No. 757,410. PATENTED APR. 12, 1904.

S. A. REEVE.

COMBINED ENGINE AND COMPRESSOR.

APPLICATION FILED MAR. 11, 1901.

NO MODEL.

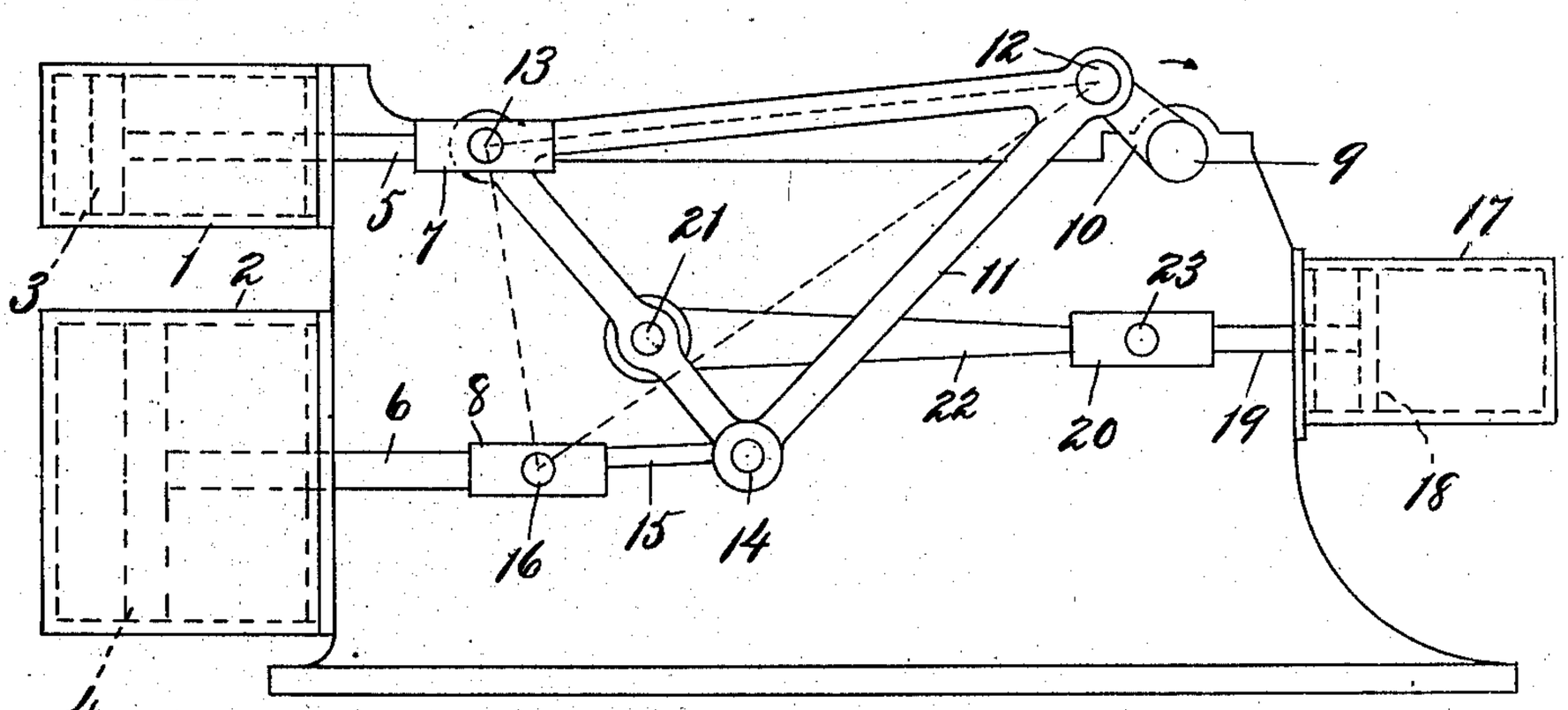

Fig. 1.

