Sheet 1 - 2 Sheets.

W. M. Storm,

Reciprocating Steam Engine,

No. 48,777, Patented July 11, 1865.

Fig: 1.

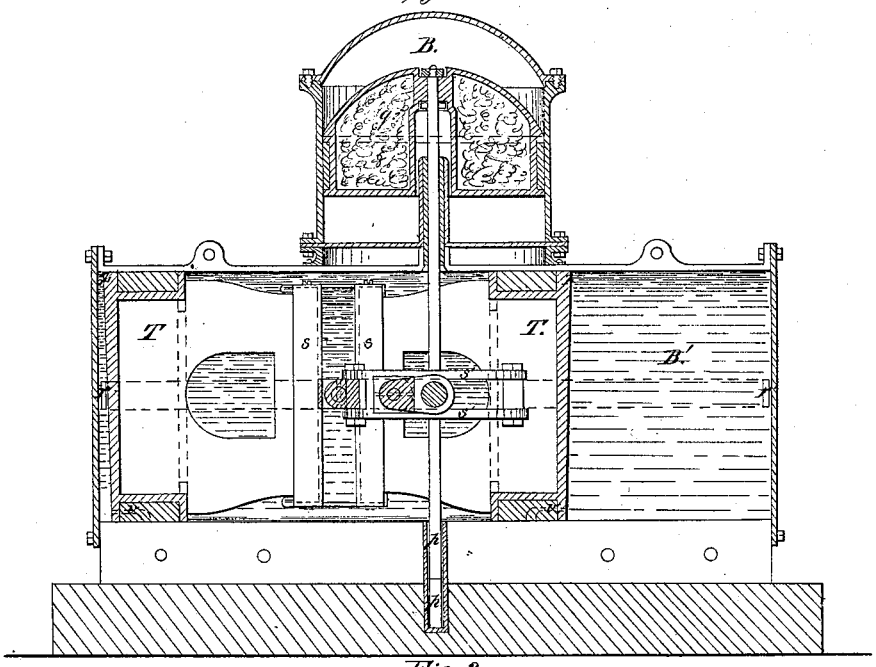
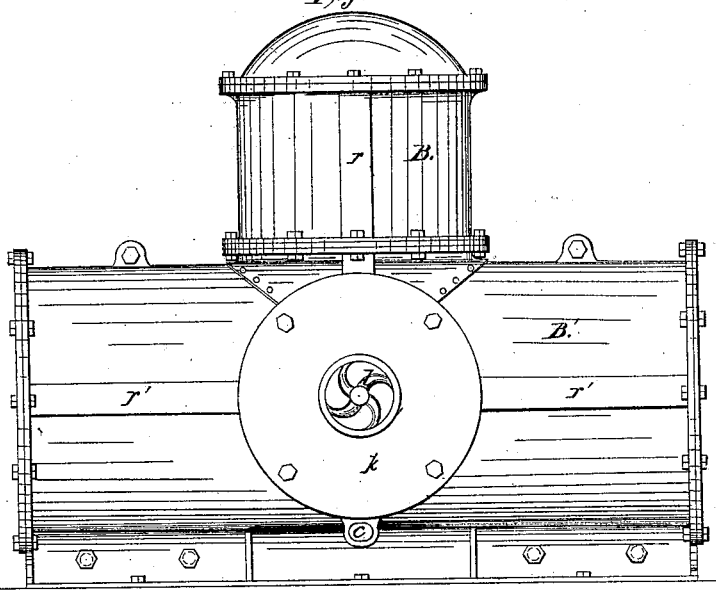


Fig: 2.



Witnesses:

Jas. H. Nightman
John W. Martin

Inventor:

Wm. Monte Storm

Sheet 2-2 Sheets.

W. M. Storm,

Reciprocating Steam Engine,

No. 48,777, Patented July 11, 1865.

Fig: 3.

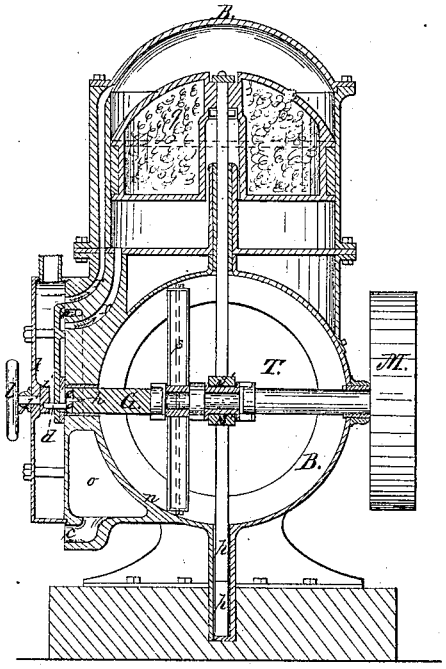


Fig: 1.

