

No. 740,133.

PATENTED SEPT. 29, 1903.

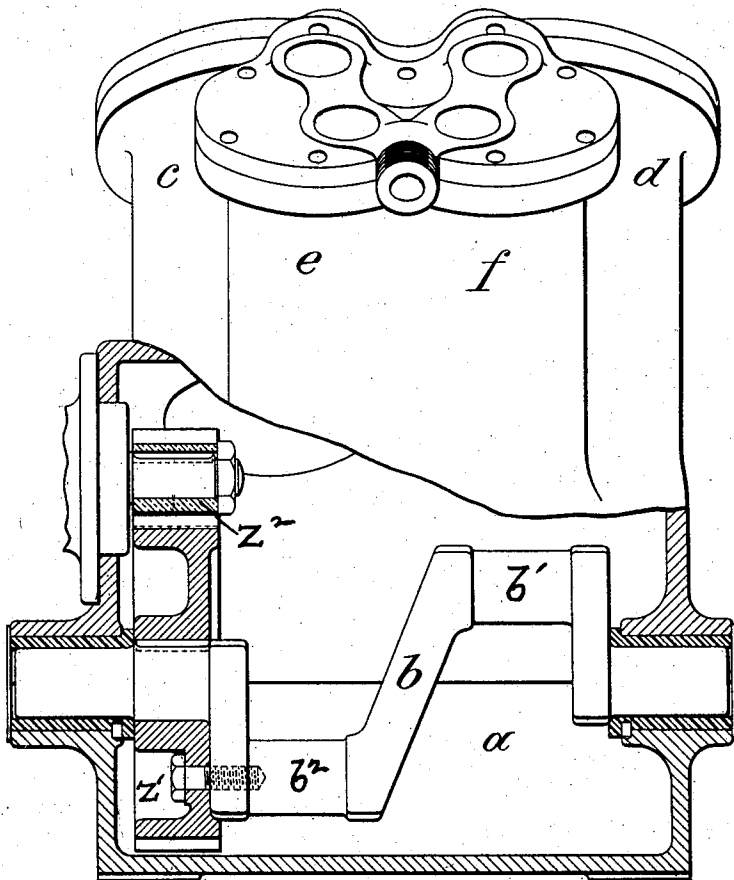
W. K. M. HILDEBRAND.
COMPRESSOR FOR AIR BRAKE SYSTEMS.

APPLICATION FILED APR. 2, 1901.

NO MODEL.

3 SHEETS—SHEET 1.

fig. 1.



