

No. 886,438.

PATENTED MAY 5, 1908.

M. H. SULLIVAN.
COMPOUND ENGINE.

APPLICATION FILED AUG. 12, 1907.

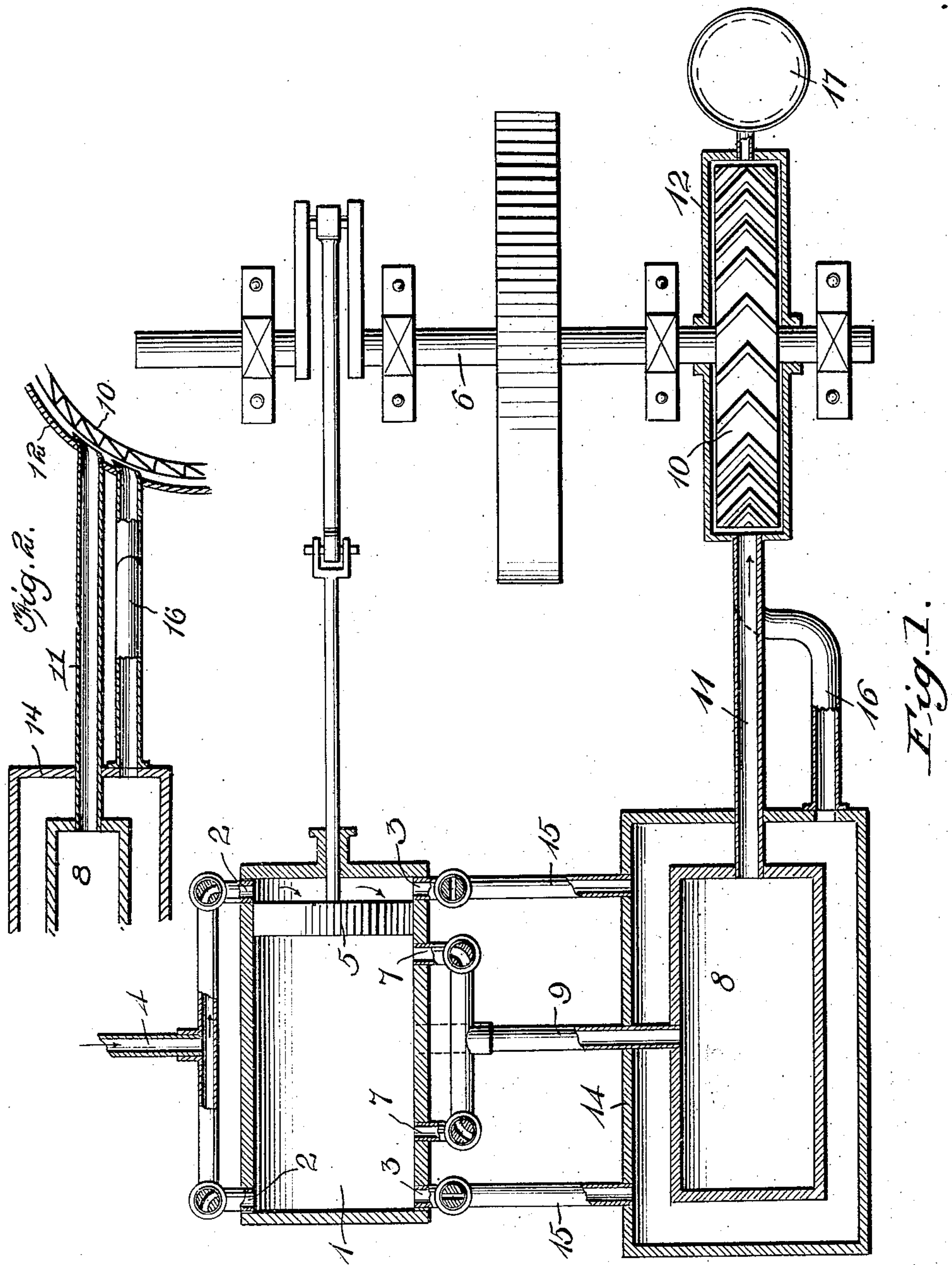


Fig. 1.