Fig: 4.

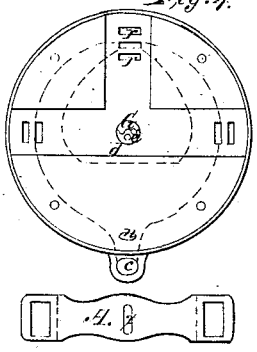


Fig: 5.

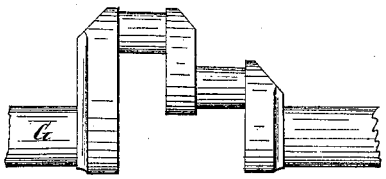


Fig: 6.

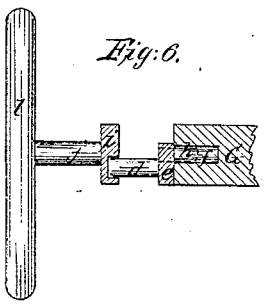


Fig: 7.

Witnesses:

Jos. J. Wightman

John. Wallace

Inventor:

Wm. Mont Storm

UNITED STATES PATENT OFFICE.

WM. MONT STORM, OF NEW YORK, N. Y., ASSIGNOR TO HIMSELF AND R. CHARLTON MITCHELL, OF SAME PLACE.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **48,777**, dated July 11, 1865.

To all whom it may concern:

Be it known that I, WILLIAM MONT STORM, of the city, county, and State of New York, have invented a new and useful form of Steam-Engine particularly adapted for propellers and portable engines, of which the following is a specification.

The construction of my engine is such as to afford remarkable compactness, strength, and simplicity with the desired qualities of a rotary, while at the same time its pistons reciprocate in straight lines, there being two single-acting pistons, T T, vibrating horizontally, and one double-acting piston, vibrating vertically. The pistons connect with the cranks (there being two of the latter parallel with each other, but of different lengths, on the same shaft and solid with it) by open cross-heads *s s* and *s′ s′* in lieu of connecting-rods.

Figure 1 is a vertical and longitudinal central section. Fig. 2 is an exterior view. Fig. 3 is a vertical mid-section at right angles to Fig. 1. Fig. 4 is a detail view (projected from Fig. 3) of the face of the valve-chest, A A′ of this figure being a view of the valves, faces upward, that respectively regulate the ingress and egress of the steam to the vertical and horizontal cylinders B B′, Figs. 1, 2, and 3. The dotted lines on Fig. 4 show the exhaust-passage (cast in the metal) communicating with the exhaust-ports of both cylinders and with the final exit *c*, Figs. 4, 3, and 2.

The piston operating in the vertical cylinder is made double-acting and half the stroke of the other, for purposes of compactness, and as it is proposed to make the vertical cylinder of the same bore as the other, it would be nominally of half the power, while providing that there shall be no cessation of force acting upon the crank during its entire revolution. By the use of a double-acting superposed cylinder with a shorter stroke I am enabled to get my crank-shaft lower down than would be possible with two single-action pistons in a vertical cylinder similar to the horizontal one.

For convenience of putting together and of examination and repair, I cast the horizontal cylinder in two parts, the cross-heads, cranks, &c., as is seen, being located within the body of the horizontal cylinder and between its two pistons, whose distance apart, &c., is properly proportioned to this end. This arrangement, with other merits, affords protection to the parts during transportation and otherwise. The opposite jaws of the cross-heads are strongly connected by proper bolts or by gibs, and between them run brasses, in which the crank-wrists turn. In practice these cross-heads may be made conveniently adjustable, so as to tighten on the brasses to allow for wear.

In lieu of casting the horizontal cylinder in two nearly equal parts (planed and fitted steam-tight together previous to boring) a large detachable plate or "bonnet" could be provided in its side next the band-wheel or pulley, which latter being made conveniently removable, such bonnet could also be readily removed and the interior works exposed. I propose to employ ordinary D slide-valves operated on the same principle as that of the cross-heads and cranks. Fig. 5 represents the latter on a larger scale than that of figures previously referred to. It will be seen that, as the crank-shaft terminates at one extremity near the face of the valve-seats and interior to the valve-chest, a pin fixed in that end of the shaft at a proper distance from its center and parallel with it, and at right angles to the cranks, or nearly so, according to the desired amount of lap and lead, and projecting through the slots *x x′* in the valves A A′, would operate them in the usual manner of most D-slide valves, so far as their relative motion is concerned; but, inasmuch as it is essential for engines for propellers to be reversible, I adopt to this end the following device, (see Fig. 6, enlarged as in Fig. 5:) In lieu of fixing the pin *d*, Figs. 6, 4, and 3, in the end of the shaft itself, it is made a solid part of a disk, *e*, which is of the size of the shaft, and which has a tang or center pin, *f*, also solid, projecting centrally into the shaft G. Fig. 7 shows this disk and the shaft end on, so to speak.