WITNESSES:
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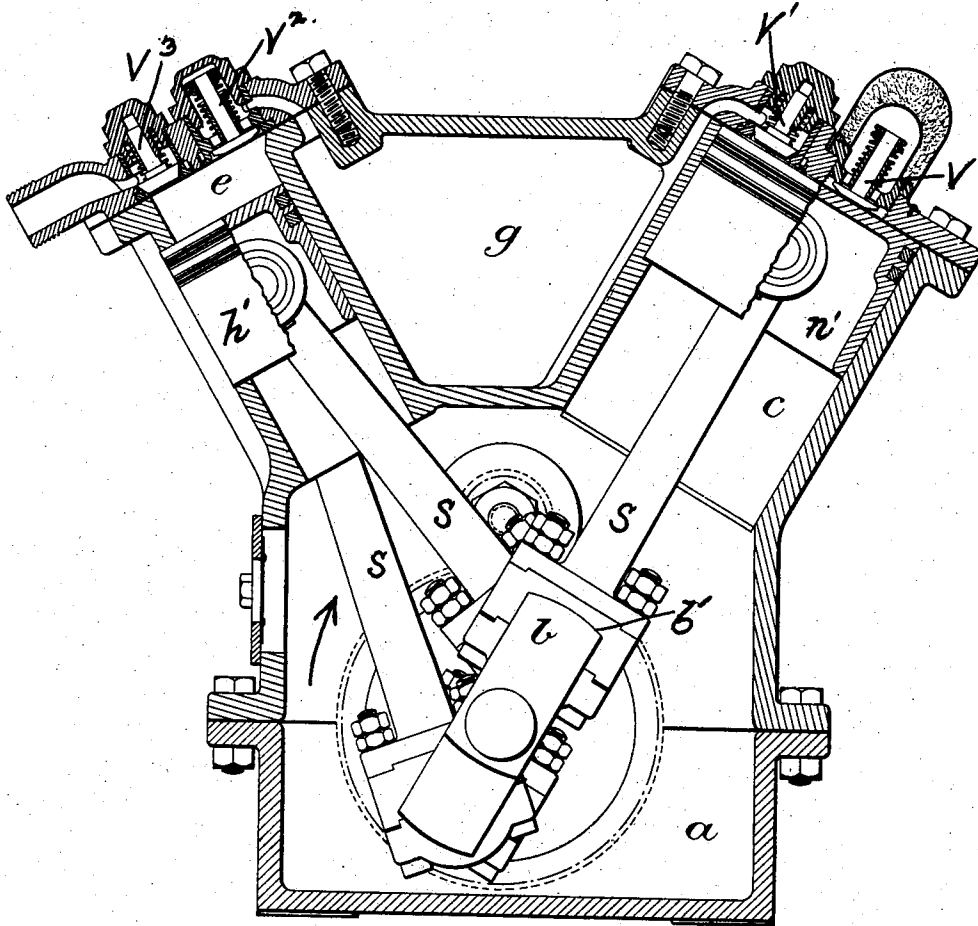
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3 SHEETS—SHEET 2.

fig. 2.



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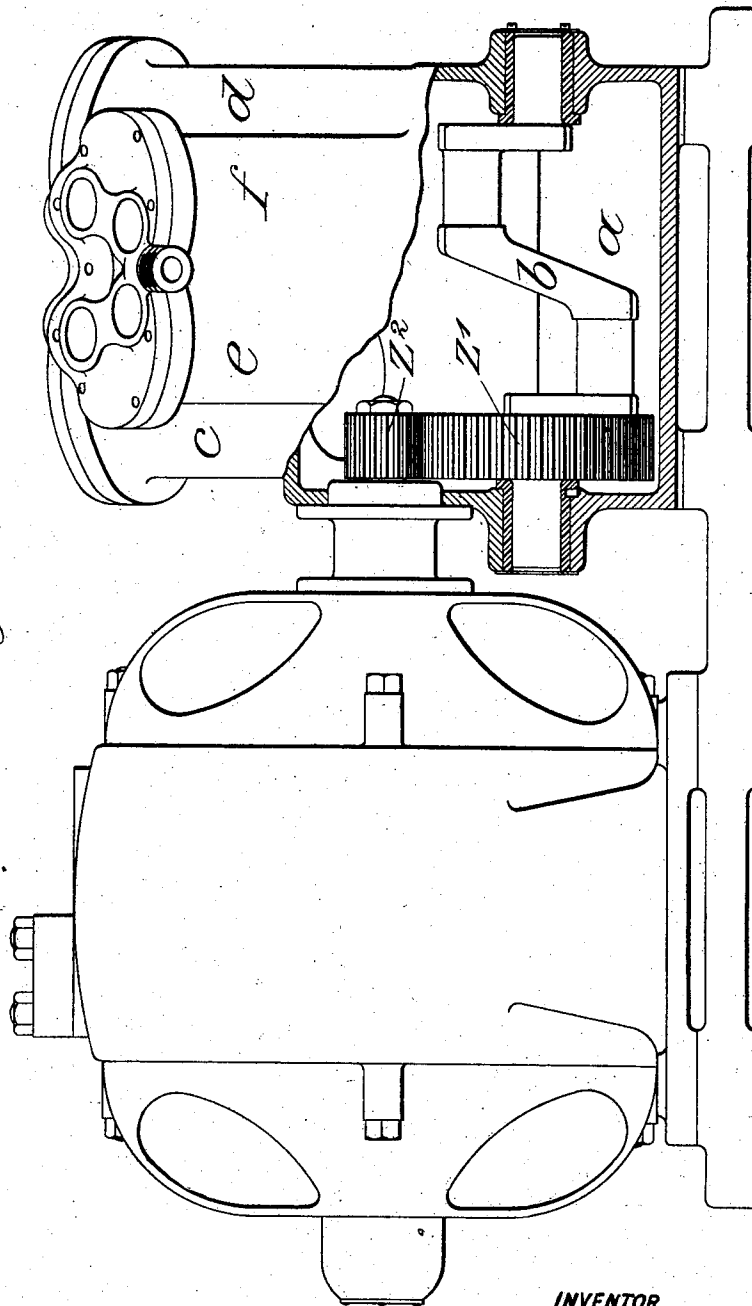
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NO MODEL.

