(No Model.) 3 Sheets—Sheet 1.

A. COLLMANN.

STEAM ENGINE.

No. 494,412. Patented Mar. 28, 1893.

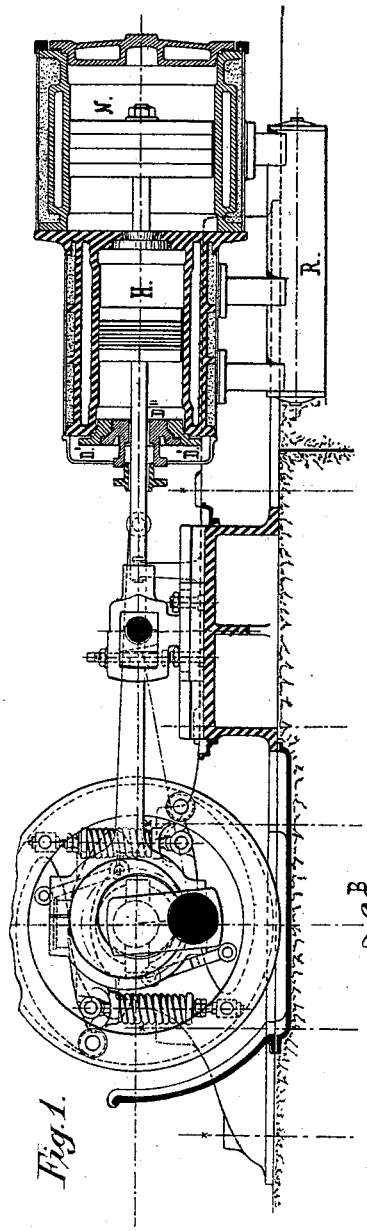

Fig. 1.

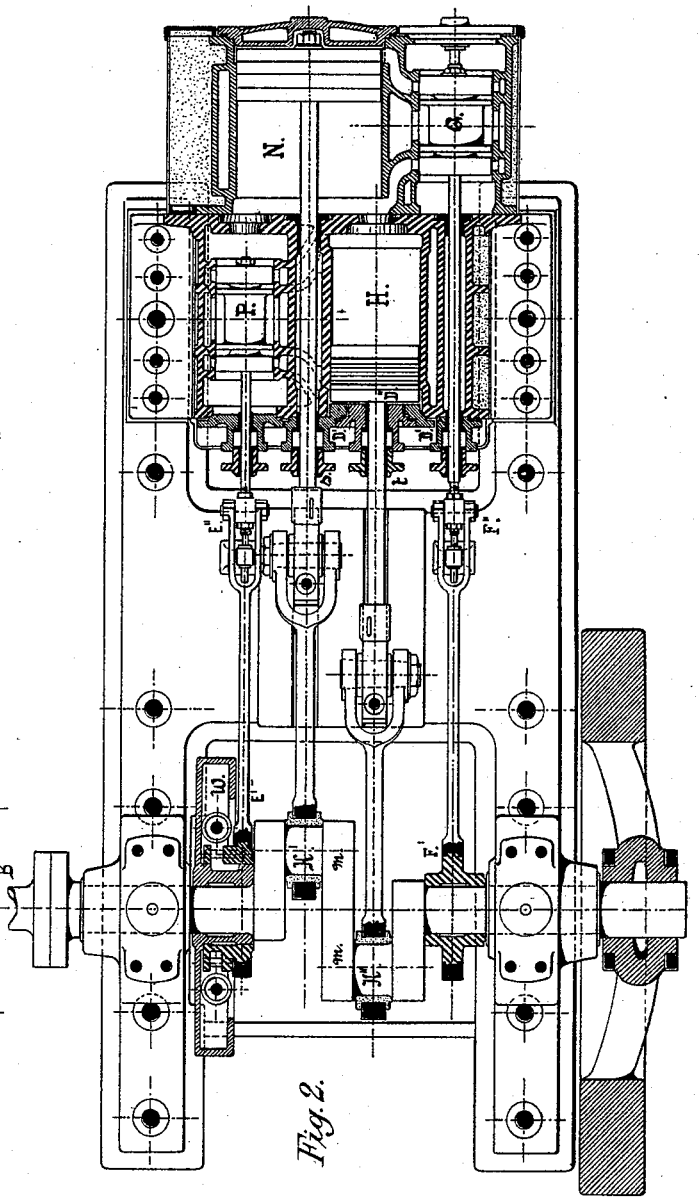

Fig. 2.

