J. COOKE.
Pumping-Engine.

No. 218,234. **Patented Aug. 5, 1879.**

FIG. 1

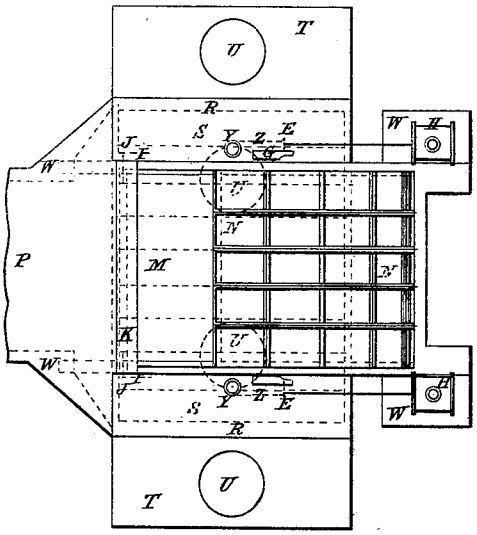


FIG. 2.

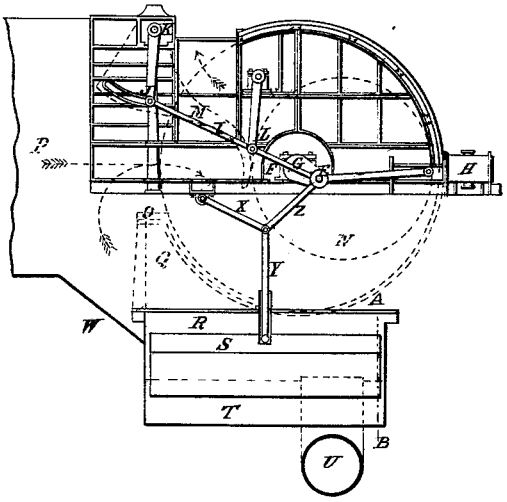


FIG 3.

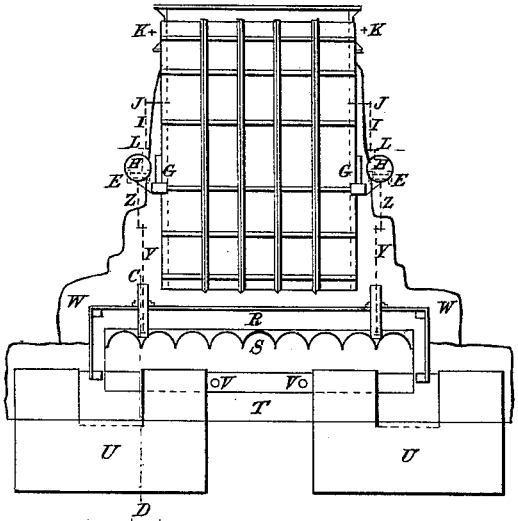
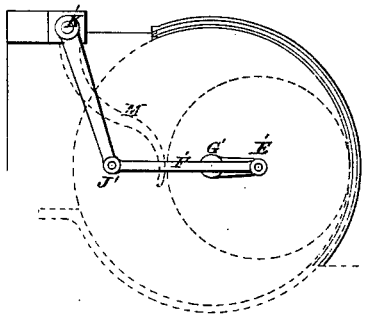


FIG 4.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN PUMPING-ENGINES.

Specification forming part of Letters Patent No. **218,234**, dated August 5, 1879; application filed October 25, 1878; patented in England, April 20, 1868, March 6, 1875, and March 15, 1875.

To all whom it may concern:

Be it known that I, JOHN COOKE, of Langley Old Hall, in the county of Durham, England, have invented certain new and useful Improvements in the Construction of Rotary Pumping-Engines, of which the following is a specification.

This invention consists of a novel construction and arrangement of such rotary pumping-engines as have a cylindrical piston or drum rotating eccentrically in a cylindrical casing, so as to sweep out its contents or be revolved or actuated by the pressure of the fluid or gas, and which have also a shutter constantly kept near to or in some cases touching the same, and passing in and out through a suitable port in the circumference of the casing, of the same length as the piston, in such a manner as to divide the inlet from the outlet of the rotary engine or pump, and also in such a manner as to prevent leakage while the piston is passing the port.

