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W. E. & E. F. PRALL.

APPARATUS FOR CONVERTING HEAT INTO POWER.

(Application filed Nov. 12, 1897.)

(No Model.)

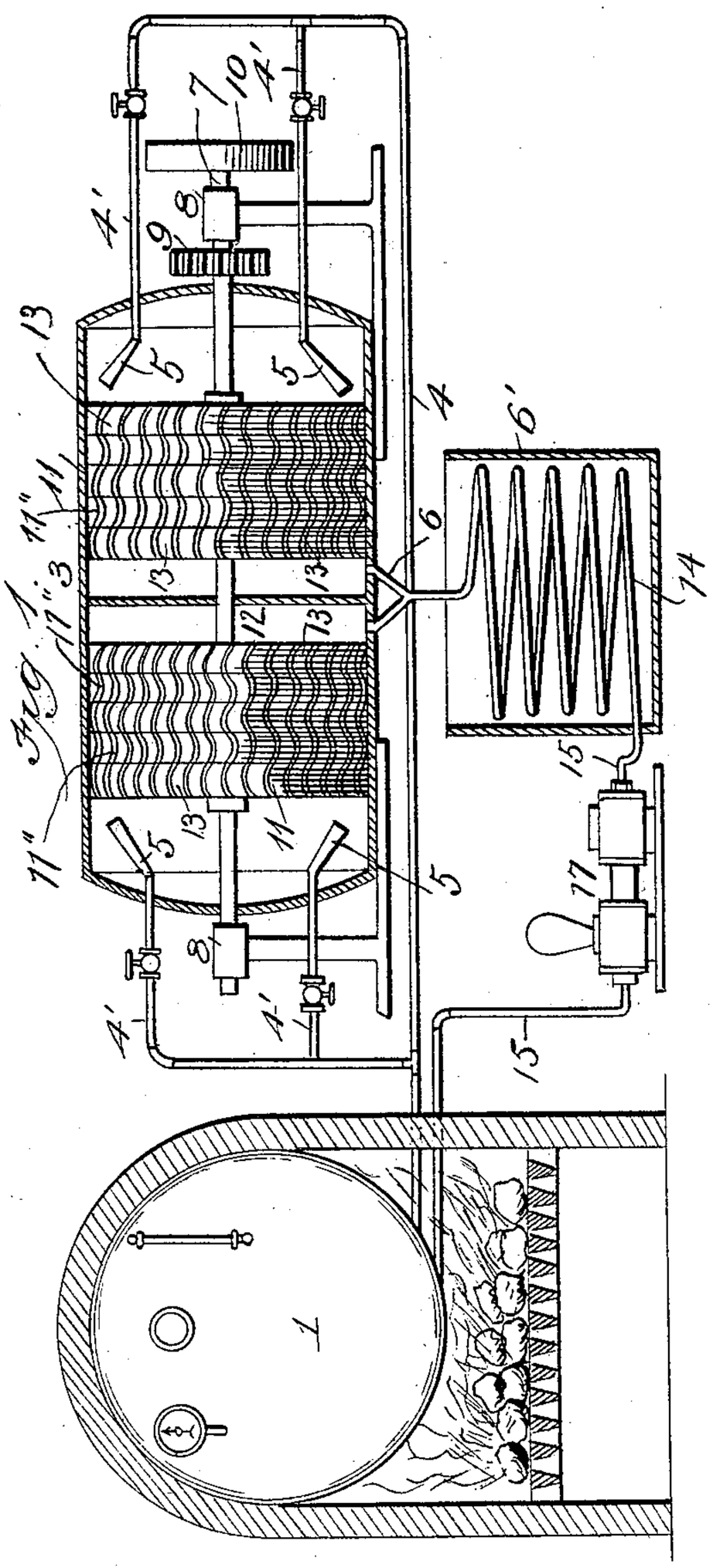

Fig. 1.

