

SPECIFICATION
OF
WILLIAM EDWARD NEWTON

MOTIVE POWER

A.D. 1861, 31 st December. N° 3270

Motive Power

LETTERS PATENT to William Edward Newton, of the Office for Patents, 66, Chancery Lane, in the County of Middlesex, Civil Engineer, for the Invention of “IMPROVED APPARATUS FOR OBTAINING MOTIVE POWER FROM EXPLOSIVE COMPOUNDS.” – A communication from abroad by Eugène Barsanti and Felix Matteucci, of Florence, in the Kingdom of Italy.

Sealed the 29th April 1862, and dated the 31st December 1861.

PROVISIONAL SPECIFICATION

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SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said William Edward Newton in the Great Seal Patent Office on the 30th June 1862.

TO ALL TO WHOM

NOW KNOW YE, ...

This invention of improved apparatus for obtaining motive power relates to a novel arrangement of parts whereby the elastic force generated by the explosion of gases or detonating or explosive compounds may be utilized and employed as a motive power for driving machinery, or for other purposes. It is well known that when a mixture of atmospheric air and hydrogen, or other explosive mixture of gases is ignited, a sudden expansion in the volume of the gases takes place, and of course a very considerable amount of elastic force is produced during this expansion. This is also the case when such substances as gunpowder, gun cotton, or other explosive compounds are ignited. The

object of the present Invention is to utilize the explosive force thus generated, and to this end a cylinder of suitable capacity is employed and provided with pistons, the rods of which pass through stuffing boxes or guides in the ends of the cylinder. An arrangement of valves is adapted to the middle part of the cylinder to admit the gases into the cylinder. The expansion of the gases when exploded will drive the pistons forward, and as the rods of the latter are connected to the lower ends of a pair of vibrating levers which are suspended from suitable bearings, these levers are caused to vibrate on their centres, and by means of connecting rods they communicate rotary motion to a crank shaft. A fly wheel and driving pulley are mounted on this crank shaft, and of course rotate with it, and may be employed for communicating motion to any machinery that requires to be driven. The inlet valves of the cylinder are worked by means of levers actuated by cams on the crank shaft, and another set of valves are actuated by rods and levers connected with the piston rods. A series of openings are made in the cylinder near each end for the purpose of admitting air behind the pistons on the return stroke. The exit valves of the cylinder are operated by means of rods, which are actuated by tappets that are acted on by the piston rods as they move to and fro.

This Invention is more particularly applicable for stationary engines, but may also be applied to locomotive engines, in which instance two working cylinders with duplicate parts must be employed, and it will be found advisable also to employ two additional air cylinders worked by compressed air, for the purpose of starting the engine, which, when at work, may be made to express the air from the cylinders, and also to form vacuums when required.

In the accompanying Drawing, Fig. 1 is a side elevation of a double-action engine constructed and arranged according to this Invention; Fig. 2 is a partial plan view, showing one-half of the same; Fig. 3 is an end view of the double engine complete; Fig. 4 is a horizontal section drawn upon an enlarged scale, and taken through the middle of one of the cylinders; Fig. 5 is a transverse section of the same, taken at right angles to Fig. 4. The other Figures represent detached views of essential parts of the mechanism, also drawn upon an enlarged scale.

A (Figs. 1, 2, and 3,) represents one of the cylinders, which is closed at each end by means of a cover bolted to it, and is provided at each end with a series of openings *l* to allow of the entrance of the atmospheric air. Outside this cylinder (Figs. 1, 4, and 5,) and precisely in the middle of it, is a rectangular opening *a*, over which works a slide valve *b*, which has also a similar opening *a*¹. Over this slide valve is set a plate perforated to correspond to the openings in the valve and cylinder, to which plate is adapted a pipe *I*, having two ways for the admission of the charge of explosive mixture. When this consists of a mixture of inflammable gas and atmospheric air, the gas is obtained from a gasometer at the side *C* of the supply pipe, and the atmospheric air enters by means of a valve into the other end of the same pipe. At the under part of the cylinder is another rectangular opening *f*, through which the products of combustion are discharged when the pistons approach each other. This opening is closed by means of a valve *g* opening outwards, and, having its seat in a slide valve, which, with the preceding one, is worked by means of excentrics on the main shaft of the engine acting upon a lever *i*, Fig. 1, which is acted upon by a spring *j*. It is not necessary that the two slide valves should work together, as their movements might be independent of each other. The two pistons *P, P*, Fig. 4, are shewn by dots in Fig. 1. Those parts of their rods *T* which are cylindrical work in the stuffing boxes. Their other parts are prismatic, and are separated by a circular shoulder or disc *V* covered at each side by a disc of caoutchouc forming an elastic tappet, the use of which will be presently seen. The upper faces of the prism are parallel, the side faces converge slightly towards the disc, and are provided with two plates of steel. *G*, Figs. 1, 2, and 3, is a fixed guide for these rods. Two large rods