Witnesses
W. S. Boyd.

Inventor
Michael H. Sullivan
By *Ray. G. Croft*
Attorney

UNITED STATES PATENT OFFICE.

MICHAEL H. SULLIVAN, OF POUGHKEEPSIE, NEW YORK.

COMPOUND ENGINE.

No. 886,438.

Specification of Letters Patent.

Patented May 5, 1908.

Application filed August 12, 1907. Serial No. 388,225.

To all whom it may concern:

Be it known that I, MICHAEL H. SULLIVAN, a citizen of the United States, residing at Poughkeepsie, in the county of Dutchess and State of New York, have invented new and useful Improvements in Compound Engines, of which the following is a specification.

This invention relates to compound engines, and has for its object to utilize or conserve the force and energy of the motive medium to the greatest possible extent.

In operating engines, and especially those in which steam is used for the motive power, there is always a greater or less amount of loss of energy by having to exhaust the steam from the piston before all of its expansive power has been utilized. Efforts have been made to utilize this power by passing the exhaust steam through one or more engines, but only with a limited amount of success. It is a well-known fact that under certain conditions steam can be used more effectively in a turbine than it can be in a reciprocatory engine, and I have invented means by which the exhaust steam from a reciprocatory engine may be thus utilized by passing it through a turbine engine. I preferably connect both engines with the same shaft and provide an accumulator between the engines, which receives the steam from the reciprocatory engine and delivers it to the rotary engine. Two exhaust ports are provided for each end of the cylinder, and a condenser is preferably provided at the discharge outlet of the turbine.

In the accompanying drawings:—Figure 1 represents a sectional diagrammatic view of one form of a plant or apparatus, by means of which my invention may be practiced and Fig. 2 is a broken sectional detail view.

Referring more particularly to the accompanying drawings, 1 indicates the cylinder of an ordinary Corliss engine, which is provided at its ends with the ordinary inlet ports, 2, and exhaust ports, 3. The inlet ports, 2, may be supplied with steam from an inlet pipe, 4, and all of said valves are actuated in a well known manner, which it is not necessary to show. The piston 5 is connected with a shaft, 6, in the well known manner, and each end of the cylinder is provided with an auxiliary exhaust, 7, which can be actuated by any ordinary means, which is, therefore, not shown. The exhaust ports, 7, are so located relative to the ends of the cylinder that each one will be uncovered by the pis-

ton, 5 before the latter reaches the limit of its movement toward that end, but is preferably not opened until just before the piston reaches its limit, and it is then held open until the piston passes it on its return stroke. This secures the greatest possible effectiveness from the steam expansively, and permits of the escape of the steam with the least possible back pressure on the return stroke of the piston. The steam from the exhaust ports, 7, is led into an accumulator, 8, as by means of a pipe, 9, from whence it is passed onto the turbine wheel, 10, through a pipe, 11. The turbine is mounted in a casing, 12, and secured to the shaft, 6, in any well known manner, and the valves, 7, are so arranged that after the steam has been passed into the accumulator, the valves are closed and back pressure from the accumulator into the cylinder 1 is thereby prevented.

As only a portion of the steam can escape through the valves, 7, the remaining portion is permitted to escape through the valves 3 in the usual manner, but instead of permitting such final exhaust to escape into the air, it is conveyed to a casing, 14, around the accumulator, 8, by means of pipes, 15. In this manner, its heat is utilized for retaining the heat of the steam in the accumulator, and it is then preferably passed on to the turbine through a pipe, 16, which leads from the casing, 14, independently of the pipe, 11.