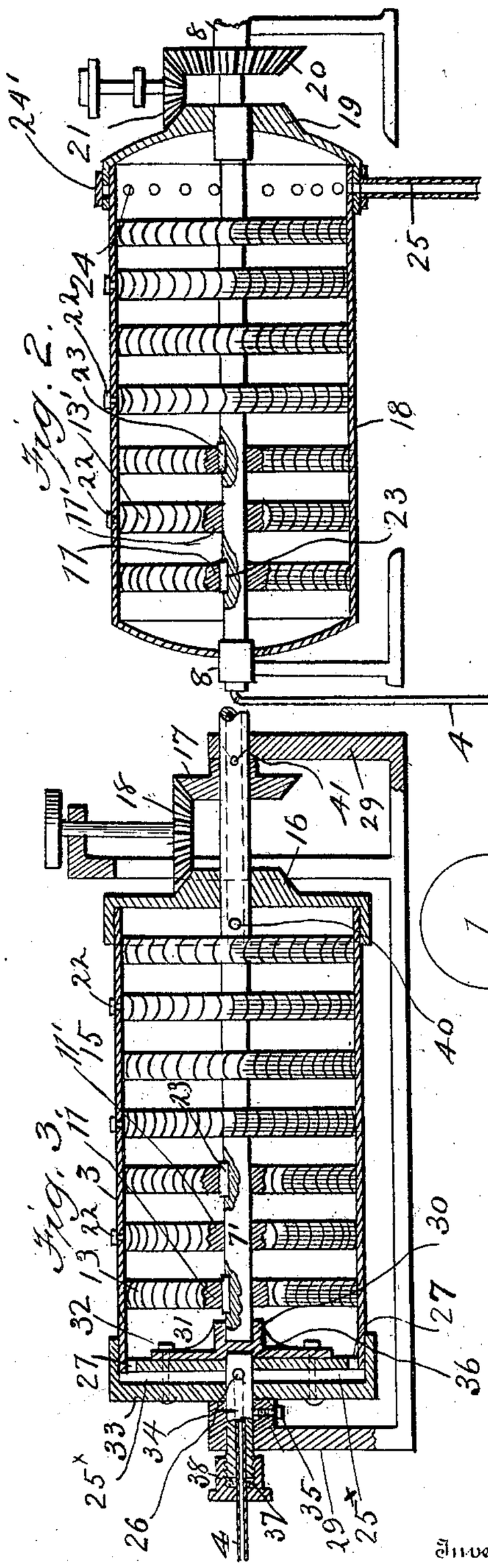

Fig. 2.

Fig. 3.

Witnesses

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APPARATUS FOR CONVERTING HEAT INTO POWER.

SPECIFICATION forming part of Letters Patent No. 610,459, dated September 6, 1898.

Application filed November 12, 1897. Serial No. 658,310. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM EDGAR PRALL and EDGAR FREDERICK PRALL, residents of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Apparatus for Converting Heat into Power; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

The invention relates to rotary engines of the turbine type and to means for operating them by the impact of a fluid. The use of steam has been proposed for such engines, but by reason of its small specific gravity an inconveniently great velocity is required for work.

The object of the present improvement is to use highly-heated water and the pressure due to its heat and the consequent momentum of water or of water mingled with wet steam.

The invention consists in the construction herein described and claimed.

In the accompanying drawings, Figure 1 is a sectional view, partially diagrammatic in character, of an apparatus comprising a rotary shaft and non-rotatable cylinder suitable for practicing the invention. Fig. 2 is a longitudinal section showing both shaft and cylinder as rotatable. Fig. 3 is a longitudinal section showing charging and exhausting devices.

