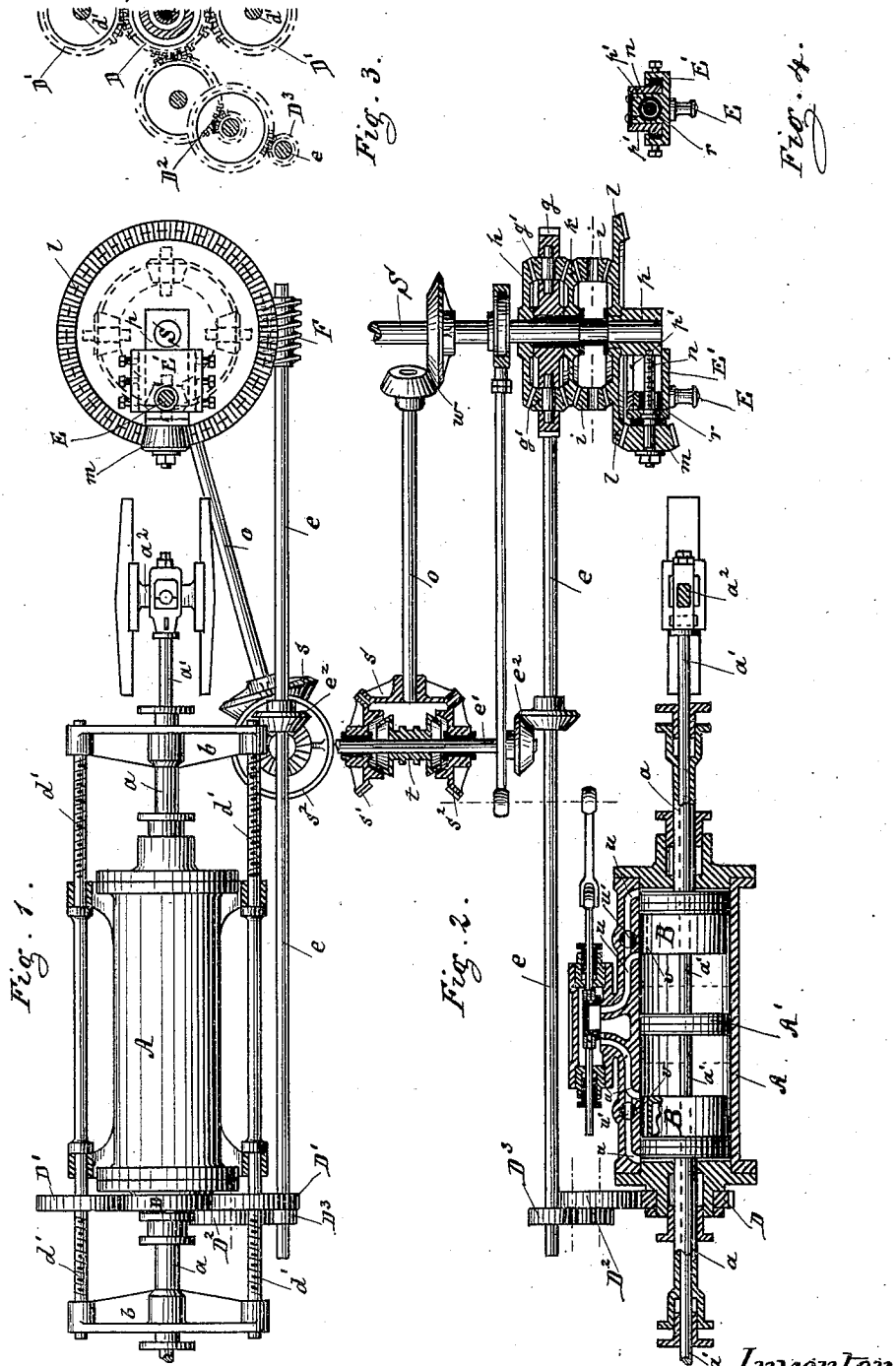


(No Model.)