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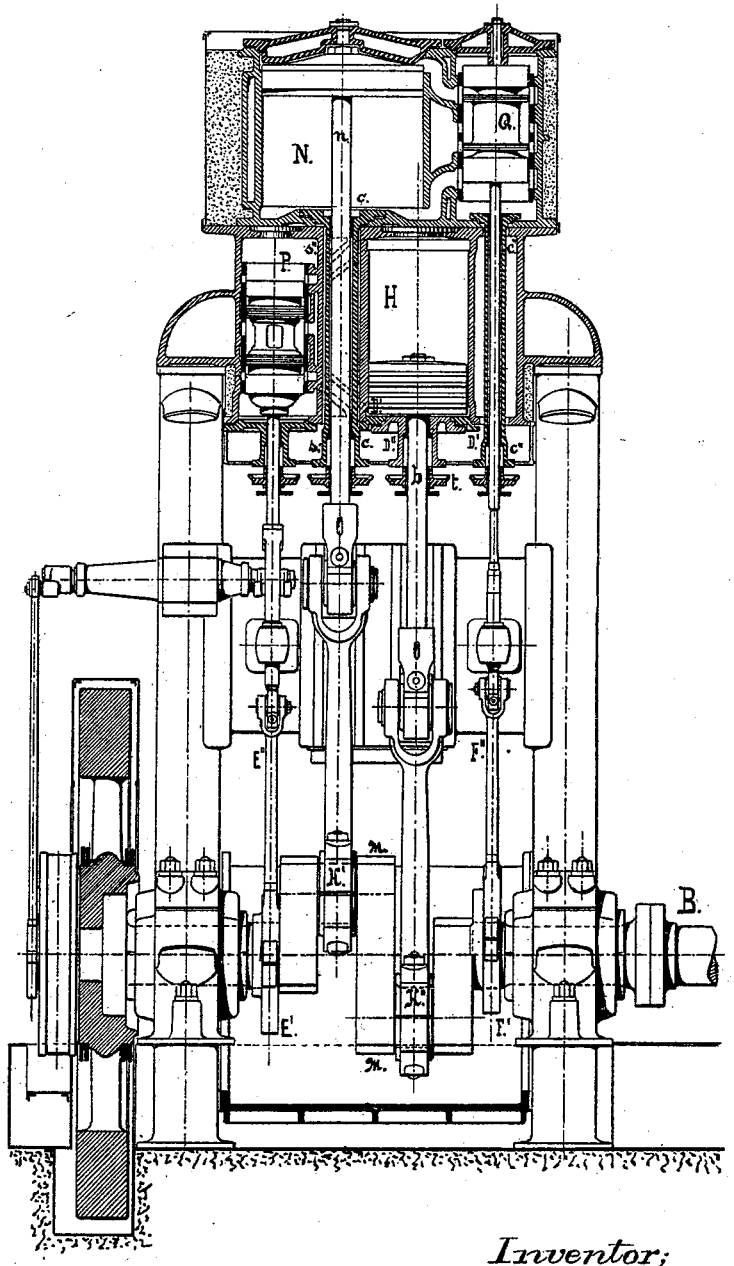
Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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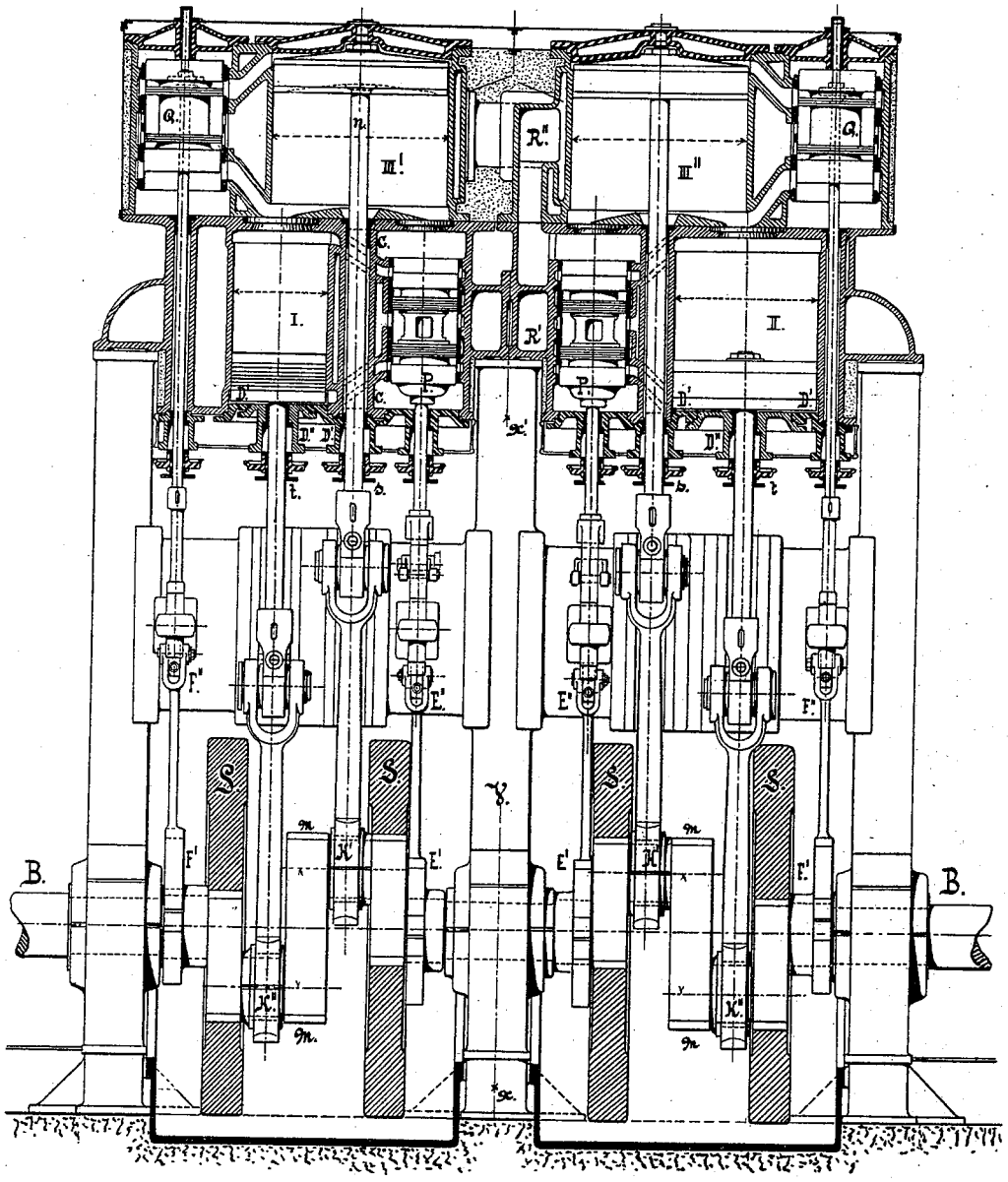
Fig. 4.



