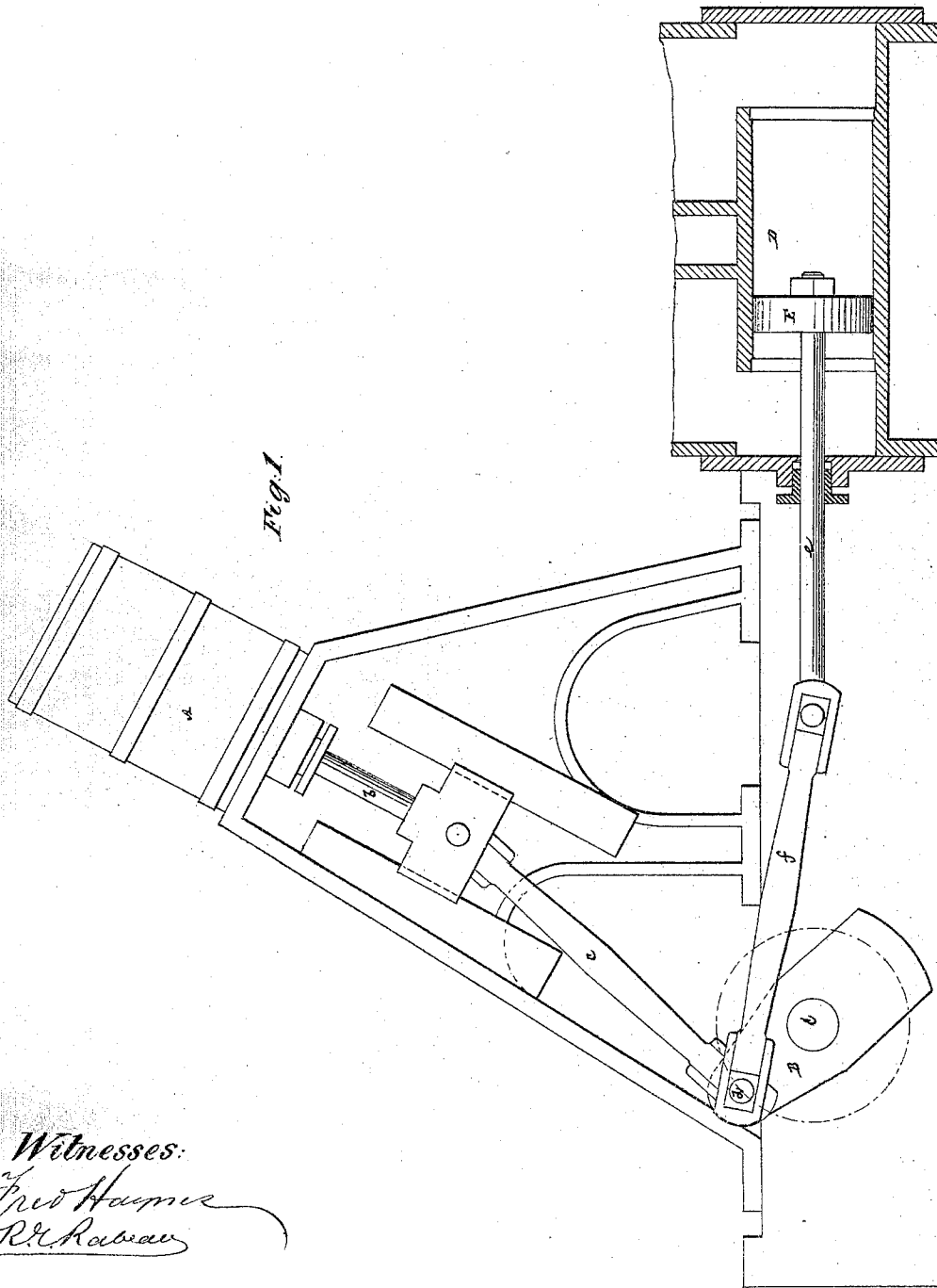


G. D. EMERSON.

Improvement in Apparatus for Compressing Air.

No. 130,627.

Patented Aug. 20, 1872.



Witnesses:
Fred Warner
R. H. Rabreau

G. D. Emerson

UNITED STATES PATENT OFFICE.

GEORGE D. EMERSON, OF NEW YORK CITY, ASSIGNOR TO ADDISON C. RAND,
OF BROOKLYN, NEW YORK.

IMPROVEMENT IN APPARATUS FOR COMPRESSING AIR.

Specification forming part of Letters Patent No. 130,627, dated August 20, 1872.

Specification describing an Improvement in Apparatus for Compressing Air and other Aeriform Fluids or Gases by Steam, the invention of GEORGE D. EMERSON, of the city, county, and State of New York.