Referring to Fig. 1, numeral 1 indicates a reservoir, tank, or boiler adapted to supply water at a high temperature and under a high pressure. It is not material whether the water is heated in receptacle 1 or heated elsewhere and then charged in said receptacle. It will be understood that the receptacle may be supplied with safety-valves, water and steam gages, and suitable charging and discharging pipes. 4 denotes a pipe whereby water may be conveyed from the tank to the cylinder or case 3. 4′ are branch pipes, preferably connected to the case at each end to supply hot water thereto. 5 denotes the flaring or trumpet-shaped discharge-mouths of said branch pipes. No dimensions are prescribed, but a feed-pipe having a diameter of from one-eighth to one-fourth of an inch or more and a delivering-mouth of about two inches diameter or more would be operative. In operation the wall of the frusto-conical water-discharging mouth acts as an abutment coöperating in the forward propulsion of the fluid. 6 denotes exhaust or discharge pipe branches communicating with the cylinder, one on each side of a partition fixed in the casing. These are situated at the bottom of the case to discharge water. 6′ denotes a condenser. 7 indicates a shaft having bearings 8. 9 denotes a pinion, and 10 a belt-pulley for transmitting power from the shaft. Any appropriate gearing may be employed to drive any vehicle or engine, the extent and character of such gearing being varied and determined by the circumstances of the case. Upon the shaft 6 are fixed disks or blades 11, which may be secured on the shaft by any suitable means. In the periphery of the disks are curved pockets or buckets 13, extending through from face to face of the disks, as indicated. 11″ denote guides fixed in the case to suitably direct the mingled fluid from one annular series of buckets to another. In operation superheated water having, preferably, a temperature of about 400° Fahrenheit or more is discharged into the wheel-case 3 and preferably at each end and in manner to act on the buckets fixed to the rotary blades or disks and rotate the shaft. The water by its impact upon the buckets rotates the shaft, the momentum of the water and commingled steam being highly efficient for this result at a comparatively low speed. In many cases it will be practicable to reuse the water discharged from the wheel and to economize the heat remaining unconverted in it. In the drawings 14 indicates a coil to receive water discharged from the pipes 6, and 15 denotes pipes whereby it may be conducted to a boiler by means of a pump 17. The improvement is not limited to the particular degree of temperature and consequent degree of pressure, which may be varied, provided heated water is conveyed solely to the engine and used as the sole vehicle and agent of heat and power in a turbine wheel, no steam being charged to the admission port or pipe. By returning

the exhaust to the boiler much heat is economized, and, further, it is made possible to lower the initial heat without diminishing the resultant power by means of a forced exhaust or a partial vacum; but we do not desire to claim, broadly, returning water of condensation to a boiler. The object of charging the hot water at opposite ends of the casing is to nullify the end thrust of the charge. The object of charging by means of several branches is to distribute the charge and also provide for varying the quantity by use of valves or cocks in said branches, enabling more or less of the water to be used at any time. For some purposes, as for running light road-wagons, it may not be important to charge water into opposite ends, and the improvement is not limited in this respect.

Referring to Fig. 2, a tank is denoted by 1, and 18 denotes an inclosing case adapted to rotate on the shaft in a direction opposite to the rotation of the shaft itself. 19 is a beveled gear fixed to the casing and loose on the shaft, and 20 is a similar gear fixed on the shaft. These gears mesh with an intermediate gear 21. 8 denotes shaft-bearings. The disks 11 are fixed to the shaft and the disks 11′ to the casing, keys 23 and set-screws 22 being indicated, respectively, for that purpose. The disks 11′ are loose on the shaft and are provided with buckets or pockets 13′, curved oppositely to those in disks 11, in order that the fluid may leave the buckets of each disk in a direction approximately tangential to the proximate part of the buckets in the succeeding disks, the direction of the fluid being reversed between adjacent disks. By this construction sudden reversal of the current is obviated and very favorable conditions are provided for imparting the momentum of the fluid to the shaft, part of the disks being fixed to it and acting thereon directly and the part that is loose on the shaft being made to coöperate by means of the case and intermediate gears, as indicated. 24 indicates exhaust-outlets communicating with a fixed casing 24′, having a final exhaust 25 at its bottom. The object of the numerous ports 24 is to provide at all times an exhaust at the bottom of the cylinder, also that any fluid escaping from the upper ports shall be conducted to a common waste-pipe at or near the bottom of the case.

