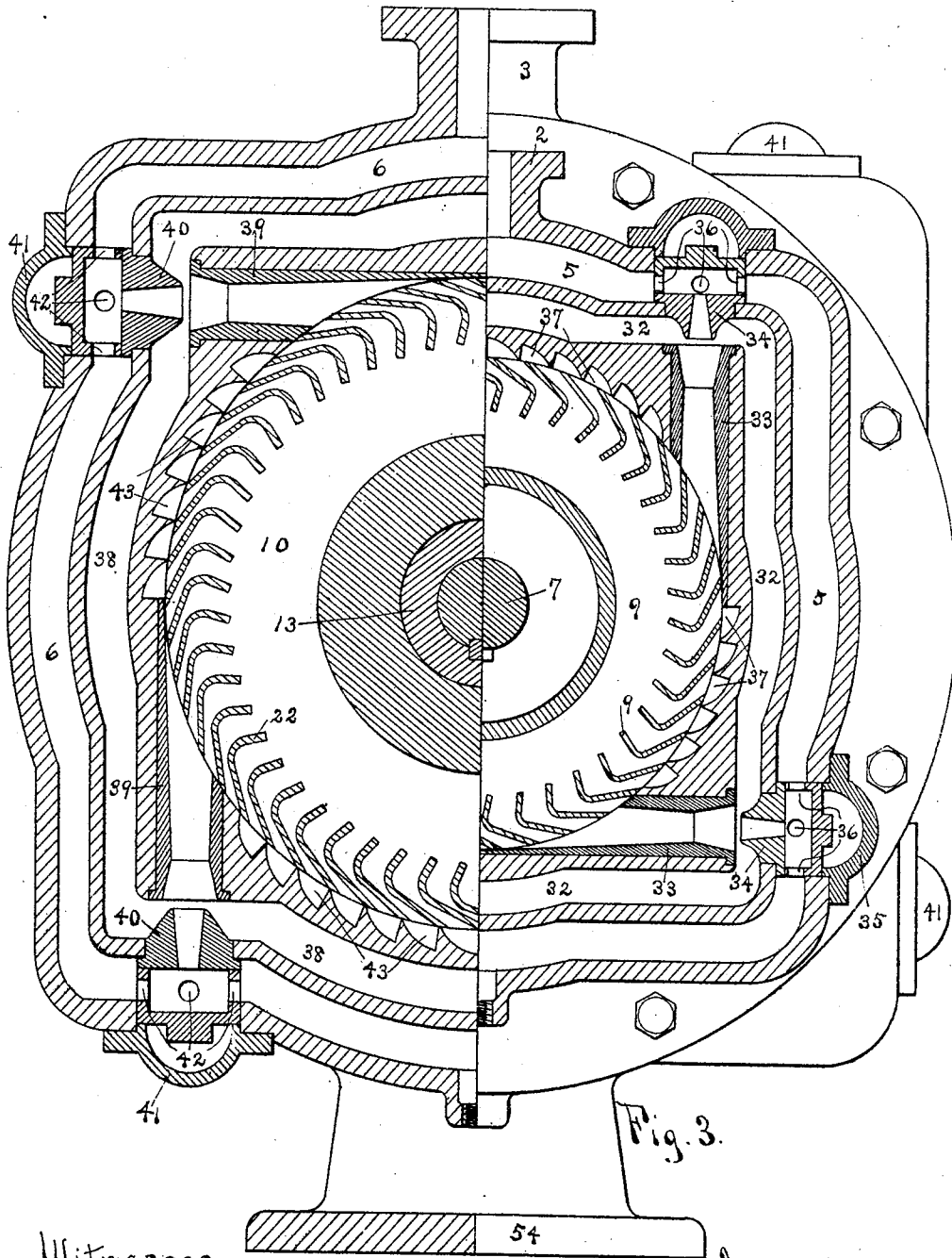


Fig. 3.

Witnesses.
A. J. Wiley
Emma Petersen.

Inventors.
E. S. Bryant & H. J. Bery.
by *Edward N. Pagelen.*
their Attorney.

UNITED STATES PATENT OFFICE.

ELLSWORTH S. BRYANT AND HENRY J. BERY, OF DETROIT, MICHIGAN.

STEAM-TURBINE.

No. 805,523.

Specification of Letters Patent.

Patented Nov. 28, 1905.