P. F. HÜBNER.  
ENGINE.

No. 356,538.

Patented Jan. 25, 1887.



Witnesses.

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# UNITED STATES PATENT OFFICE.

PAUL FRIEDRICH HÜBNER, OF ZSCHOPPAU, GERMANY.

## ENGINE.

SPECIFICATION forming part of Letters Patent No. 356,538, dated January 25, 1887.

Application filed May 12, 1886. Serial No. 201,942. (No model.)

*To all whom it may concern:*

Be it known that I, PAUL FRIEDRICH HÜBNER, a resident of Zschoppau, Germany, have invented Improvements in Steam, Air, and other Engines, of which the following specification is a full, clear, and exact description.

My invention relates to steam, air, and other engines; and it consists in the arrangement of two extra pistons, one in each end of the cylinder, and adapted to be moved nearer together and farther apart, whereby the length of the working part of said cylinder can be increased or diminished; and, further, in the arrangement of a crank-pin capable of sliding on the crank-arm to increase or diminish the stroke of the main piston, said extra pistons and crank-pins being operated by gearing and connected together, so that any motion of the pistons will at the same time act upon the crank-pin and move the same in exact proportions nearer to or farther away from the center of the driving-shaft, to diminish or increase the stroke of the main piston as the working part of the cylinder is diminished or increased.

In the accompanying drawings, Figure 1 represents a side view of part of an engine with my improvement attached. Fig. 2 is a horizontal section of the same. Fig. 3 shows the gearing for operating the pistons, and Fig. 4 is a cross-section at line *x x*, Fig. 2.

A represents the cylinders, provided with the usual piston, A', and piston-rod *a'*, connected to the cross-head *a'*, which latter is connected through a connecting-rod (not shown in the drawings) with the crank-pins E. Into each end of the cylinder pistons B B are fitted, provided with hollow piston-rods *a a*, through which the piston-rod *a'* of the piston A' passes.

The piston-rods *a a* carry at their ends cross-bars *b b*. The ends of these cross-bars are threaded to receive the screw-threads of the bolts *d' d'*, attached to the cylinder A, capable of turning, but prevented from moving longitudinally.

Upon one of the cylinder-heads a gear-wheel, D, is placed, meshing into corresponding wheels, D' D', fast upon the bolts *d' d'*. By this arrangement, the turning of the gearing D D', and consequently of the bolts *d' d'*, the pistons B B will be moved nearer together or farther apart in the cylinder, lengthening or

shortening thereby the working part of said cylinder A.

The wheel D is connected, through intermediate gear-wheels, D<sup>2</sup> D<sup>2</sup>, with a gear-wheel, D<sup>3</sup>, fast upon a shaft, *e*. (See Fig. 3.) By this arrangement any motion communicated to said shaft *e* will be communicated to the pistons B B. This shaft *e* extends to the main shaft S and carries at its end a worm, F. This worm F works into a worm-wheel, *g*, turning loosely on the shaft S, and carrying internal bevel-pinions, *g' g'*, meshing into bevel-wheels *h* and *k*, placed on each side of the wheel *g*. The bevel-wheel *h* is firmly attached to the main shaft S, and the bevel-wheel *k* turns loosely on the shaft S. This wheel *k* is provided with teeth on both sides. The teeth on one side mesh into the teeth of the pinions *g' g'*, as above described, while the teeth on the other side mesh into the teeth of corresponding bevel-pinions, *i i*, journaled in a suitable frame centered on the shaft S and attached to the main framing. (Not shown in the drawings.) These pinions *i i* mesh into corresponding teeth on the wheel *l*, firmly attached to the shaft S or upon the hub of the crank. The wheel *l* is provided with two sets of teeth on opposite sides of the wheel. One set meshes with the teeth of the pinions *i i*, as described, and the other set meshes into a bevel-pinion, *m*, fast on the end of a screw, *n*, fixed in the arm *p'* of the crank *p*. This screw *n* carries a nut, *r*, fast to a slide, E', upon which the crank-pin E is firmly attached. The slide E' is constructed and connected with the arm *p'* of the crank *p*, similar to a slide-rest of a turning-lathe. By this described arrangement of gearing any motion communicated to the shaft *e* will be at the same time communicated to the crank pin E.