3 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

WILHELM KARL MAX HILDEBRAND, OF GROSS LICHTERFELDE, NEAR
BERLIN, GERMANY.

COMPRESSOR FOR AIR-BRAKE SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 740,133, dated September 29, 1903.

Application filed April 2, 1901. Serial No. 54,055. (No model.)

To all whom it may concern:

Be it known that I, WILHELM KARL MAX HILDEBRAND, engineer, a subject of the Grand Duke of Baden, residing at Berlinerstrasse 46, Gross Lichterfelde, near Berlin, Germany, have invented certain new and useful Improvements in Compressors for Air-Brake Systems, of which the following is a specification.

This invention relates to compressed-air brakes, and has for its object certain improvements hereinafter more particularly referred to.

Air-brakes for use on both broad and narrow gage electric railways should possess noiselessly-working compressors capable of rapidly delivering a considerable quantity of air under high pressure, while at the same time they should occupy but little room, as the space at disposal is exceedingly limited.

Now this invention has for its object to construct a compound air-compressor which shall occupy but little space, while the motor is also reduced in size, yet at the same time insuring a favorable action of the pump and facilitating the starting, so that the capacity of the compressor is greatly increased as compared with other forms of constructions. This is effected by placing two single-acting low-pressure cylinders opposite to two single-acting high-pressure cylinders in combination with an intermediate casing common to all, said cylinders being arranged at such an inclination to the vertical plane of the crank-shaft as to insure that the work upon the periphery of the motor-anchor and upon the toothed wheel will be as nearly as possible of a uniform character, thus allowing the compressor to be connected either directly with an electromotor of low speed or, through the intervention of suitable gear, with a high-speed motor.

According to my invention I arrange in an oil-tank at the lower end of the casing a double-cranked shaft actuated either by means of a simple gear from a high-speed motor or directly by a low-speed motor. Above the crank-shaft and on each side thereof are arranged the single-acting cylinders in such a manner that the two low-pressure cylinders are on one side and the two high-pressure cylinders

on the other side of the said shaft. Between the two pairs of cylinders are walls forming an inclosed space into which the two low-pressure cylinders compress the air previously drawn in and from which the high-pressure cylinders draw the air for further compression. The angle formed by the middle line of the low-pressure cylinders with those of the high-pressure cylinders will obviously depend upon the cylinder proportions and the working pressure; but it is so calculated as to cause the work as far as possible to be uniform at the periphery of the crank-shaft.

By employing single-acting cylinders a more compact arrangement is provided and lubrication is more easy, the oil being caused to splash from below into the cylinders.

The upright position of the cylinders causes less wear thereof, and, furthermore, the oil is not drawn in, as is the case in horizontal cylinders.

By adopting cranks set at different angles in conjunction with the intermediary compression-chamber a greater number of revolutions and therefore an increased efficiency of the motor is obtained, so that there may be employed a comparatively small motor, consequently effecting a reduction in the amount of energy consumed, while at the same time noise is reduced to a minimum.

