J. & E. Hartman,

Rotary Steam Engine.

No. 21,494. Patented Sep. 14, 1858.

Fig. 3.

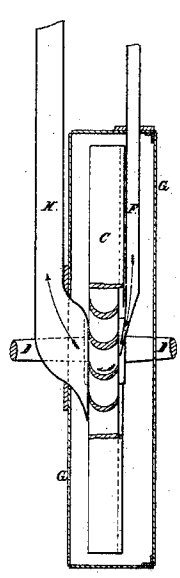


Fig. 6.

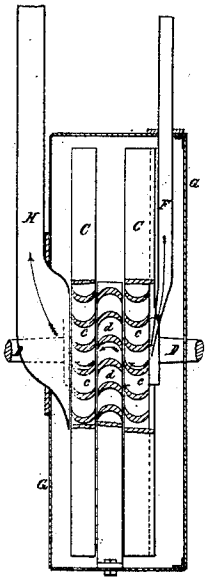


Fig. 5.

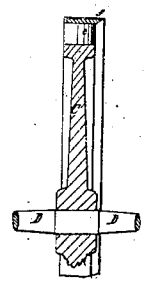


Fig. 4.

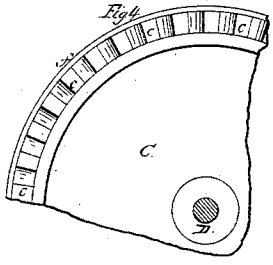


Fig. 1.

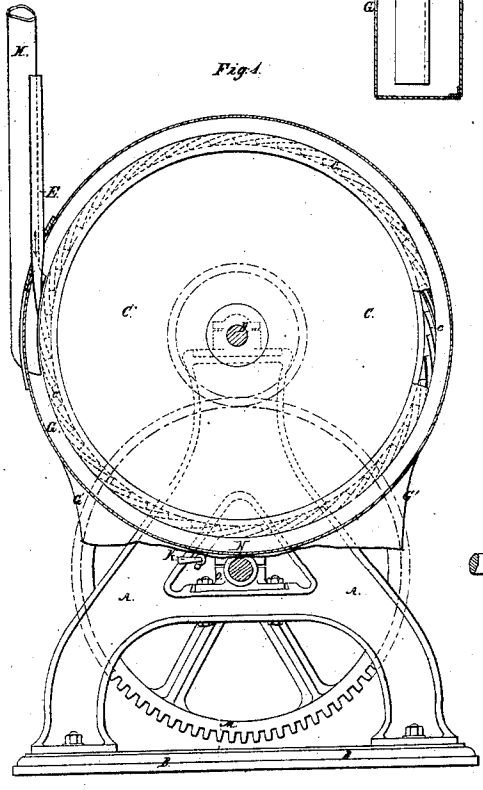
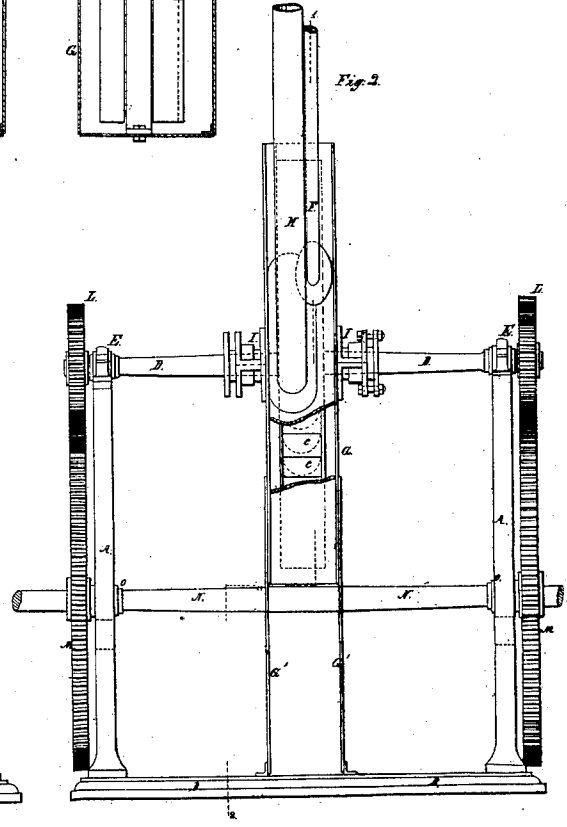


Fig. 2.



