(No Model.)

G. J. ALTHAM.

MOTOR.

2 Sheets—Sheet 1.

No. 475,958. Patented May 31, 1892.

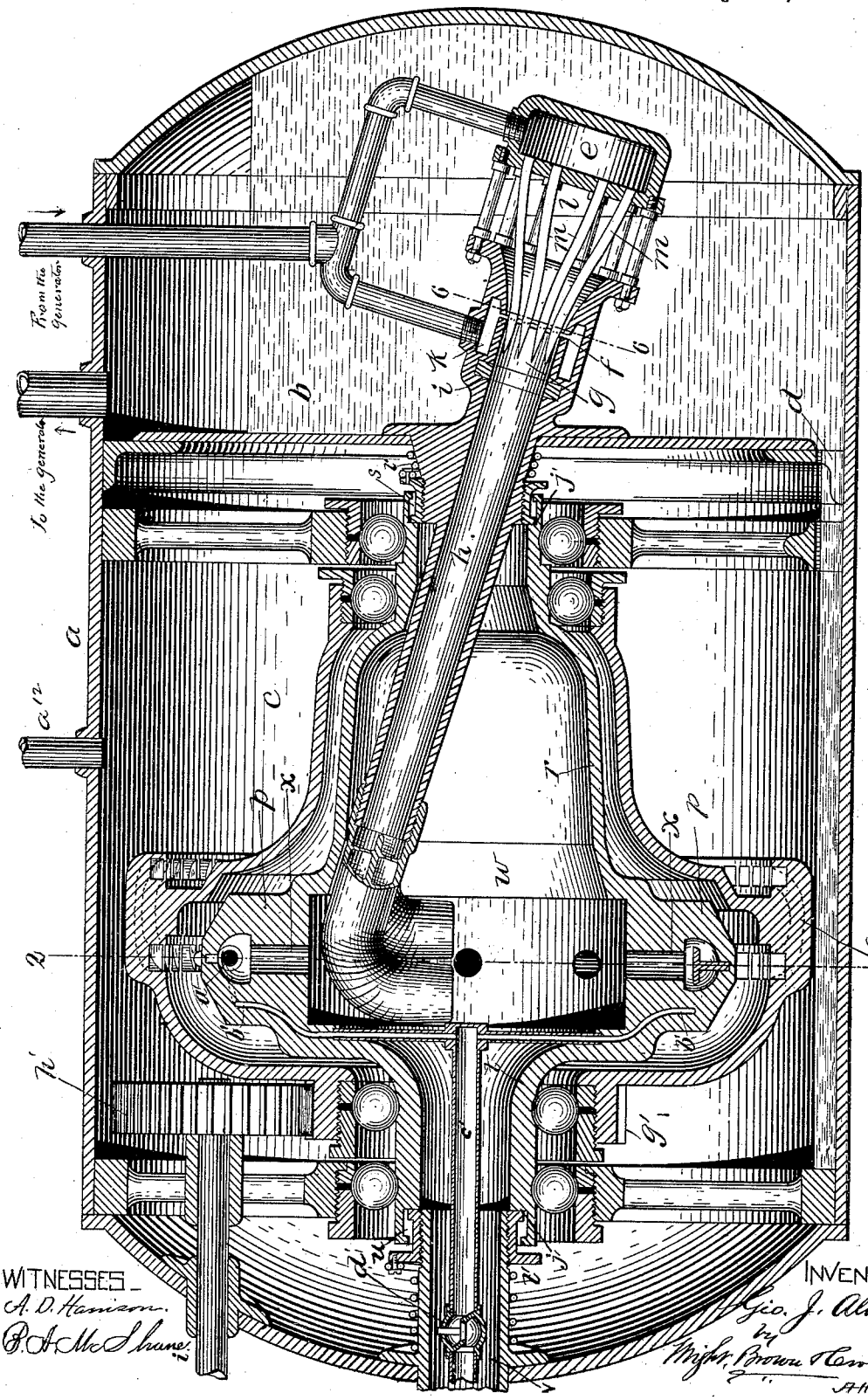

Fig. 1.