Application filed May 25, 1904. Serial No. 209,632.

To all whom it may concern:

Be it known that we, ELLSWORTH S. BRYANT and HENRY J. BERY, citizens of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented a new and Improved Steam-Turbine, of which the following is a specification.

This invention relates to high-speed rotary piston-engines of the impact type, commonly known as "steam-turbines," and the objects of our improvements are to produce an engine capable of attaining very high speed, one that will yield the maximum amount of power for the steam used, one that will combine the exhaust-steam with live steam and use the mixture to drive a piston, and an engine that will be light, have few wearing-surfaces, that may be cheaply and easily constructed, and that cannot get out of order. We attain these objects by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a plan of the engine, one-half being in horizontal central section. Fig. 2 is an end view of the same, a portion being in vertical section on the line 2 2 of Fig. 1. Fig. 3 is a section on the offset line 3 3 of Fig. 1.

Similar reference characters refer to like parts throughout the specification and claims.

In the drawings is shown a three-piston turbine embodying our invention, which consists of the casing which forms the cylinders, the shaft, and the pistons. The casing is provided with three connections 1, 2, and 3 for the attachment of the pipes for conducting live steam to the engine. These connections open into the circumferential live-steam passages 4, 5, and 6, which passages are entirely disconnected from each other. Passing centrally through the casing is a revoluble shaft 7, which carries the three pistons 8, 9, and 10, which are united and rigidly secured on said shaft by means of the keys 11. This three-piston part 12 is more easily made by fitting the sleeve 13 into one end of the same and securing the sleeve to the shaft. Each piston is made up of two side disks or rings with buckets or feathers between them. The small piston 8 has the rings 14 and 15 and the buckets 16. The intermediate piston 9 has the rings 17 and 18 and the buckets 19, while

the third piston 10 has the rings 20 and 21 and the buckets 22. While three pistons are shown, the number may be increased at will, the casing being enlarged by adding on addition-cylinders. The casing here shown is composed of the closed sleeve 23, that furnishes a bearing for one end of the shaft, the part 24, that acts as a cylinder for the pistons 8 and 9, the part 25, that acts as the cylinder for the piston 10, the head 26, and the sleeve 27, that forms the outer bearing.

Each cylinder of this engine is provided with four steam-injectors for the purpose of directing the steam against the buckets of the piston. In Fig. 2 the tubes 28 are shown held in place by the hollow caps 29. The caps are provided with holes 30, which permit the live steam to pass from the passage 4 into the injectors, which direct the steam so as to strike the buckets 16 in a tangential manner to turn the piston. The steam will pass through between the buckets into the space between the walls 14 and 15, where it will expand and pass out again between the buckets into the passages 31 and through them laterally into the space or passage 32. (Shown in Fig. 1.) Because of the curved form of the buckets the force of the steam passing into the piston and its reaction in passing out will be utilized to the fullest extent.

The injectors of the intermediate cylinder are composed of the tubes 33, the nozzles 34, and the caps 35. The live steam passes from the passage 5, through the holes 36, into the nozzles 34, which direct it into the tubes 33. In passing across the spaces between the nozzles 34 and the ends of the tubes 33 the live steam will draw in with it the exhaust-steam from the passage 32 and force it against the buckets 19 of the piston 9, thus using the exhaust-steam a second time. This mixed live and exhaust steam will expand in the piston 9 and pass out between the buckets 19 and through the passages 37 into the passage 38, which surrounds the large piston 10. The large cylinder has injectors composed of the tubes 39, the nozzles 40, and the caps 41. The live steam passes through the holes 42, the nozzles 40, and tubes 39 against the buckets, drawing with it the exhaust-steam in the passage 38. The steam escapes from inside

the piston 10 through between the buckets 22 and passages 43 into the exhaust-space 44 and thence by the exhaust-pipe 45 to the open air or to a condenser.

5 The sleeve 27 is provided at its outer end with means to prevent the shaft from moving endwise, which consist of the flange 46, having bolts 47, on the ends of which is slidably adjustable the disk 48. On the shaft is
10 secured the collar 49 by the pin 50. Grooved rings 51 are let into the flange 46 and disk 48, and balls 52 are placed in the grooves. All parts are adjusted by the nuts on the bolts
15 47. To keep out the dust and hold oil, a tube 53 is tightly fitted over the disk and flange.