B, B, are pendent from the points *b* of a cylindrical shaft E which connects the two main standards M of the framing. These pendent rods have at their lower ends a fork *e*, Fig. 3, which embraces a frame (shewn at Figs. 6, 7, and 8, in horizontal and vertical section, and in plan view). This frame carries the mechanism for bringing the pendent rods B when necessary into gear with the pistons. To each of the pendent rods is jointed a connecting rod H, which is connected at its other end to a crank on the main shaft D, situate above the cylinder and perpendicular to its axis. The mechanism shewn in Figs. 6, 7, and 8, which receives and transmits directly the working action of the pistons, consists of a frame, which at its two extremities carries two trunnions set in two bearings, which have slight play in slots in the forked arms *e* of the pendent rods B. *t, t*, (Figs. 6 and 7,) are two excentric pieces, which, by reason of their form, are called sectors, and which terminate in axles passing through the framing. The curve of these sectors is a spiral, made in such manner that the piston rod in its forward course tends to open them, and on the contrary on its return stroke causes them to turn in a contrary direction, and lastly, to close and become stationary and immoveable with the frame *e* and its corresponding rod B. To the lower axles are fixed spiral springs for the purpose of keeping them in contact with the rod. The upper projecting axles, on the contrary, are provided with levers *r, r*, (Fig. 8) between which is driven a wedge *s*, which forces the sectors *t* to free themselves from the rod at the moment the wedge is pushed forward. The movement of this wedge is governed by two stops *x, z*, Fig. 2. The former is fixed immoveably to the cover of the cylinder, and serves to push the wedge forward; the latter by means of an adjusting screw serves to push it backward. By carrying this point forward, that is to say, towards the cylinder, it will sooner come in contact with the wedge, and consequently the sectors *t* will sooner take on to the piston rods T, and the charge will be sooner drawn in. For this reason this agent serves to regulate the charge or supply. It may be here remarked that the same result may be produced by various arrangements of mechanical agents. It may be also observed (when engines of large size are being worked) that if the sectors are not to be too much worked in drawing in the supply to the cylinder, it is more advantageous to work them by means of a system composed of beams, connecting rods, and crossheads worked at stated periods by two excentrics mounted upon the main shaft.

OPERATION OF THE MACHINE.

Suppose the pistons of a cylinder to be nearly in contact one with the other, which occurs when the corresponding pendent rods assume the position indicated by the red line in Fig. 1, the wedges *s*, Fig. 8, will have come in contact with the points *x*, Fig. 2, and will have brought the sectors *t* out of connexion with the rod T; then by communicating motion to the fly wheel the pendent rods B will move forward without carrying forward the pistons P, but before arriving at their furthest position, shewn by blue lines, the wedges *s*, Fig. 8, will come in contact with the points *z*, and the sectors *t* being free to engage with the piston rods T, these latter being carried forward by the pendent rods B will separate, and a vacuum will be formed between them; and the way or port *a*, Fig. 4, having been already opened by the excentric, the gas and air will be drawn in. As soon as the pendent rods B have attained their furthest position the slide valves will close the port, and the electric spark will be produced in the interior of the cylinder. The pistons will then be set in motion by another explosion, and will arrive at the end of their forward stroke at the moment when the pendent rods B are ready to return. At this point the atmospheric pressure exerting its force upon the anterior surfaces of the pistons P through the openings *l*, Figs. 1 and 4, will force the pistons back, and the rods of these latter by acting on the sectors will carry with them the pendent rods B, which in their turn will communicate motion to the main or crank shaft through the connecting rods H. The action of the atmospheric

pressure upon the pistons will continue until the tension of the products of combustion restores the equilibrium; at the same time the excentric will have opened the lower slide valve *g*, and the return movement of the pistons caused thereby will carry the frame of the sectors into contact with the elastic tappet *V*, and will force the pistons to continue their course, and thus to drive off the products of combustion through the escape valve.

As there are two similar cylinders which alternate in their working, that is to say, the one being charged whilst the other is being set in motion, the result is that the main shaft will have a continuous motion imparted to it with the same succession of strokes as is the case with an ordinary double-action steam engine. The main shaft is also provided with a fly wheel, and, if preferred, only one cylinder need be employed, the requisite impetus being given to the fly wheel.