Referring to Fig. 3, which illustrates modified devices, $25^{\times}$ indicates a chamber in the cylinder-head, and 26 indicates passages whereby water may pass from a charging-pipe 4 into said chamber and to the openings 27, which are adapted to deliver water to buckets 13. The disks 11 and 11′, which may be reduced in thickness between the buckets and hubs, are fastened, respectively, to the shaft and to the case by screws 22 and keys 23 or the like, the disks 11 being loose in the case and disks 11′ loose on the shaft. The case and shaft may be geared together, as indicated and as stated in connection with Fig. 2 or in any known manner, to insure their coöperation in the transmission of power. The exhaust devices may be such as above described or the end of the case can be of spider or other open form to discharge water, vapor, and steam freely. Numeral 7′ denotes a shaft having a bearing in post 29 and in the socket 30. This socket is in a casing 31, secured by bolts 32 to the end of the case 3. A ring or collar 33, fixed to the opposite side of the said case end, receives a short tubular shaft 34, which is fixed thereto by a set-screw 35. The short tube 34 is closed at its inner end, which extends through the case end and has a bearing in a socket in the casing. It also has a bearing in a post 29. 26 denotes perforations whereby the interior of the said tube 34 communicates with the chamber (or with passages) $25^{\times}$, having charging-ports 27 opening into the interior of the case. The outer end of the short tubular shaft 34 has a coupling 38, having a water-tight seat or packing 37 for the supply-pipe. The coupling 38 may be screwed onto the tube 34 or held in any suitable manner. The case at one end is supported by means of the tube 34, which has a bearing in a post 29, and at the other by means of the shaft having a like bearing. The latter is made hollow, and its interior communicates with the case by means of exhaust-exits 40, though such exhaust-ports are not preferred, and particularly if no guides to direct water to such exit-ports are employed. 41 denotes a shoulder fixed on the gear and pinned thereto to prevent its endwise movement. The case and the shaft have fixed to them alternately disks or wheels provided with pockets and are geared together, as indicated and as described in connection with Fig. 2.

It is characteristic of our improvement that hot water held under pressure, the heat and pressure being such that the water when released will flash into steam, is conveyed by a conduit directly to the turbine cylinder or case without development of steam until admission to the cylinder occurs and that this charging of the water is effected by pressure upon the surface of the water in the receptacle, and no claim is made to devices for the injection of water by steam into a turbine or other engine.

Having described our invention, what we claim is—

1. The combination of a receptacle containing superheated water under high pressure, a cylinder containing power receiving and transmitting buckets or the like adapted to be rotated by the impact of water, and a conduit beginning below the water-level in the receptacle and terminating in the cylinder for direct charging of water into the cylinder by equal transmission of pressure through the water in the said receptacle whereby superheated water can be charged into the cylinder and projected together with steam generated in the cylinder against the buckets, and means

for discharging water and steam from said cylinder, substantially as described.

2. The combination of a boiler containing highly-heated water under pressure, a cylinder containing power receiving and transmitting buckets or the like adapted to be rotated by the impact of water, a conduit beginning below the water-level in the boiler and terminating in the cylinder for direct charging of water into the cylinder by equal transmission of pressure through the water in the said receptacle whereby superheated water can be charged into the cylinder and projected together with steam generated in the cylinder against the buckets, means for discharging water and steam from said cylinder, a condenser, and a pump to convey exhaust to the boiler, substantially as described.

3. The combination of a receptacle containing highly-heated water under pressure, the cylinder containing power receiving and transmitting buckets or the like adapted to be rotated by the impact of water, a conduit beginning below the water-level in the receptacle and terminating in the cylinder for direct charging of water into the cylinder by equal transmission of pressure through the water in the said receptacle whereby superheated water can be charged into the cylinder and projected together with steam generated in the cylinder against the buckets, and means for discharging water and steam from said cylinder, comprising exhaust-ports around its periphery, substantially as described.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

WILLIAM EDGAR PRALL.
EDGAR FREDERICK PRALL.

Witnesses:
H. C. TERHUNE,
A. A. WHITING.