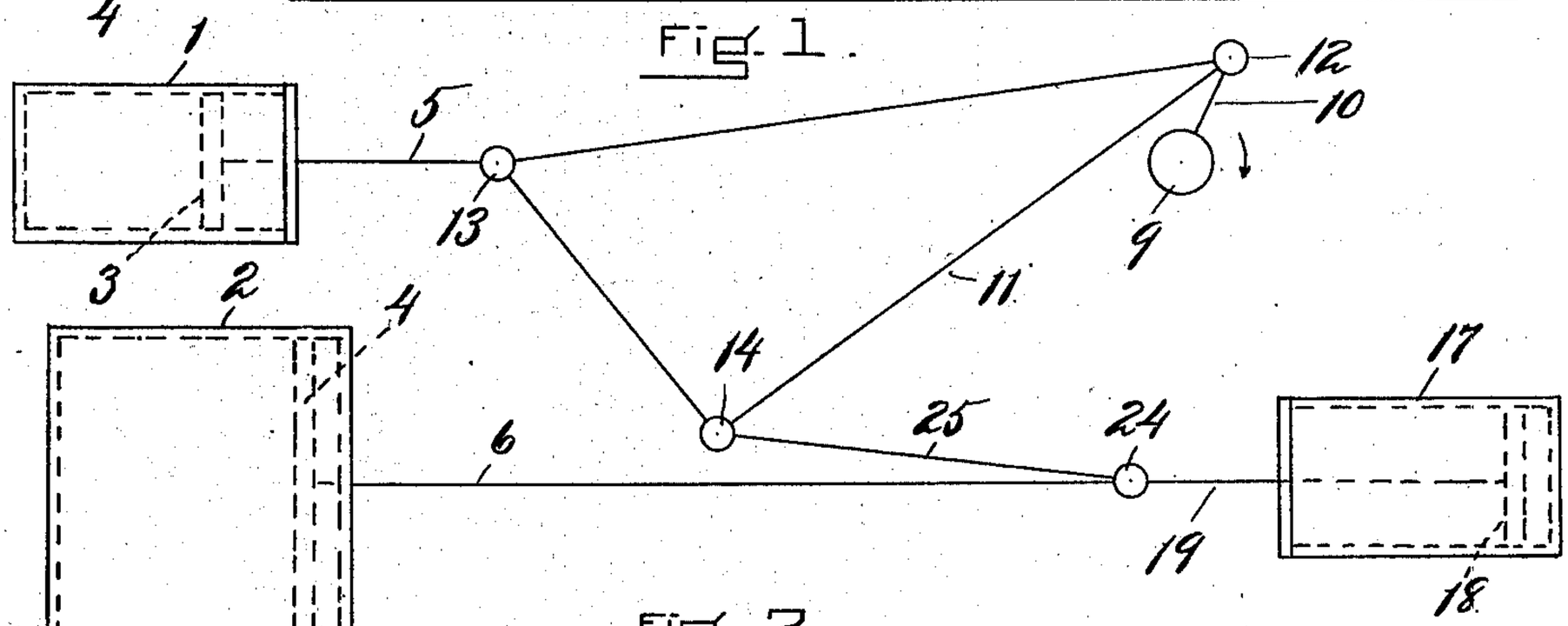

Fig. 2

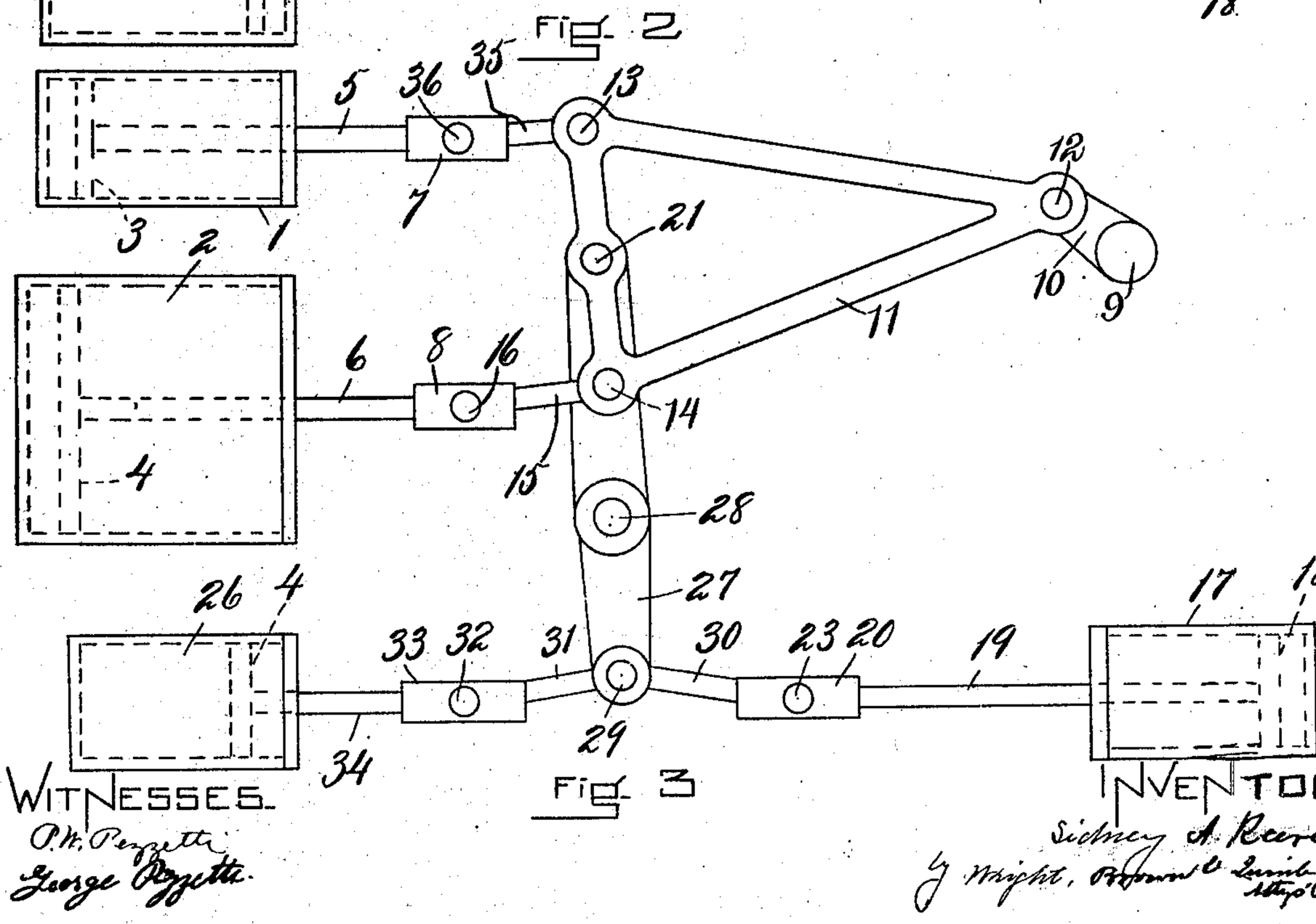

Fig. 3

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UNITED STATES PATENT OFFICE.

SIDNEY A. REEVE, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO CHARLES F. BROWN, TRUSTEE, OF READING, MASSACHUSETTS.

COMBINED ENGINE AND COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 757,410, dated April 12, 1904.

Application filed March 11, 1901. Serial No. 50,536. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY A. REEVE, of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in a Combined Engine and Compressor, of which the following is a specification.

This invention relates to apparatus in which an elastic-fluid compressor is combined with a motor of the steam-engine type for driving it.

The main objects of the invention are to measurably equalize crank effort throughout the stroke to avoid diametric reversal strains through the crank-shaft and crank-pin bearings and to decrease friction.

The invention consists in certain novel features of construction and arrangement, which I shall now proceed to describe and claim.

Of the accompanying drawings, Figure 1 represents a side elevation of a combined engine and compressor constructed in accordance with my invention. Fig. 2 represents a diagrammatic view showing a modification. Fig. 3 represents a side elevation showing another modification.

In all of the figures only such parts of a working apparatus are shown as to render the invention clearly understandable.