Now, it will be observed, so far as described, that the disk could turn independently of the shaft; but by means of the stop-pin *h*, (shown in red, Fig. 6,) which is fixed in the end of the shaft, the disk is prevented from turning more than half its circumference, except it does so with the shaft. The pin *d*, after passing through the slots *x x′* in the valves, projects into a hole (see Figs. 6 and 3) in a disk, *i*,

which abuts against the interior of and has a bearing-shaft, *j*, in and through the bonnet *k*, Figs. 2 and 3, of the valve-chest, outside of which, and on the end of *j*, and turning with the crank-shaft when the engine is in motion, is a small hand-wheel, *l*. Now, it will be understood by an expert that by stopping the engine, or nearly so, and turning the wheel *l* in the direction in which the engine was previously running, the disk *e*, with the pin *d*, will be turned half-way round, the valves correspondingly moved, and the engine reversed, the then corresponding notch of disk *e* resting over the stop-pin *h*, (shown in red in Fig. 6,) and being there kept by the corresponding direction of the rotation of the crank-shaft, this device thus performing the functions of what is known as a "loose eccentric."

M is the pulley or band-wheel from which motion to other mechanisms is to be imparted. The pistons are cast hollow or skeleton, that their momentum and inertia may be the more easily overcome at each reversal of the direction of their motion. As a high velocity of piston is anticipated as permissible in this engine, I give the steam sides of the horizontal pistons (see *z z'*, Fig. 1) an overhang, so that they present to the pressure of the steam a slightly-inclined plane, so that the friction otherwise resulting from their gravity shall be relieved, as will be understood.

By the formation of the parts I have endeavored to avoid the necessity of stuffing-boxes. I have also anticipated opening a communication, *n n*, (see Figs. 3 and 4,) from the exhaust passage or chamber *o o* (see same figures) to the crank-chamber, also containing the cross-heads, &c., that the condensed water might act as a lubricant, assuming that such water being hot, as are also the parts lubricated by it, the water would evaporate after the engine was stopped and pass out through the exhaust-pipe, and so cause little or no rust. I have also anticipated the use of counterpart cross-heads, or, in other words, two at equal distances from the center of either the horizontal or vertical pistons, that the thrust should be balanced, but do not deem it materially necessary. This remark is made because, as would be observed, the cross-heads appertaining to the horizontal pistons are connected and shown (see Fig. 3) eccentric to the latter. I have also anticipated making the lower stem or guide, *p*, (see Figs. 1 and 3,) appertaining to the cross-head of the vertically-vibrating piston *q*, to serve, with its sheath or socket *p'*, as a feed-pump, the necessary valves, packing, and connection being easily supplied, should it prove desirable. *r r* (see Fig. 3) show the steam-passages to the vertical cylinder, and *r' r'*, Fig. 2, those of the horizontal cylinder.

It will be perceived that the horizontal cylinder alone would act in effect as an ordinary reciprocating engine, yet the superposed conjointly-acting cylinder is very desirable. As a substitute for the overhang before spoken of, a communication may be made through the horizontal piston-heads and their packing-rings at their lower portions, as shown in red, *v v*, Fig. 1.

Though the lower portion of the valve-chest is not occupied, I prefer to make the valve-chest a complete circle for convenience of turning off and of finish.

Having now fully described my invention, what I desire to claim and secure by Letters Patent, is as follows:

1. An engine constituted as follows, to wit: of a cylinder containing two single-acting pistons rigidly connected by open cross-heads, substantially as described, to the crank, both of the latter (crank and cross-head) being located within the body of such cylinder and between its pistons, the whole being proportioned and arranged to this end as set forth.

2. In combination with the above, the superposed cylinder or engine B, to act upon a crank parallel to the first and on the same shaft, also through the mediation of a cross-head located in the same chamber between the pistons of the horizontal cylinder, substantially in the manner and for the purposes described.

3. The arrangement whereby the stroke of the piston of such superposed engine is made considerably less than those of the horizontal one, so that the length of its cross-head, as will be understood, may not render necessary an undue separation of the horizontal pistons, thus occupying unnecessary space, while the combined action of the whole device obviates a dead-point, &c.

4. Making the pistons of the horizontal cylinder with an overhang, for the purpose described.

5. The pin *d*, projecting longitudinally with but eccentric to the shaft, and rotating with it, to operate the valve by fitting slots *x x'* in their tails at right angles to the lines of their motion, all as explained.

6. The combination of the parts *e f h i j l*, constituting the reversing-gear, as described.

WM. MONT STORM.

Witnesses:
JAS. F. WIGHTMAN,
JOHN W. MARTIN.