Such rotary pumping-engines, in order to be subject to the minimum of friction, are either made not to touch or to touch very lightly at their lines of cylindrical contact, the required closeness or contiguity of the shutter being preserved by the use of a connecting rod or rods, the length of which is determined either simply by that of the radius of the cylindrical piston or drum added to that of the arc of the shutter contiguous to the same, and also to any amount of clearance which may be adopted for each special case, or, where this construction is not suitable, by a fixed proportion to the before-mentioned total length derived from "the angle of construction," a term which will be understood by mechanists upon reference to the drawings.

The center of the arc of the shutter contiguous to the drum in the simple case before referred to has a pin or pins for connection to one or more cranks or eccentrics on the drum-shaft, the angular position and the center of the throw of which is the same as that of the drum.

Such an arrangement preserves the requisite contiguity of the drum and the shutter, and also provides for the prevention of leakage while the drum is passing the port—that is to say, that part of the casing which is left out in order to allow free passage for the fluid and for the reciprocation of the shutter.

In the most approved arrangement of the apparatus now being described the shutter is fixed on a shaft parallel to the drum, and so placed that the center from which the curve at the lower part of the shutter is struck is as nearly as possible in a radial line from the center of the casing when at the opposite extremities of its oscillation, and has keyed on it an arm or lever, the position of which is shown in the drawing marked Figure 4, hereunto annexed, and the length of which corresponds to the distance between the center of such shaft and the before-mentioned center from which the curve at the lower part of the shutter is struck, and such curve is (either wholly curved or otherwise) extended far enough when moved out of the casing to shut onto a curved ledge projecting from the same, and remain closed while the extremity of the drum is passing the port.

The effect of this arrangement is such, for approximately one-fourth of the revolution, that the shutter alone prevents leakage, and the drum and shutter together effect this for the rest of the time.

The connecting-rod may obviously be shortened or lengthened at will to adjust the clearance to the requirements. This action of the apparatus in its simple form gives rise to an interruption of the flow and inequality of work which has hitherto in many applications rendered necessary the use of two such rotary engines, so that while the shutter has been closed in one the other has been open for the flow of fluid.

By the use of the "differentiator" provided by this invention, one such rotary pumping-engine is enabled to produce a flow approximately as equable as that hitherto produced by two. This differentiator, which is shown at the lower part of the side elevation, (marked Fig. 2 in the drawings hereunto annexed,) consists of one or more platforms or diaphragms swung, suspended, or carried in a case, and connected on one side to the passage where the equable flow of the fluid or gas is required, while the other side thereof is open, as shown in the drawings, to communicate freely with the atmosphere by the conduits or

passages U U, or it may be connected in like manner to the other passage.

Before proceeding to refer particularly to the drawings, it is necessary to explain a useful modification of the construction of the rotary pumping-engine itself, as shown at the upper part of the side elevation. (Marked Fig. 2.)

The vibration of the shutter, arising from a given proportion of the stroke of the drum to the length of the shutter, from the center of its shaft to the center from which the curve at its extremity is struck, and the length of the connecting-rod, is always through the same angle for any given corresponding angle of the drum, whatever the scale may be. Hence by introducing a secondary rocking shaft at a distance from the center of the casing, having some definite proportion to that of the shutter-shaft, and maintaining precisely the same proportion in the lengths of the substituted vibrating levers or arms and of the substituted connecting rod and crank or eccentric, precisely the same angle is developed in the substituted levers or arms for any given movement of the drum, and this may be transferred to the shutter, so as to give quite accurately the desired result by any parallel movement; but the simplest parallel movement, and varying as little from a rectangle at one extremity of its oscillation as at the other, is described herein, and presents the simplest strains and least wear of the parts.

It should here be stated that the connecting-rod can be varied to alter the clearance, bearing in mind the special proportion of the case.

I will now proceed to refer to the accompanying drawings, from which the nature of my said invention will be more clearly understood.