The relative proportions of the gearing operating the crank-pin E and the proportions of the gearing operating the pistons B B are such that any motion of the shaft *e* will move the crank-pin nearer to or farther away from the center of the shaft S in the exact proportion as the pistons B B are moved nearer together or farther apart, and the length of the working part of the cylinder A is increased or diminished.

When the pistons B B are stationary and the crank-pin E is moved to the position corresponding with the length of stroke of the main piston A', the shaft *e* is stationary, in conse-

quence of which the worm F at the end of said shaft *e* will hold the wheel *g* stationary. When the engine is in operation, the wheel *h*, attached to the shaft S, will turn with the same, turning, 5 through the pinions *g' g'*, the wheel *k*. The wheel *k* is the same size as wheel *h*, and consequently will make the same number of revolutions as wheel *h*, but in a contrary direction, on account of being loose on the shaft S. This 10 wheel *k* transmits its motion through the pinions *i i* to the wheel *l*, and consequently this wheel *l* makes the same number of revolutions as the wheel *k* and as the wheel *h*, or, in other words, as the shaft S, and will therefore commu- 15 nicate no motion to the pinion *m* or screw *n*, and thus the crank-pin E will be held stationary as long as pistons B B are retained in the same position.

As before mentioned, the position of the pistons B B is changed by turning the shaft *e* in one or the other direction, and which said motion of the shaft *e* moves likewise the crank-pin E.

To change the position of these pistons B B 25 and crank-pin E whenever required while the engine is in operation, and through the turning of the shaft S, the shaft *e* is connected with a shaft, *e'*, by means of miter-wheels *e<sup>2</sup>*. Upon the shaft *e'* loose bevel-wheels *s' s<sup>2</sup>* are placed, 30 meshing into a bevel-wheel, *s*, attached to a shaft, *o*, which latter is connected through the bevel-wheels *w* with the driving-shaft S. Upon the shaft *e'* a double clutch, *t*, is secured by a feather upon the shaft, to couple either the 35 wheel *s'* or *s<sup>2</sup>* to the same, and thus turn this shaft, and consequently the shaft *e*, in either direction desired. The clutch *t* is operated by a

lever (not shown in the drawings) in the usual manner.

To produce an equal pressure before and 40 behind the pistons B B when it is desired to change their position, the ports *u u* are extended behind these pistons and provided with valves or cocks *u' u'*, and suitable cavities, *v v*, are provided on the inside of said pistons to 45 allow the free passage of the steam when the pistons are moved close together.

I claim as my invention—

1. The combination of cylinder A with adjustable pistons B B, piston A', and with crank 50 *p*, sliding piece E', carrying crank-pin E, and with screw *n* and means for moving the sliding piece E', substantially as specified.

2. The combination of a cylinder with three pistons, one of which is connected to a crank 55 adapted to operate the shaft, while the other two pistons are adjustable, all being so constructed that by varying the distance between the movable pistons the stroke of the crank is proportionately varied, substantially as specified. 60

3. The combination of cylinder A and pistons B B with cross-bars *b b*, threaded bolts *d' d'*, gearing D D' D<sup>2</sup> D<sup>3</sup>, shaft *e*, worm F, bevel-wheels *g*, *g' g'*, *h*, *k*, *i i*, *l*, and *m*, screw *n*, nut *r*, slide *p'*, 65 crank-pin E, crank *p*, and driving-shaft S, arranged to operate in the manner and for the purpose substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PAUL FRIEDRICH HÜBNER.

Witnesses:

JOHANN EMIL HARTEWIG,  
BRUNO UALY.