UNITED STATES PATENT OFFICE.

JOHN HARTHAN AND EZRA HARTHAN, OF TIMBERSBROOK, NEAR CONGLETON, ENGLAND.

ROTARY STEAM-ENGINE.

Specification of Letters Patent No. 21,494, dated September 14, 1858.

To all whom it may concern:

Be it known that we, JOHN HARTHAN and EZRA HARTHAN, of Timbersbrook, near Congleton, in the county of Chester, England, silkmen, have invented an Improved Engine for Obtaining Motive Power; and we declare that the following is a full, clear, and exact description of the principle or character which distinguishes it from all other things before known and of the usual manner of making, modifying, and using the same, reference being had to the drawings hereunto annexed and to the letters and figures marked thereon—that is to say:

Our said invention relates to a system or mode of obtaining motive power by the aid of a rotary engine of a peculiar construction which may be worked either by steam or compressed air whereby the direct pressure in conjunction with the reactive force of the propelling medium is made available.

The engine which we propose to employ consists essentially of a plate wheel made as light as possible consistent with the power to be exerted by the engine and fitted or formed at or near its periphery with a number of peculiarly constructed projections forming chambers somewhat similar to the buckets of an overshot water wheel. Each chamber is divided from its neighbor by a thin metallic plate which is curved and inclined a little toward the center of the wheel such plates being placed nearly parallel to each other. Each plate slightly overlaps the other and the bottom or lower part of each chamber is made of a curved or nearly semicircular form the curve commencing immediately at one side of the mouth and terminating in the same lateral line so as to extend from side to side of the chamber or in the direction of the axis of the wheel. Care should be taken to balance the wheel accurately on its axis. A jet or jets of steam or air is or are brought to play into these spaces or chambers entering therein nearly at a tangent to the periphery of the wheel, or the jet or jets may be so directed as to enter the chambers at the sides but in a direction nearly tangential to the circle or chambers. The chambers in this latter case are closed at their circumference and open only at their sides. The steam or air on issuing from the jet enters the spaces or chambers on one side impinges against and passes over surfaces of the curved bottoms thereof and issues out on the other side of the spaces nearly in an opposite direction to that at which it entered, thus imparting its force to the wheel by pressure and reaction and causing it to revolve. The power of these engines is regulated by the size of the jet pipe and the size of the chambers is regulated by that of the jet.

The mouth of the jet pipe is curved and beveled to conform to the periphery of the wheel when the openings of the chambers are made in the periphery. The velocity of the wheel should be so adjusted that the chambers will never attain the half of the velocity of the jet or jets of steam or air and a discharge pipe should be so placed that its mouth may be at the opposite side of the chambers and the mouth of this discharge pipe should extend over three or four of the spaces or chambers for the purpose of more readily carrying off the steam or air after impinging on the interior of the chambers. The mouth of the discharge pipe may be curved and expanded to fit the periphery or the side of the wheel according to the arrangement of the chambers. The speed of the wheel may be brought down by the aid of gearing or friction pulleys of any suitable description.

An iron frame or casing incloses the wheel and is made concentric therewith over the whole or a portion of its circumference and the supply and discharge pipes are made to pass through this casing. The spindle of the wheel may work through stuffing boxes in the sides of the casing of the wheel and a small pipe or cock should be fitted to the bottom of such casing to carry off condensed steam where steam is employed. The spaces or chambers in the periphery of the wheel may be varied in their position, as for example, they may commence at the periphery and turn inward toward the center and may terminate at any intermediate point between the circumference and the center but the discharge pipe must always be correspondingly adjusted so as to receive the issuing steam or air. The jet pipe may also if found desirable be placed at an intermediate point between the center and the periphery of the wheel but in all cases the bottoms of the chambers are curved from side to side.