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UNITED STATES PATENT OFFICE.

ALFRED COLLMANN, OF VIENNA, AUSTRIA-HUNGARY.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 494,412, dated March 28, 1893.

Application filed July 6, 1892. Serial No. 439,120. (No model.) Patented in Austria-Hungary November 6, 1888, No. 29,681 and No. 49,749; in France January 20, 1889, No. 218,826; in Germany March 14, 1889, No. 49,861, and in Belgium January 30, 1892, No. 97,934.

To all whom it may concern:

Be it known that I, ALFRED COLLMANN, a subject of the Queen of England, and a resident of Vienna, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Steam-Engines, (for which I have received Letters Patent in Austria-Hungary, dated November 6, 1888, No. 29,681 and No. 49,749; in France, dated January 20, 1889, No. 218,826; in Germany, dated March 14, 1889, No. 49,861, and in Belgium, dated January 30, 1892, No. 97,934,) of which the following is a specification.

This invention relates to steam engines with two or more cylinders, and its object is to provide a compact and easy running high speed engine.

The invention consists of certain novel features hereinafter described and claimed.

Figure 1 is a sectional side elevation and Fig. 2 a sectional plan of a horizontal simple compound engine. Fig. 3 is a sectional front elevation of a vertical simple compound engine. Fig. 4 is a sectional front elevation of a vertical double compound engine, all of which machines are constructed in accordance with my present invention.

The object in view I obtain in the simple compound engine shown in Figs. 1 and 2 by arranging the two cylinders H and N the one behind the other and in different vertical planes so that the piston rod of the rear cylinder N passes in close proximity to the side of the front cylinder H. The pistons of these cylinders act upon cranks K′ K″ respectively set at an angle of one hundred and eighty degrees. Now when the pistons, piston rods, cross heads and connecting rods of both cylinders H and N are made equal in weight, the equal masses reciprocating in opposite directions balance each other to the most perfect degree possible in the direction of the axes of the cylinders as well as normally thereto, because the distance between the axes of the two cylinders is reduced to a minimum. Therefore, firstly, all the actions of the inertia of the two pistons together with the connected moving parts are not transmitted to the foundation but are taken up directly by and balance each other in the straight middle arm M M of the double crank; secondly, the bed plate of the engine has to transmit only about the difference of the work of the two cylinders; and thirdly, the crankshaft bearings are charged with only the difference of this pressure as alternating strains. Hence smaller foundations, weaker bed plates and quiet motion with high speed are secured.