The accompanying drawings represent the new compressor for air-brakes worked by electric power.

Figure 1 is a side view, partly in section; and Fig. 2 shows a section through the centers of the valves. Fig. 3 shows the transmission of motion by toothed wheels.

The crank-shaft *b*, which is bent twice at right angles, rotates in an oil-receptacle *a* in the lower part of the case. Motion is imparted to said crank-shaft either by means of a toothed-wheel transmission, as shown in Fig. 3, the larger wheel *Z'* of which is fixed upon the crank-shaft, while the small wheel *Z²* is fastened to the motor-shaft which projects into the case of the compressor, or by means of direct connection with a motor. Above this crank-shaft at both sides of the axis the simple-acting cylinders are fitted up in such a manner that on one side are placed

the two low-pressure cylinders *c d*, while on the other side there are the two high-pressure cylinders *e f*. Between the two pairs of cylinders the intermediate vessel or chamber *g* is placed, into which the two low-pressure cylinders *c d* force the air, while the high-pressure cylinders *e f* withdraw from it the air for further compression. The angle which is formed by the center lines of the low-pressure cylinders and those of the high-pressure cylinders depends upon the proportion of the cylinders and the working pressure and is ascertained exactly in such a manner that the work at the axis of the crank-shaft is rendered as equal as possible. By means of rods *S* motion is imparted to the four pistons from the crank-shaft in such a manner that one low-pressure piston and one high-pressure piston *n'* and *h'* is connected with the crank *b'* of the crank-shaft by means of two of the slide-rods *S*, while the other two pistons in the high and low pressure cylinders are connected with the crank *b''* by means of the other two rods *S*. These pistons do not appear in Fig. 2; but their arrangement will be obvious from an inspection of the drawings.

If the crank-shaft is turned in the direction indicated by the arrow, low-pressure piston *n'* moves downward and sucks air from the atmosphere by means of the suction-valve *V*. At the same time the other low-pressure piston begins to move upward and to compress the air which has been sucked in before. In the further course of this compression and after the pressure has reached the height of the pressure in the intermediate vessel *g* the delivery-valve *V'* opens and allows the compressed air to flow over into the intermediate vessel. At the time the low-pressure pistons begin their stroke, with the position of the shaft as shown in the drawings, the two high-pressure pistons have already traveled over one part of their course—that is to say, over that part which corresponds to the angle which the two pairs of cylinders make with each other. The piston *h'* is moving down-

ward and has sucked air from the intermediate vessel *g* by means of suction-valve *V''*. The other high-pressure piston, however, which is placed in the rear, compresses the air that has been sucked with the same tension which exists in the intermediate vessel to the height of the pressure in the reservoir and forces it then into it with the aid of delivery-valve *v''*.

I claim—

1. A compound air-compressor for air-brakes and the like comprising two single-acting low-pressure cylinders, two single-acting high-pressure cylinders and pistons, said low and high pressure cylinders being arranged at an angle to each other and with their axial lines converging downwardly, a crank-chamber, a crank-shaft therein, pistons and piston-rods connected with the crank-shaft, and a chamber between the cylinders at their upper ends common to the same and ports connecting said chamber with the cylinders, substantially as described.

2. A compound air-compressor for air-brakes and the like, which is driven by a rotating shaft, comprising a pair of low-pressure cylinders with their pistons, a pair of high-pressure cylinders with their pistons, said pairs of cylinders being arranged at an upwardly-diverging angle to each other above a closed crank-chamber, a common shaft having two cranks, each crank having connected thereto one of the high and one of the low pressure pistons, an intermediate chamber common to all the cylinders filling the said angle between the cylinders into which intermediate chamber the low-pressure cylinders discharge and from which the high-pressure pistons suck air and valves between the said cylinders and the said chamber, substantially as described.

Signed at Berlin, Germany, this 12th day of March, 1901.

WILHELM KARL MAX HILDEBRAND.

Witnesses:

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WOLDEMAR HAUPT.