The invention consists in a certain combination of a double-acting pump or single air-compressing cylinder and its piston with a steam-cylinder and its piston, when the two pistons are connected to one and the same revolving shaft by a crank-pin common to both, whereby great simplicity is attained and a compression of the air or gas kept up, subject to an approximation of the power exerted by the steam to the resistance encountered at various points throughout both strokes of the pump.

In the accompanying drawing which forms part of this specification, Figure 1 represents a side elevation of a direct-acting steam-engine and double-acting air-pump, combined and arranged in accordance with my improvement; Fig. 2, a diagram in illustration of the manner of determining the proper inclination of the steam-cylinder relatively to the air-compressing cylinder; and Fig. 3, a diagram illustrating the varying power of the engine relatively to the resistance encountered at different points in the stroke.

A in Fig. 1 represents the steam-engine cylinder; *b*, its piston-rod; *c*, its connecting-rod; and *d*, the pin of the crank B, by which the engine-shaft C is revolved. D is the air-compressing cylinder or barrel of a double-acting air-pump; E, its piston; *e*, the piston-rod; and *f*, the connecting-rod by which the piston E is driven from the crank-pin *d* of the engine. The engine-cylinder A is set in an oblique position relatively to the air-cylinder B. This is is all important in my improvement, and the proper inclination of the cylinder A is determined by the point or distance in the stroke at which the steam is cut off. Thus, referring more particularly to Fig. 2 of the drawing, I first strike the circle of rotation *g* described by the crank-pin *d* and draw a line, *h*, through the axis of the crank-shaft and center of the compressing-cylinder. Then take in the compasses the length of the connecting-rod of the compressing-piston and set off on the line *h* the extreme ends of its stroke. Then mark on the line *h*, within the measure of the stroke, the

points of the desired compression at which the air passes off from the cylinder, and which are here shown at *k k*. Next, with the compasses set to the length of the connecting-rod of the compressing-piston, from the points or divisions *k k* mark on the circle of rotation *g* the positions of the crank-pin, shown by *d d* in Fig. 2, when the compressing-piston, in its forward and backward strokes, reaches the points or divisions *k k*. Afterward, with the length of the connecting-rod *o o* of the steam-piston, from the points *d d* in the circle *g*, draw the arcs *l l* forming part of a lune. Having ascertained the point at which it is desired to cut off steam, and which will here, by way of illustration, be fixed at three-eighths ($\frac{3}{8}$) of the stroke, find a line, *m*, drawn from the center of the crank, through the lines *l l*, at points in said lines *l l* which would measure between them two-eighths ($\frac{2}{8}$) of the engine stroke, leaving three-eighths ($\frac{3}{8}$) or thereabout on the outside of the lines *l l*. A line, *m*, thus drawn gives the proper obliquity for the engine-cylinder relatively to the air-compressing cylinder, to secure a correct proportioning of the power exerted to the resistance encountered. Thus, supposing the crank and connecting-rod of the air-piston to be in the positions represented by the lines *n n* and *i i*, the engine-piston will then be commencing its stroke, or rather have begun it, with its connecting-rod and the crank in an inferior position for the transmission of power, but with a full head of steam on the piston and with the connecting-rod of the air-piston in its most effective position relatively with the crank, and which occurs when the air-piston has reached about half its stroke. As steam is cut off at three eighths of the stroke, then the crank and engine connecting-rod approach their most effective position or relation with each other, till said parts finally reach the positions represented for them by the dotted lines *n' n'* and *o o*, by which time the air-piston is near the end of its stroke.

The diagram in Fig. 3 represents the relative variations in power applied and resistance encountered throughout the stroke, the dotted lines *r* and *s* indicating the variations in power during the two or reverse strokes of the engine, and the lines *u* and *v* indicating the variations of resistance by compression of the air during

said strokes, and whereby it will be seen that the power applied, when cutting off steam, as described, is made to approximate the resistance encountered.

The engine has here been described as using a stationary cylinder and as operating the crank by means of a connecting-rod; but it will be obvious that an oscillating cylinder may be used instead, and the connecting-rod be dispensed with, said cylinder, when the crank is on its dead center, occupying a like angle to that of the stationary cylinder.

What is here claimed, and desired to be secured by Letters Patent, is—

The combination of the double-acting pump-cylinder D and its piston E with the steam-cylinder A and its piston, the revolving shaft C, and crank-pin *d* common to both pistons, when said cylinders are arranged in angular relation with each other, substantially as and for the purposes herein described.

Witnesses: GEO. D. EMERSON.

HENRY T. BROWN,
FRED. HAYNES.