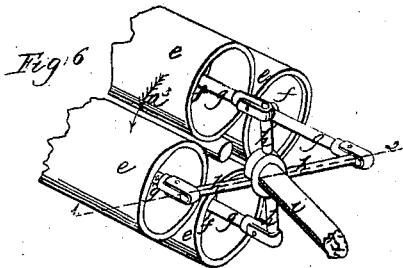
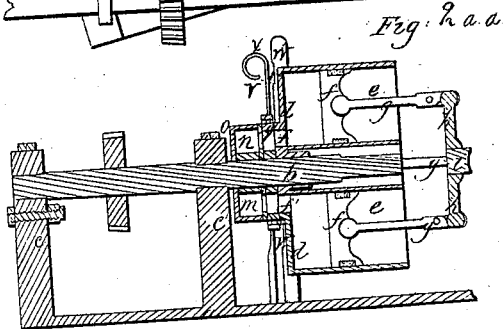
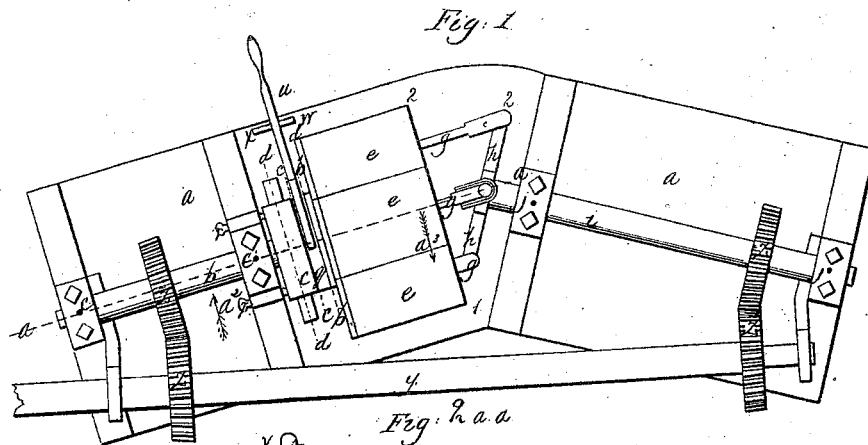


No. 5,185.

Fig. 4.c.c. Fig. 5.b.b. Fig. 5.d.d.



UNITED STATES PATENT OFFICE.

BENJ. S. BENSON, OF BALTIMORE, MARYLAND.

STEAM-ENGINE.

Specification of Letters Patent No. 5,185, dated July 10, 1847.

To all whom it may concern:

Be it known that I, BENJAMIN S. BENSON, of Baltimore, in the State of Maryland, have invented new and useful Improvements in Steam-Engines and Pumps, and that the following is a full, clear, and exact description of the principle or character which distinguishes them from all other things before known, and of the manner of making, constructing, and using the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan of the engine; Fig. 2, a vertical section at the line (*a, a*) of Fig. 1 and looking in the direction of the arrow *a*²; Figs. 3, 4, and 5, cross vertical sections at the lines (*b, b*), (*c, c*), and (*d, d*) of Fig. 1 and Fig. 6 a perspective representation of the cylinders and their connections.

The same letters indicate like parts in all the figures.

The nature of my invention consists in placing one, two, or more cylinders around the axis of a shaft, parallel with, and at equal distance from it, and connecting the rods of the pistons that work in them with arms, projecting from a shaft placed at an angle less than a right angle with the axis of the shaft that carries the cylinders, and thus obtain a rotary from the reciprocating motions of the pistons, when the pistons are actuated by steam, &c., or give reciprocating rectilinear motions to the pistons when the shaft or shafts are rotated by any power to cause the pistons to act on any fluid as a pump. I will first describe my invention as applied to the steam engine.

In the accompanying drawings (*a*) represents a frame properly adapted to the purpose, and (*b*) a horizontal shaft, the journals of which run in boxes in the standards (*c, c'*). A disk (*d*) is attached to that part of the shaft which is outside the standard, and to the front face of the disk are secured four cylinders (*e, e, e, e*) placed at equal distances apart, parallel with each other and with the axis of the shaft and at equal distances from it. To these cylinders are fitted four pistons (*f, f, f, f*) constructed like the pistons of other steam engines, except that they should be made thicker, but this is arbitrary. The rods (*g, g, g, g*) of these pistons are connected by ball and socket joints with the pistons and with four arms (*h, h, h, h*) that radiate from the end

of a shaft (*i*) the journals of which run in appropriate boxes in standards (*j, j*); and the axis of this shaft is placed at an angle, less than a right angle, with the axis of the shaft which carries the cylinders, so that by the rotation of the two shafts, the pistons, in passing from the point (1), half a revolution, to the point (2) will move out from the bottom of the cylinder to the end, and in passing from the point (2) to (1) they will move back, the length of stroke of the pistons being governed by the diameter of the circle generated by the axis of the cylinders and the angle formed by the axes of the two shafts. The two shafts should be so placed that the axis of the one which carries the cylinders if projected would intersect the other at a plane passing through the balls on the ends of the arms which fit the sockets in the ends of the piston rods.