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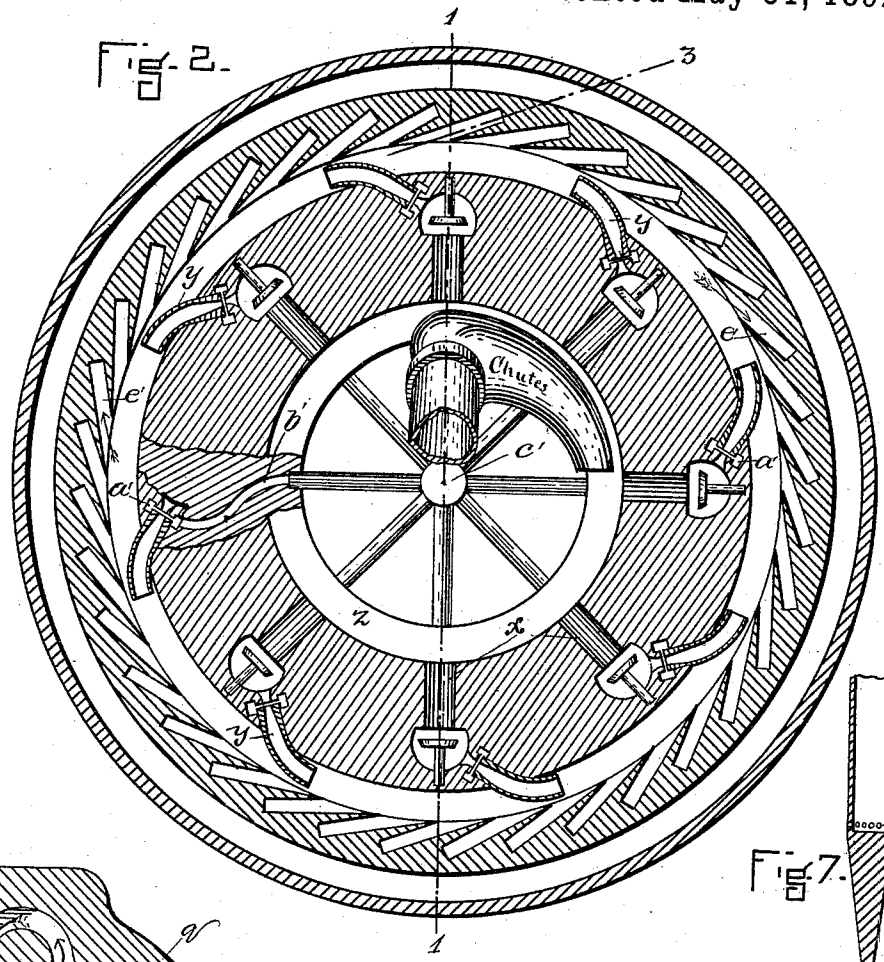
(No Model.) 2 Sheets—Sheet 2.

G. J. ALTHAM.

MOTOR.

No. 475,958. Patented May 31, 1892.

Fig. 2.



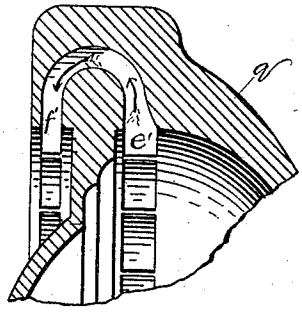


Fig. 3.

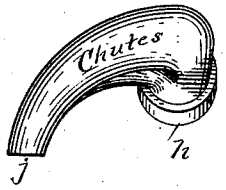


Fig. 4.

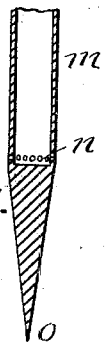


Fig. 7.

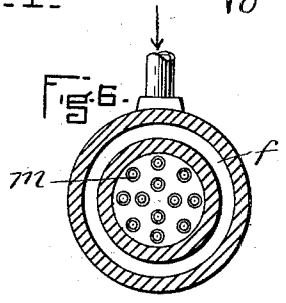


Fig. 6.

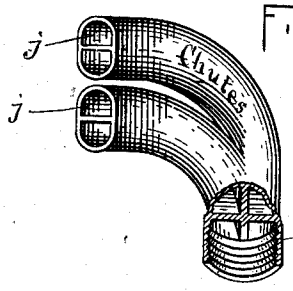


Fig. 5.

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UNITED STATES PATENT OFFICE.

GEORGE J. ALTHAM, OF SWANSEA, MASSACHUSETTS.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 475,958, dated May 31, 1892.

Application filed February 16, 1891. Renewed May 4, 1892. Serial No. 431,755. (No model.)

To all whom it may concern:

Be it known that I, GEORGE J. ALTHAM, of Swansea, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Motors, of which the following is a specification.