In order to regulate the power of the engine, two methods are employed; the first consists in causing the bearing points *z* to advance or recede as above mentioned, and the second consists in opening the passage for the gas to a greater or less extent. According to the first method, the length of the charge is preserved. In the engine constructed by the Inventors, the length for the charge is from 8½ to 9½ inches, the longest stroke of the pistons being 20 inches, but it varies slightly according to the quality of the gas. By augmenting the length of charge in the cylinder, the stroke is (within certain limits) increased in greater proportion, and the same results takes place when the diameter of the cylinder is increased, without varying the length of charge; consequently engines of larger dimensions have the advantage of being proportionately less costly than smaller ones.

The electric spark which ignites the charge is obtained by means of static electricity produced by means of a Ruhmkorff's battery, and is conducted into the interior of the cylinder by an insulated wire, which at the required time is put into communication with the end of the outside wire of the apparatus.

In order to avoid any accident which might be occasioned by derangement of the parts giving rise to too heavy a charge, one of the reophores of the battery is arranged in such manner as to surround the engine, and opposite the extremity of each piston rod is a circuit breaker *n, n*, which, whilst the pistons are at rest, and are drawing in a normal charge, remains closed by the interposition of an insulated metallic ring carried by the extremity of the rod, Fig. 9. Supposing that one of the pistons draws in too heavy a charge, the ring will advance more than usual, and will break the circuit, and the current of electricity will not pass, and consequently the charge will not be ignited.

The explosive mixture may also be ignited by means of a constant flame, which, at the moment when the ignition is required to be effected, may be drawn in by a small pump set at about the middle of the cylinder; or a pneumatic fire-producing apparatus might be employed for this purpose.

In order to prevent the heating which takes place after working for a certain time, the pistons, during their forward stroke, draw into the cylinders through small tubes *o* (Fig. 1) a certain quantity of water, which is afterwards, together with the products of combustion, returned through the discharge valve into the vessel from which it was drawn; or the cylinders may be surrounded with a jacket in which a continuous circulation of water is kept up. This space between the cylinder heads and the pistons is occupied by a layer or cushion of compressed air, which prevents the pistons from striking against the cylinder heads or covers.

Although it is preferred to employ, for the purposes of this Invention, a mixture of atmospheric air and hydrogen gas, yet the principle upon which the engine is constructed will, with slight

modifications, allow of its being worked by means of any explosive compound such as gun cotton and gunpowder.

The construction of engines of small power may be simplified in the following manner: -- During its forward stroke one of the pistons is free, as in the preceding case; the other, on the contrary, is connected with the main shaft by means of levers, cranks, and connecting rods. The principal office of this latter is to draw in the charge during the forward stroke, and drive off the products of combustion during the return stroke, whilst the other piston is at rest. When the explosion takes place the free piston drives forward, whilst the other receives an impetus which it communicates to the crank shaft to which it is connected; during the return stroke both are equally put in action by atmospheric pressure. In this application, in order to simplify the mechanism, a rack and pinion only may be employed, being alternately put into and out of gear with the main shaft. This engine, when thus worked, may be with facility employed as a hammer or as a punching machine, for which purposes it is only necessary to provide the rod of the free piston with a hammer head or punching tool, and set the engine in such manner that the axis of the cylinder shall be horizontal.

Amongst the applications of which the first described system of motive engine is susceptible, locomotives may be mentioned, in which case certain arrangements which I will now describe may be adopted. To this principle motive engine an auxiliary motive engine may be added, and which might be worked by compressed air. This auxiliary motor, the mechanism of which might be at pleasure connected with the principal engine, may be driven by compressed air contained in a reservoir, into which the air may be compressed by any mechanical means.

When the train is in motion, and it is required to stop, the movement of the motive engine should be reversed in order to replenish the compressed air in the reservoir, which in consequence of the resistance offered, would also form a break for the whole motive apparatus.

From the above description, it will be seen that the Invention which forms the subject of the above in part recited Letters Patent, consists of a motive engine in which explosive and expansive chemical agents combined are rendered available as motive agents either by means of electricity, by a flame, or by means of any process by which fire may be produced. I would observe, in conclusion, that I do not confine myself to the precise arrangement, form, or dimensions of the parts above described, provided the physical, mechanical, or chemical results above mentioned be produced, and which constitute the principle of the Invention; neither do I confine myself to any particular purpose to which the improved engine forming the subject of this Invention is to be applied, as it may be used as a stationary, locomotive, marine, or other engine.

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