Engines of this description may be worked either vertically horizontally or obliquely and may be worked singly or in combination with others under the ordinary atmospheric pressure or *in vacuo* by inclosing each wheel

or engine in a separate air tight casing in which casing the steam or air may be made to pass by means of a suitable pipe from one wheel to the next. According to this arrangement the area of each succeeding jet must increase as the density of the fluid diminishes; and in order that our said invention may be fully understood we shall now proceed more particularly to describe the same and for that purpose we shall refer to the several figures on the sheet of drawings hereto annexed the same letters of reference indicating corresponding parts throughout all the figures.

Figure 1 of the annexed sheet of drawings represents a transverse vertical section of one modification of our improved engine taken along the line 1—2 in Fig. 2, and Fig. 2 is a corresponding side elevation of the same partly in section. Figs. 3 and 4 represent other modifications which we shall hereinafter fully describe and refer to.

A, A, are two cast iron standards which may be bolted or not to a bed plate B. These standards serve to carry the several parts of the engine and gearing connected therewith.

The engine itself consists of a plate wheel or disk C mounted upon a shaft D which works in ordinary plummer blocks E, E, on the main standards A. The periphery of this wheel is fitted or formed with a series of spaces or chambers *c* shown in dotted lines and partly in section in Fig. 1. These chambers in this arrangement present somewhat the appearance of the buckets of an ordinary overshot water wheel but in place of the bottoms of the chambers being flat they are curved from one side of the chamber to the other in the direction of the axis of the wheel as shown at *c*, *c*, in Figs. 3 and 4. The propelling medium which may be either a jet or jets of steam or air, is brought to bear successfully upon the several chambers of the wheel by means of the jet pipe F. This pipe is inserted into the casing G (surrounding the wheel C and supported by the plates G^1) and is extended inside the casing for the purpose of bringing the jet orifice into close proximity to the mouths of the chambers *c* in the periphery of the wheel but without actually touching them. This jet pipe is placed near one side or edge of the periphery of the wheel the opposite side or edge having an exhaust or escape pipe H placed in close proximity thereto as will be clearly understood on referring to Fig. 2 of our drawings.

The steam or air may be supplied from any suitable generator or reservoir with which the jet pipe F should be in direct communication and this pipe should be fitted with the ordinary stop valve and throttle valve or regulator used for steam engines whereby the engine may be readily stopped started and controlled in its movements, any convenient governor being used for that purpose. The jet of steam or air impinges when the stop valve is opened on the curved bottom of one or more of the chambers *c* and imparts a rotatory motion to the wheel C, thereby bringing the next chamber under the influence of the jet and so on throughout the entire series. The wheel will consequently continue to rotate so long as the jet is in action. When the steam or air has struck one side of the bottom of the chamber the curve will divert it in the direction of the discharge pipe H, placed at the other side of the series of chambers. The mouth of this discharge pipe is expanded so as to embrace four or more of the chambers and should be placed as nearly as possible in the direction in which the steam or air issues from the chambers the more readily to allow of the free escape thereof from such chambers. By this arrangement we turn to account not only the first pressure of the jet but also the reactive force which it exerts on its leaving the chambers.

If found desirable the engine may be worked with low pressure steam in a vacuum in which case the shaft D may work through stuffing boxes I, I, fitted into the casing G, as shown in the drawing. The stuffing boxes and their glands should be made in two halves to admit of their being readily fitted on to the shaft. A small discharge cock K should also be fitted into the bottom of the casing for the purpose of drawing off any condensed steam which may collect therein.