My invention is based upon the principles expressed in the natural laws that when a fluid escapes from an orifice its whole potential energy becomes kinetic, that the kinetic energy of the same weight of fluid increases as the square of the velocity of the fluid, and that the velocity of a fluid-jet issuing under pressure from a vessel is inversely as the square root of its density.

The present invention consists of means for carrying out the process described and claimed in an application filed by me January 3, 1891, Serial No. 376,584, which process consists of reducing the density of a fluid by intermixing at the same or approximately the same pressure a second fluid of less density, so that the energy of the lighter fluid may be imparted to the heavier fluid, transforming the original pressure or potential energy of the several fluids into velocity of kinetic energy of the mixture, increasing the pressure and separating the mixture by means of centrifugal force, which is accomplished by reason of the energy of the lighter liquid having been imparted to the heavier and utilizing the increased pressure by its employment as power for mechanical and other purposes. The fluids may be both liquid or both gaseous or one liquid and the other gaseous, so that the fluid of lighter density be capable of intermixture with the denser.

In its simplest form the apparatus comprising the present invention consists of two chambers, one of which, called the "receiver," contains the supply of liquid ready for use, and the other, called the "discharge-chamber," contains the spent liquid which is discharged from the motor; a nozzle, which the liquid enters on leaving the first chamber or receiver and through which it is discharged by the combined action of the gas and the pressure of liquid in the receiver, the gas being also introduced at the nozzle; stationary chutes connected to the end of the discharge-tube, by means of which the proper direction is given to the discharging liquid, and a reaction-wheel which revolves around the chutes and serves as a motor. The interior of the wheel communicates with the atmosphere, while the exterior is in free communication with the second or outlet chamber of the apparatus.

In the operation of the motor the liquid from the receiving-chamber and the gas for intermixing enter the nozzle together and are thoroughly mixed in their passage through, the pressure being slightly reduced by suitable interior construction to allow their thoroughly mixing, and the potential energy formerly stored up in the gas and liquid under pressure is gradually converted into kinetic energy which appears in the form of velocity imparted to the whole mass. The mixture of liquid and gas by this action is finally discharged from the chutes at a high velocity, though under a pressure which is little if any above the atmosphere. The discharge from the chutes takes place into an annular chamber at the inner rim of the wheel, which chamber revolves at approximately the velocity of the mixture issuing from the chutes. The centrifugal force caused by the revolution of the wheel separates the liquid and the gas, the liquid moving radially outward and the gas remaining in the interior. The thickness of the stratum of the liquid at the rim of the wheel must be graduated to produce the requisite velocity of the wheel, so as to avoid loss of power. The gas after separation passes out through the open communication to the atmosphere, while the liquid proceeds through the curved passages in the wheel and by force of reaction, as in a turbine water-wheel, the wheel is made to revolve. Although the pressure of the liquid at its discharge from the chutes has all been converted into velocity, a new and greatly-increased pressure under the action of centrifugal force or tendency is exerted in the stratum of liquid in the wheel, and when the liquid is discharged from the wheel this pressure is reduced to the original pressure of the gas and extends throughout the outlet-chamber and back into the first or receiving-chamber. The whole apparatus is therefore under a pressure equal to that of the gas, excepting the interior of the wheel and the passage between the nozzle and the ends of the chutes.

Having referred to the principles on which the new motor works, the actual apparatus may now be described, reference being had to the accompanying drawings, of which—

Figure 1 is a longitudinal section through the whole apparatus. Fig. 2 is a cross section through the wheel on the line 2 2, Fig. 1. Fig. 3 is a detail section taken on the line 3 3, Fig. 2. Figs. 4 and 5 are detail views of the discharge-chutes. Fig. 6 is a sectional detail taken on the line 6 6, Fig. 1. Fig. 7 is a sectional detail of the end of a gas-admitting tube, drawn to an enlarged scale.