From the foregoing it will be obvious that the moment one of the pistons has in its rotation passed the point nearest the plane of motion of the arms and cylinders that any force applied to the piston to force it out will tend to turn it in a direction from that point, by reason of the inclination of the plane of motion of the cylinders with the plane of motion of the arms with which the pistons are connected, and that from the point of greatest distance, continuing the rotation the piston will be forced in; hence it follows that if steam &c. be introduced in the cylinder, and behind the piston, after the cylinder has passed the point of nearest proximity of the two planes of motion that it will exert a force on the arm with which the piston rod is connected in an oblique direction equal to the angle formed by one shaft with the plane of the other, and that consequently the two shafts will rotate together and with equal forces, and that if the steam be condensed after the cylinder has passed the point of greatest separation, that the pressure of the atmosphere on the outer surface of the piston, and a corresponding area on the cylinder head will cause the two shafts to continue their rotation in the same direction until the cylinder reaches the point of nearest proximity. In this way the several pistons receive and transfer these forces and motions; and thereby give the required rotary motion to the shafts. Under this arrangement each cylinder and piston has its two dead points in the circle, viz., the point

of greatest proximity and the point of greatest separation, and therefore if an engine be constructed with one or two cylinders the same difficulty will be experienced in passing these dead points, as with the ordinary crank engines, unless when two are used they be so placed as to pass the dead points in succession. But this difficulty is easily overcome by employing three or more cylinders placed at equal distances apart.

The method of working this engine by steam is as follows, viz: The disk (d) which constitutes the heads of the cylinders, has a hole (f') passing through it for each of the cylinders, and opening into it, through which steam is introduced and discharged by turns, as in succession either of them pass the ports (k) and (l) of the steam and exhaust chambers (m) and (n) both of which are made in a circular case (o), that is slipped onto the shafts which turns in it with a ring (q) interposed between it and the disk, the faces of these being fitted with ground joints and kept tight by temper screws (r, r) that pass through the standard (c') and bear against the back fall of the circular case. The ring (q) has two long ports (s) and (t) cut through it, and forming segments of an annulus, with the solid parts between them of sufficient size to cover the steam and exhaust ports (k) and (l) in the front face of the circular case (o). And this ring turns freely on the shaft, and has the starting bar (u) attached to, and projecting from it, so that it can be moved up and down and held in place at any one of these points by being held in notches (v, v') (the middle one not being visible in the drawing) in a standard (w) by a spring (x). When held in the middle notch the solid parts between the ports (s, t) lie over and close the steam and exhaust ports (k) and (l), when in the top notch, the port (s) opens a communication with the steam chamber and the steam cylinders that have passed the point of nearest proximity in the direction of the arrow (a^3) to give them steam, and the port (t) opens a communication, for the escape of steam, between the exhaust chamber and the cylinders that have passed the point of greatest separation; and when the starting bar is shifted to the lower notch the parts are reversed

for the purpose of reversing the motion of the engine. In this way all the cylinders as they pass in succession to one side of the point of nearest proximity receive steam to impel them, and exhaust after they pass the point of greatest separation. And it will be obvious from the foregoing that the exhaust may communicate with a condenser or not at pleasure; and that by rotating the shafts this engine will act as a pump, exhausting on one side and forcing out on the other.

For the purpose of avoiding any undue strain on the piston rods and arms the two shafts gear into a third shaft (y) by means of beveled wheels (z, z, z, z), or this may be done by connecting rods, or by any other equivalent means, or the two shafts may be coupled together by an universal joint. The piston rods if desired may have sliding cross heads with connecting rods extending to the arms. And if it be desired to avoid the greater wear of that part of the cylinders which is farthest from the axis of motion, by centrifugal force, this may be counteracted by extending the piston or connecting rods beyond the ball and socket joints with a ball at the end of each to balance the piston the balls answering the purpose of a fly wheel.

The face of the valve ring which is toward the disk and the disk may be made conical or in the form of a segment of a sphere to prevent in part the unequal wear of the parts in consequence of the greater motion of the outer than the inner periphery.

What I claim as my invention and desire to secure by Letters Patent is—

Placing a cylinder or cylinders at any distance from the axis of their motion, substantially as described, when this is combined with the connecting of the piston or pistons with the arm or arms or their equivalent of a shaft or its equivalent the axis of motion of which makes an angle less than a right angle with the line of the axis of motion of the cylinder or cylinders, substantially as herein described.

BENJAMIN S. BENSON.

Witnesses:

THOMAS J. HULL,
JOSH. MATTHEWS, Jr.