Figs. 1, 2, and 3 show the arrangement of a rotary pumping-engine constructed according to this invention, for the purpose of mine-ventilation, with the proportion of parts one-half, and Fig. 4 illustrates the more simple form to which the differentiator may be applied. Fig. 1 is a plan horizontal view with some parts shown dotted through. Fig. 2 is an end elevation with some parts dotted through, and is partly in section through the line C D of Fig. 3. Fig. 3 shows a back elevation, partly in section, through the line A B, Fig. 2.

Similar letters refer to similar parts in the four figures.

On the drum N being moved in the direction of the arrows the air inclosed in the casing at the upper side of the drum and shutter is expelled, and at the point where the drum ceases to be in contact with the casing the shutter M closes onto the ledge O, and remains so closed until the revolution of the machine permits it to open with the drum at the lower part of the casing. During this part of the revolution very little air is extracted from the mine by the drum, the shutter being closed or acting prejudicially for a great part of the semi-revolution, which commences a little (about twelve degrees, more or less) before the drum becomes vertical. As nearly as possible when this is occurring the platform S in the casing R is made to descend by means of the links Y and Z, attached to the crank-pin E and guided by the radius-rod X, the platform being in this instance shown to have a trunk-guide. The effect of this descent of the platform is to extract about one-half of the quantity of air from the mine, which the drum will in its revolution expel, and this is done exactly in the least useful semi-revolution of the drum.

During the other or most useful or ascending semi-revolution of the drum, and when the bulk of its work is being done, the pressure of the atmosphere, which has free access beneath the platform through the passages *u u*, tends to assist the revolution of the drum and support its own weight, and at the same time, when the drum nearly reaches the position shown in the drawings, is furnishing, say, one-half of the air which is being extracted by the drum. The general effect of this action is to exhaust from the mine during each semi-revolution of the drum about one-half of the total quantity per revolution, and so to equalize to a considerable extent both the work of the engine and the pressure and flow of the air immediately adjoining the upcast shaft or ventilating-drift.

The platform in the drawings is constructed of iron or steel sheets bent to radius, and fixed between iron or steel plates, so as to be strong enough with the minimum of weight, and dipping into the water T makes a water-joint, and hollow stays are carried across between the sides of the same, which can be made to support the weight of the platform to any desired extent.

P is the airway from the mine, and Q is the open space for the oscillation of the air to meet the requirements of the machine. The differentiator-casing, as also that part of the other nearest the ventilating-drift, is shown covered with timber. W is the masonry.

This part of the invention being now fully described, I proceed to describe that part of it which refers to preserving the true position of the shutter (without undue weight) by the means set forth at length above.

H H are the cylinders, one of which is used at a time, and which are shown to have the same stroke as the cranks used for the rotary engine, and consequently act on the pins marked E. Next the crank is the rod driving the shutter, then the engine-rod, and outside the differentiator-rod on both sides of the machine. This preserves the truth of the shutter, and is to some extent necessary for the platform.

L is the secondary rocking lever; K, the shutter-shaft; F, the substituted connecting-rod; I, the parallel rod; J, the shutter-pin projecting past the side of the casing, and G is the crank.

The arrangement of the apparatus above described may be so modified as to drive the

air into the mine, as will be well understood by persons conversant with such machinery.

The sides of this machine, as drawn, are made of cast-iron, the drum and shutters of wrought-iron and steel, and the platform of iron and steel.

The conduits are supposed to be of brick-work. A very convenient arrangement of the platform is (so as not to project very far beyond the sides of the casing, as shown in the drawings) for its greater length to be in the same direction as the ventilating-drift.

I claim as my invention—

1. The combination, with a rotary pumping-engine, of a casing outside the cylinder thereof, provided with a piston connected with the piston of the engine, said casing having an opening adjacent to the induction-port of the engine-cylinder, which opening is adapted to be opened and the casing to commence to receive as said induction-port is being closed, substantially as described, and for the purpose set forth.

2. The combination, with a common supply-passage, of a rotary pumping-engine having its induction-port connected with said passage, and a receiver connected also with said passage, and provided with a piston connected with the moving parts of the engine, and adapted to be forced into the receiver from its mouth and open the same as the induction-port of the engine is being closed, substantially as set forth.

3. In a rotary pumping-engine, the combination, with the drum or piston and its crank G and the shutter M, of the swinging arm L and the rods G and I, connecting said arm with the crank and shutter, respectively, substantially as set forth.

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