The apparatus is inclosed in a cylindrical vessel *a*, which is provided with a head at each end, both of which are closed, with the exception of the openings for the shaft and tubes hereinafter mentioned. This vessel is divided into two chambers *b* and *c*, which communicate with each other by an opening at the bottom at the point *d*. When the apparatus is in working order, the receiver-chamber *b* is filled with the liquid which operates the motor and the discharge-chamber *c* is empty, with the exception of the spent liquid, which is on its way back to the "receiver-chamber." The part which I term the "nozzle," through which the liquid and gas enter, is shown at *e f g*, which is separated from the tube *h*, into which the mixture of liquid and gas is discharged by means of a gate *i*. The nozzle is composed of two distinct parts, the chambers *e* and *k* and the chambers *l* and *g*. The chambers *e* and *k* receive gas from the outside of the apparatus through appropriate tubes. The chamber *l* is in free communication with the receiver-chamber *b* and receives liquid from that point. The chamber *l* gradually converges to the point *f*, where there is an opening between the chamber *k* and the tube *h*, which completely encircles the tube. One supply of gas escapes into the tube from this opening, and a second supply is furnished from the chamber *e* by means of a number of small tubes *m*, which extend from the chamber *e* to the point *f*. These tubes, which are distributed at uniform distances throughout the whole space, (in the manner shown in cross-section in the detailed drawing, Fig. 6,) are closed at the ends, and the gas escapes from them into the chamber *l* through small holes *n*, Fig. 7, drilled in the circumference of the tube *m*. These holes are located as nearly opposite as may be to the circular outlet of the chamber *f*. Beyond these openings each gas-tube is extended a certain distance and drawn down to a point shown at *o*, and by this means the space extending from the point *f* to the point *g* gradually enlarges in cross-section. By this arrangement of the nozzle from *f* to *g* the velocity of the liquid as it traverses this section is reduced and a certain amount of kinetic energy takes the form of a reduction of pressure, which at once causes the aeriform fluids to flow in and intimately mingle with the liquid, and the mixture then issues into the parallel or converging tube or a combined parallel and converging tube *h*. In this tube the potential energy of the liquid and gas is converted into the kinetic energy of motion, and the mixture passes through the tube *h* at a gradually-increasing velocity on the principle that a fluid flowing toward an area of reduced pressure will throw its whole energy into velocity. The nozzle and the tube *h* are held stationary in the partition which separates the chamber *c* from the chamber *b*. The direction of the nozzle and tube with reference to the axis of the motor is somewhat inclined, so as to facilitate discharge from the tube to the wheel *p*. At the end of the tube *h* an outlet piece or "chute" *g*, as it may be called, is attached for the purpose of guiding the discharge of liquid and gas in the proper direction as it is supplied to the wheel *p*.

The complete apparatus here shown contains a double wheel, the main wheel being the inner one *p* and the supplementary wheel the outer one *q*. The wheel *p* is provided with a bell-shaped cover *r* at the inlet end, which surrounds the tube *h*, and at the extreme end it is provided with a packing-box *s*, which seals the communication at that point with the chamber *c* and at the same time forms a roller-bearing on which the inner end is supported and turned. The opposite end of the wheel *p* is closed in by means of the casing *t*, which is prevented from communicating with the chamber *c* by means of another packing-box *u*, and this casing also serves for a support and bearing for this end of the wheel. The interior of the bearing at this end communicates with the atmosphere, as at *v*, by which means the whole interior *w* of the wheel *p* is likewise open to the atmosphere. The base of this wheel, referring to Fig. 2, contains a number of radial openings *x*, which extend nearly through to the periphery of the wheel, each terminating in a tangential tube *y*, the outlet of this tube having a direction which lies in a tangent to the periphery of the wheel. The mixture of liquid and gas discharged from the chute collects in the annular space *z*, which is close to the inside circle of the wheel *p*, and here the gas which has been previously mixed with the liquid is separated by the centrifugal tendency of the liquid and escapes from the liquid at its interior surface. From the point *z* the liquid thus separated passes outward through the openings *x* into the tangential tubes *y*. Here by force of reaction the escape of the liquid causes the wheel *p* to revolve.

In the form shown in Fig. 2 the tangential tubes *y* are fitted as aspirators, arranged at such an angle as will enable the fluids to pass through them in a line nearly right and radial. When the device is operating, in order that very little centrifugal force may be imparted to the fluids by the revolution of the apparatus, to the end that the intimate mixture of air and the comparatively heavy liquid may not be disturbed by the centrifugal

force, they are composed of two parts separated by an opening communicating with an exterior chamber a', encircling the tube y. This exterior chamber is placed at the point of smallest section of the aspirator, the section gradually decreasing in area from each end up to this point. The encircling chamber a' communicates by means of the pipes b' with the tube c', (shown in Fig. 1,) and thereby through a check-valve d' to the atmosphere.