From the turbine wheel, 10, the exhaust steam is delivered to an ordinary condenser as shown at 17, by means of which it may be utilized for heating feed water, or any other purpose. By condensing the steam after it has passed through the turbine wheel, a vacuum is produced, which thereby completely prevents any back pressure, and, in reality, permits of the escape of the exhaust through the valves, 3, more effectively than if the exhaust were discharged into the atmosphere, as substantially all back pressure is eliminated.

When using a reciprocatory engine under heavy load, the supply of steam is not cut off until just before the piston reaches the limit of its stroke, and by properly adjusting the movement of the auxiliary valves, 7, the exhaust steam therefrom passes into the accumulator almost at boiler pressure. By discharging steam into the comparatively large chamber of the accumulator, and then passing it through the turbine wheel through a comparatively smaller pipe, the discharge

of the steam to the turbine is rendered comparatively even and uniform, thereby securing great efficiency with very simple apparatus.

5 Having thus fully described my invention, what I claim as new and desire to secure by Letters-Patent, is:

1. In a compound engine, a reciprocatory engine, a crank shaft connected therewith, a turbine engine on said shaft, an accumulator, means for passing part of the exhaust steam from the reciprocatory engine through the accumulator to the turbine engine, and means for passing the remainder of the exhaust around the accumulator and to the turbine engine.

2. In a compound engine, a reciprocatory engine provided with two exhaust ports at each end, a crank shaft connected with said engine, a turbine engine connected with said shaft, an accumulator communicating with the turbine engine and with one of said exhaust ports at each end of the reciprocatory engine, and a casing around the accumulator communicating with the turbine engine and with the other port at each end of the reciprocatory engine.

3. In a compound engine, a reciprocatory engine provided with two exhaust ports for each end of the engine cylinder, one of which is at a distance from its end, a crank shaft connected with said engine, a turbine engine secured to said shaft, a condenser communicating with the exhaust port of the turbine engine, an accumulator communicating with the turbine engine and with the two exhausts at a distance from the ends of the reciprocatory engine, a casing around the accumulator communicating with the turbine engine and with the other exhaust ports of the reciprocatory engine.

4. In combination a reciprocatory engine the cylinder of which has an exhaust and an inlet port at each end and an exhaust port intermediate its ends, a turbine, an accumulator, means for establishing communication between the intermediate exhaust port and the accumulator, and means for establishing communication between the accumulator and the turbine.

5. In combination a reciprocatory engine the cylinder of which has an exhaust and an

inlet port at each end and an exhaust port intermediate its ends, a turbine, an accumulator, a jacket surrounding the accumulator and spaced therefrom, means for establishing communication between the intermediate exhaust port and the accumulator, means for establishing communication between the jacket and the end exhaust ports, and means for establishing communication between the turbine and the accumulator and means for establishing communication between the turbine and the jacket surrounding the accumulator.

6. In a compound engine, a reciprocatory engine, a crank shaft connected therewith, a turbine engine, an accumulator, means for passing part of the exhaust steam from the reciprocatory engine through the accumulator to the turbine engine, and means for passing the remaining portion of the exhaust around the accumulator and to the turbine engine.

7. In combination, a reciprocatory engine, the cylinder of which has an exhaust and an inlet port and an extra exhaust port, a turbine, an accumulator, means for establishing communication between the extra exhaust port and the accumulator, and means for establishing communication between the accumulator and the turbine.

8. In combination, a reciprocatory engine, the cylinder of which has the usual inlet and exhaust ports, and an extra exhaust port, an accumulator, a jacket surrounding the accumulator and spaced therefrom, means for establishing communication between the extra exhaust port and the accumulator, means for establishing communication between the jacket and the usual exhaust ports, means for establishing communication between the turbine and the accumulator, and means for establishing communication between the turbine and the jacket surrounding the accumulator.

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

MICHAEL H. SULLIVAN.

Witnesses:

BENJ. G. COWL.
L. O. HILTON.