Referring at first to Fig. 1, 1 and 2 represent two cylinders of an engine adapted to use steam or other suitable expansive fluid and having pistons 3 4, piston-rods 5 6, and cross-heads 7 8 at the outer ends of said piston-rods, the guides for the cross-heads being omitted for the sake of clearness. 9 is a crank-shaft having a crank 10, and 11 is a rigid triangular connecting-rod, hereinafter termed the "trirod," pivoted at its outer angle to the wrist or crank pin 12, at its upper inner angle to a wrist-pin 13 at the cross-head 7, and at its lower inner angle to a wrist-pin 14, which is connected by a link 15 to a wrist-pin 16 at the cross-head 8. 17 is a compressor-cylinder adapted to compress air or other elastic fluid and having a piston 18, piston-rod 19, and cross-head 20, suitably guided. The piston is driven from a pin 21 on the trirod 11 through a connecting-rod 22, pivoted to a wrist-pin 23 at the cross-head 20. The trirod has a reciprocating motion as a whole through space, and the two engine-pistons 3 4 reach dead-points at different times in the stroke of the crank, the dead-point of piston 4 occurring earlier than that of piston 3, so that the crank has no dead-center. Assuming the normal rotation of the crank to be in the direction of the arrow or clockwise at the beginning of piston 18's movement to the right, piston 3 is entirely idle or is pulling to the left, and piston 4, on account of the absence of compression in cylinder 17, is chiefly engaged in producing an upward effort on the crank-pin. In midstroke of piston 18 all horizontal forces are well equalized, the crank-pin 12 receiving only the normal excess of motive over compressive forces necessary to maintain rotation. Later in piston 18's stroke when the resistance due to compression is a maximum piston 4 has reached its right-hand dead-point, or is practically arrested by cushion, and pin 16 is acting as a fulcrum, whereby the remaining force behind piston 3, assisted by inertia, operates against piston 18 with a decided mechanical advantage. The resultant effort on the crank-pin at this point and immediately thereafter when piston 4 has started to the left is a downward one, or, in other words, the reversal of strains at the beginning of the left-handed stroke occurs rotatively in the same direction as the rotation of the crank on both crank-shaft and crank-pin instead of occurring diametrically through the bearings of these parts. I thereby avoid the racking strains and the necessity for extra size and care of bearings which are incident to many types of compressor apparatus. The return stroke toward the left is substantially a repetition of that toward the right. By proper design on the lines herein indicated the crank may be caused to receive a forward acceleration in all parts of its stroke, even with a compressor absorbing a large proportion of the power of the engine, whereby I avoid the use of an excessively-heavy fly-wheel.

The apparatus herein illustrated is particularly adapted to furnish an excess of power for outside purposes beyond that required for

operating the compressor. In adapting the apparatus herein shown to suit special conditions the triangle 13 12 16 or the trirod 11 may be of any needed proportion and either isosceles, equilateral, right-angled, or scalene in character, according to the proportions of power to be distributed to the compressor and crank, respectively, and according to other considerations which will occur to the skilled designer and need not be enumerated here.

The pin 21 may be located anywhere in rigid connection with the trirod 11, and in engines compressing air or other fluid for their own consumption, where the power absorbed in compression is an important portion of that developed in the motor-cylinders, it is sometimes advantageous to make the point 21 coincide with 14, as illustrated diagrammatically in Fig. 2. This figure also shows the engine-piston 4 driving the compressor-piston 18 directly by a straight-line connection, leaving the engine-piston 3 principally to the task of rotating the crank 10. The two piston-rods 6 19 are in this case continuations the one of the other and are provided at 24 with a wrist connected by a nearly parallel link 25 with the lower wrist 14 on the trirod 11. This is a good design where the power developed is divided about equally between the two motor-cylinders and the power absorbed by the compressor is approximately one-half of the total developed.

In Fig. 3 is shown a second modification, wherein the motion for two compressor-cylinders 17 and 26 is taken off from the pin 21 by a rock-lever 27, pivoted at 28 to a stationary support and connected by a wrist-pin 29 at its lower end and links 30 31 with wrist-pins 23 32 on the cross-heads 20 33 at the ends of the compressor piston-rods 19 34. In this case the rear end of the trirod 11 is supported by the rock-lever 27 and a link 35 is introduced between the wrist-pin 13 on the trirod and a wrist-pin 36 on the cross-head 7. It is further to be noted that the pin 21 is located midway between the pins 13 and 14, and the crank-shaft 9 is located midway between the two piston-rods 5 6. The whole motor and crank part of the apparatus is here symmetrical with the compressor part as respects the driving of the latter, and the action of the whole apparatus is the same for either direction of rotation of the crank.

I claim—

1. A combined steam-engine and compressor comprising two engine-cylinders having non-synchronous pistons, a crank, a rigid reciprocating member connecting the two pistons with the crank, and an elastic-fluid-compressor cylinder whose piston receives motion from said reciprocating member, and is timed to reach dead-point slightly ahead of the later of the two engine-pistons.

2. A combined steam-engine and compressor comprising two engine-cylinders having non-synchronous pistons, a crank, a rigid connecting member having wrists connecting it with the later-timed of the two pistons and with the crank and a third wrist, an elastic-fluid compressor having its piston alined and rigidly connected with the earlier-timed engine-piston, and a link connecting the said third wrist with the said alined pistons.

In testimony whereof I have affixed my signature in presence of two witnesses.

SIDNEY A. REEVE.

Witnesses:
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