The object of the aspirators is to draw in air by the suction produced by the passage of the liquid through the aspirators, and thereby secure a mixture of air and liquid on its passage from the tangential tubes. This air, it may be remarked, is drawn in for the purpose of providing a supply of air under pressure to be used in a separate apparatus for the oxidation of a hydrocarbon under pressure for working the motor when that gas is one formed by combustion in the exterior vessel. When the aspirators are used in connection with the apparatus, the air passed through the wheel into chamber c maintains a sufficient working pressure, and when the apparatus is worked without the aspirators the working pressure is maintained by introducing the steam or gas into the chamber c, in which chamber I preferably apply and maintain the pressure.

The second wheel q completely surrounds the inner wheel p and revolves upon roller-bearings in a similar manner to the plan carried out for the inner wheel. The employment of this wheel when its use is desirable furnishes a means for taking power in varying quantities, or none at all, without affecting the operation of the inner wheel and enables that portion of the energy of the liquid which has not been given out to the inner wheel p to be utilized. The liquid or mixture of liquid and air escaping from the tangential tubes $x\,y$ of the inner wheel enters the tubes e', contained in the outer wheel, and these tubes are so shaped that the liquid takes an opposite turn, as indicated by the arrows, and escapes into the chamber c through the opening f'. By this means the outer wheel revolves in the same direction as the inner wheel, but at a greatly-reduced speed.

The passage of the liquid through the two wheels under the action of the centrifugal tendency enables the liquid to be discharged from the outer wheel under the full pressure of the chamber c, which also corresponds to that in chamber b, and at the same time without any velocity relatively to the earth. The liquid on its escape from the outer wheel drops to the bottom of the chamber c and in the end finds its way back to the chamber b, from which it started.

If, as in the apparatus here shown, the liquid is charged with air drawn in by the use of the aspirators, the air on its escape to the chamber c is immediately separated from the liquid and it is carried off through a pipe attached to the chamber b.

The motion of the outer wheel q is communicated to the outside of the apparatus by means of a gear g', attached to the hub of the outer wheel, which works in a gear h', attached to the driving-shaft i'.

The packing-boxes $s\,u$ at the two ends of the inner wheel are self-packing. There is a ground joint j' between the end of the hub and the face of the packing. The packing is threaded upon the frame and somewhat loosely fitted, so that when revolved upon the thread it moves toward or away from the joint, as the case may be. A spiral spring l' encircles the frame, being securely attached thereto at one end and being attached at the other end to the packing. By suitable tension on this spring this arrangement provides that the packing shall always be forced against the joint with sufficient pressure to overcome the friction, and thereby always to maintain a tight joint.

I do not confine myself to the precise form and arrangement of parts here shown, as these may be varied without departing from the nature or spirit of the invention.

Having thus explained the nature of my invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be constructed, I declare that what I claim is—

1. A motor comprising in its construction a reaction-wheel, a nozzle adapted to receive fluids under pressure, a tube connected with said nozzle and extending into said wheel, and stationary chutes connected with the end of the tube and arranged to discharge the fluids tangentially with respect to the inner circumferences of the wheel, and a supplementary wheel outside of the reaction-wheel to receive the discharge therefrom, as set forth.

2. A motor comprising in its construction a reaction-wheel provided with a cover r, a nozzle adapted to receive fluids under pressure, a tube connected with said nozzle and extending into said wheel, the tube being inclined with respect to the axis of the wheel and cover, and stationary chutes connected with the end of the tube and arranged to discharge the fluids tangentially with respect to the inner circumferences of the wheel, as set forth.

3. A motor comprising in its construction a receiving-chamber and a discharge-chamber, a reaction-wheel, a nozzle adapted to receive fluids under pressure, a tube connected with said nozzle and extending into said wheel, and stationary chutes connected with the end of the tube, the interior of the wheel at its center communicating with the atmosphere and having communication at its periphery with the discharge-chamber, as set forth.

4. A motor comprising in its construction

a receiving-chamber and a discharge-chamber, a reaction-wheel, a nozzle adapted to receive fluids under pressure, a tube connected with said nozzle and extending into said wheel, and stationary chutes connected with the end of the tube, and a wheel surrounding the first-mentioned wheel, the interior of the latter wheel at its center communicating with the atmosphere and having communication at its periphery with the surrounding wheel, which in turn communicates at its periphery with the discharge-chamber, as set forth.

5. A nozzle for mixing fluids under pressure, embracing in its construction the chamber *g* and the annular chamber *k*, communicating therewith, the chamber *e*, communicating with chamber *g* by means of pipes or tubes, and the intervening open chamber *l* between the chambers *e* and *g*, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of February, A. D. 1891.

GEORGE J. ALTHAM.

Witnesses:
ARTHUR W. CROSSLEY,
A. D. HARRISON.