The speed of the engine may be brought down by proper gearing and for this purpose we propose to key a small spur wheel or pinion L on to each extremity of the engine shaft which wheels or pinions severally gear into the large spur wheels M fast on the second motion shaft N. This shaft is carried in bearings O, O, in the lower or other convenient portion of the main standards and may be continued or extended on either side of the engine as shown in the drawings for the purpose of driving any machinery required.

Fig. 3 represents a front elevation and partial section of another modification of the wheel C detached.

Fig. 4 is a detail side elevation of a portion of the wheel and Fig. 5 is a corresponding section of the same taken along the axis of the wheel. According to this arrangement of the chambers *c*, *c*, in place of being open at the periphery of the wheel are open at the sides. The bottoms of the chambers are however still made of a curved form, but as they are open at the sides only the ject pipe must be so disposed as to direct the jet laterally into the chambers and as nearly as possible in a direction tangen-

tial to the motion of the wheel. In this modification the mouth of the jet should be so constructed as to be rather less than the width of the openings of the chambers taken in the direction of the radius of the wheel. It is obvious that the action and reaction of the jet in this second modification will be identical with that of the first described arrangement. A projecting rim *f* on the side of the wheel next to the jet pipe serves to direct into the chambers any steam which may escape from the jet pipe along the side of the wheel.

Fig. 6 represents a detail of a third modification wherein we propose to employ two wheels C, C^1, each precisely similar to the wheel in the last described arrangement both of such wheels being fast on one shaft D. A space is left between the contiguous faces of these wheels for the reception of four or more returning chambers *d*, *d*, the bottoms of which are curved in a direction opposite to that of the bottoms of the chambers *c*, *c*, in the wheels. These chambers in other respects are precisely similar to those in the wheels and are fitted to a rim which is bolted or otherwise secured to the interior of the casing G. The jet and discharge pipes are disposed in a similar manner to those in Fig. 3 namely at the sides of the wheels the jet pipe F being at the side of one wheel and the discharge pipe H on the opposite side of the second wheel. The jet on being first introduced impinges against the curved bottoms of the chambers in the wheel C^1, and is thence diverted against the fixed chambers *d*, *d*, whence it is again diverted onto the curved bottoms of the chambers in the second wheel C and finally passes off by the escape pipe H in the manner previously described.

Care should be taken in working the engine that the speed of the wheel or wheels in the various modifications which we have described be so adjusted or regulated by the governor that the velocity of the revolving chambers shall never attain the half of the velocity of the actuating jet as by this mode of working the engine the greatest economy of fuel will be obtained. We prefer to so regulate the velocity of the chambers that it shall be about from one third to four tenths of that of the steam or air as it issues from the jet pipe. The form of jet pipe which we prefer to use is a pipe the mouth of which is contracted from the greatest to the smallest diameter by an inward curve as shown in our drawings.

Having now described and particularly ascertained the nature of our said invention and in what manner the same is or may be used or carried into effect we may observe that we are aware that rotatory engines consisting of wheels having a number of projections formed or fitted upon their peripheries and actuated by the impingement of steam or air against such peripheral projections or chambers have long been known in this country and therefore we lay no claim to the principle of such arrangement. We may also observe that we do not confine or restrict ourselves to the precise details or arrangements which we have had occasion to describe or refer to as variations may be made therefrom without deviating from the principles or main features of our said invention; but

What we consider to be novel and original and therefore claim as the invention secured to us by the hereinbefore in part recited Letters Patent is—

1. The system or mode of obtaining motive power by causing steam or air to impinge upon a series of chambers with curved bottoms, arranged around a wheel at or near the periphery thereof as hereinbefore described.

2. The general constructions and arrangements of machinery or apparatus for obtaining motive power as hereinbefore described.

In testimony whereof we have signed our names to this specification before two subscribing witnesses.

JOHN HARTHAN.
EZRA HARTHAN.

Signed in the presence of—
J. HENRY JOHNSON,
JAMES HUNT.