To support the engine, the casing is provided with a foot 54.

The operation of the engine is as follows:
20 When steam is admitted through the connections 1, 2, and 3, it will enter the passages 4, 5, and 6, pass through the tubes 28, and strike the buckets 16 of the small wheel, turning the wheel and passing into the piston.
25 Instead of freely exhausting laterally it is confined by the walls of the piston and forced to escape through the angular passages between the buckets, thereby adding to the turning stress on the piston, and finally passing
30 into the passage 32. This passage 32 acts as a receiver where the exhaust-steam may continue to expand before entering the tubes 33. To cause greater impact between this steam and the buckets 19, the nozzles 34
35 are provided to direct live steam into these tubes along with the exhaust-steam. The action in the third piston is the same as in the second, and its increased size renders the attachment of a condenser of greater value.

40 Having now explained our improvements, what we claim as our invention, and desire to secure by Letters Patent, is—

1. In a turbine-engine, a casing, a shaft
45 revoluble in said casing, a plurality of pistons revoluble in said casing, means for directing a jet of steam to act tangentially on one piston, said casing having exhaust-passages for said steam, and means to direct a second jet
50 steam to act tangentially against a second piston and adapted to cause said jet to force the exhaust-steam of the first piston to act tangentially against the second.

2. In a turbine-engine, a casing, a shaft
55 revoluble in said casing, a plurality of connected pistons secured to said shaft and revoluble in the casing, said pistons each comprising walls and a ring of buckets secured near to and between the outer edges of said rings, tubes for directing jets of steam against the
60 buckets of one of said pistons, said casing having longitudinal exhaust-passages at the circumference of the piston opening into a circular passage surrounding an adjacent

piston and injectors for directing jets of steam against the buckets of the adjacent
65 piston and to force the exhaust-steam from the first piston to act on the second.

3. In a turbine-engine, a revoluble cylindrical piston comprising parallel sides and a ring of buckets of angular form extending
70 between said flanges at their outer edges, and forming an acute angle with their circumference, a casing for said piston having circumferential passages for steam of different pressures, injectors forming connecting-passages
75 between said steam-passages and the piston, whereby a jet of high-pressure steam will force the lower-pressure steam against the bucket of said piston to revolve the same.

4. In a turbine-engine, the combination of
80 a plurality of connected revoluble pistons, a casing for said pistons having exhaust-steam passages surrounding said pistons, and live-steam passages surrounding the exhaust-steam passages, and injectors for directing
85 jets of live steam against a piston together with the exhaust-steam from an adjacent piston.

5. In a turbine-engine, the combination of
90 a revoluble piston, a casing for said piston having concentric passages for steam of higher and lower pressure surrounding the piston, and injectors for directing jets of steam of the higher pressure tangentially
95 against the piston together with the steam of lower pressure.

6. In a turbine-engine, the combination of
a casing provided with live-steam inlets, rotary members mounted within said shell and provided with buckets in their peripheries,
100 said casing having preliminary longitudinal exhaust-channels formed in its inner wall to receive exhaust-steam from one piston and deliver it to the other, and also having passages connecting the live-steam inlets, the
105 exhaust-steam passages and the chambers for the pistons.

7. In a turbine-engine, the combination of
a plurality of connected revoluble pistons, a casing for said pistons having exhaust-passages and live-steam passages adjacent to
110 the exhaust-steam passages, and an injector for directing a jet of live steam against a piston together with the exhaust-steam from an adjacent piston.

8. In a turbine-engine, the combination of
115 a revoluble piston, a casing for said piston having passages for steam of higher and lower pressures adjacent to each other, and an injector for directing a jet of steam of the
120 higher pressure against the piston together with the steam of lower pressure.

9. In a turbine-engine, the combination of
a revoluble piston comprising parallel walls and a ring of angular buckets secured near to
125 and between the outer edges of said rings, a

. casing for said piston having passages for
steam of higher and lower pressure concen-
tric with and surrounding the piston, and in-
jectors for directing jets of steam of the
5 higher pressure against the piston together
with the steam of lower pressure.

In testimony whereof we have signed our

names to this specification in the presence of
two subscribing witnesses.

ELLSWORTH S. BRYANT.

HENRY J. BERY.

In presence of—

GEO. W. BARRUS,

EDWARD N. PAGELSEN.