The two cylinders arranged the one behind the other may have equal diameters constituting a twin engine, or as shown in Figs. 1, 2, and 3, the two cylinders may be of different diameters constituting a simple compound engine, with the high pressure cylinder H in front and the low pressure cylinders N in rear; or as in Fig. 4 a double compound engine may be constructed according to my invention by causing the steam from the high pressure cylinder I to pass to the medium pressure cylinder II which is also situated in front, while the third expansion cylinder is divided into two low pressure cylinders III′ III″ each of half the sectional area which a single low pressure cylinder otherwise would have. In the construction shown in Fig. 4 the high pressure cylinder I and one of the low pressure cylinders III′ act by pistons &c. of equal weight against cranks set at an angle of one hundred and eighty degrees while the medium pressure cylinder II and the other low pressure cylinder III″ are similarly connected to another double crank. These two double cranks K′ K″ and K′ K″ are set at an angle of ninety to one hundred and ten degrees, according to the intended rate of total expansion, to obtain the highest possible degree of uniformity of tangential forces. By this arrangement I am able as shown in Fig. 4 to employ fly disks S S S S on the cranks and to avoid the use of a separate fly wheel which particularly in dynamo-driving plants permits of a much more compact arrangement. For very high steam pressures I can convert the double compound engine shown in Fig. 4 into a triple compound engine by making the cylinder III′ to act alone as the third expansion cylinder, whereas the cylinder III″ which is suitably enlarged acts as fourth and last ex-

pansion cylinder. In both cases the engine can be so mounted that its two halves are separated on the line *x x* Fig. 4, in the direction of the main shaft, each half having its separate standard V between which the fly wheel and also the governor may be arranged. In this arrangement of the cylinders the head of the high pressure cylinder forms usually the bottom or front head of the low pressure cylinder, as shown in Figs. 1, 2 and 4 and the piston rod of the latter works in the tube C C cast on to the high pressure cylinder; at the front end of this tube the stuffing box *s* for the low pressure piston rod is arranged.

In large machines the low pressure cylinder may as shown in Fig. 3 have a separate lower head and the tube C C is cast on to this head and extends downward along the high pressure cylinder carrying at its outer end the low pressure stuffing box *s*. Only in very large machines is it practicable to dispense with the said tube C C and to arrange the stuffing box *s* directly at the lower head of the low pressure cylinder, in which case the low pressure piston rod passes freely along the high pressure cylinder.

In order to facilitate, particularly in smaller engines, the removal of the front or lower high pressure piston H, the cylinder head is made in two pieces as shown in the drawings, so that the inner part D′ of the cover can be first removed, and then the ring portion D″ which is made in one piece with the low pressure stuffing box can be drawn away sliding along the low pressure piston rod and along the cross head guides. Although in larger steam engines with this improved arrangement of the cylinders any desired valve gear may be employed, yet it is advisable for the sake of compactness to arrange the valve gear with the piston valves P and Q shown in such a manner that the high pressure valve is located at the low pressure side and the low pressure valve at the high pressure side of the crank. By this reversed arrangement the engine is made as compact as possible and direct eccentric motions E′ E″ and F′ F″ are obtained throughout.

The expansion gear acts as shown in Figs. 1 and 2 by means of an Armington governor directly upon the main valve, or a separate expansion valve inserted in the main valve P, Figs. 3 and 4, and operated by a fly wheel governor; or a vertical governor actuated by gear wheels may produce the expansion in the usual way.

It is desirable to obviate as shown, the location of the valve gear outside the crank shaft bearings particularly when the engines have to be directly coupled with dynamo-electric machines at B B.

I claim—

1. In a steam engine, the combination with a main shaft of a large and a small cylinder, the larger cylinder being partially behind the smaller, and having its axis parallel thereto, of a piston rod for each cylinder parallel with and close to the piston rod of the next, a suitable connecting rod for each piston rod, two cranks set approximately at an angle of one hundred and eighty degrees for the said pair of cylinders, and having the weight of the reciprocating parts of each cylinder of said pair made practically equal, an admission valve to the larger cylinder arranged at the side thereof next the piston rod of the smaller cylinder, and an admission valve to the smaller cylinder arranged at the opposite side of the smaller cylinder, and overlapping the larger cylinder, substantially as and for the purposes described.

2. In a steam engine, the combination with a main shaft, of a large and a small cylinder the larger cylinder being partially behind the smaller, and the piston rod of the larger cylinder passing through the steam chest of the smaller and being parallel to the piston rod of the smaller, a suitable connecting rod for each piston rod, two cranks set at approximately an angle of one hundred and eighty degrees for the said pair of cylinders, and having the weight of the reciprocating parts to each cylinder of said pair made practically equal, an admission valve to the larger cylinder arranged at the side thereof next the piston rod of the smaller cylinder, and an admission valve to the smaller cylinder arranged at the opposite side of the smaller cylinder, and overlapping the larger cylinder, substantially as and for the purposes described.

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

ALFRED COLLMANN.

Witnesses:
C. O. PAGET,
T. G. HARDY.