A. F. Smith,

Steam-Boiler Condenser.

No. 39,965. Patented Sep. 15, 1863.

Fig. 1.

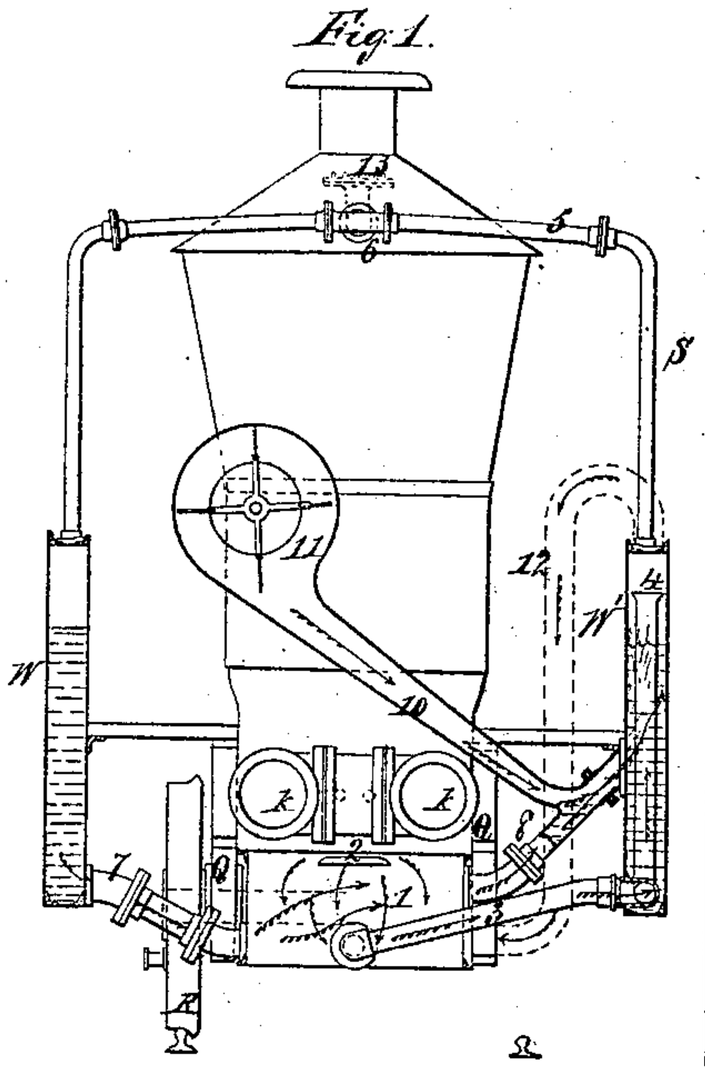


Fig. 2.

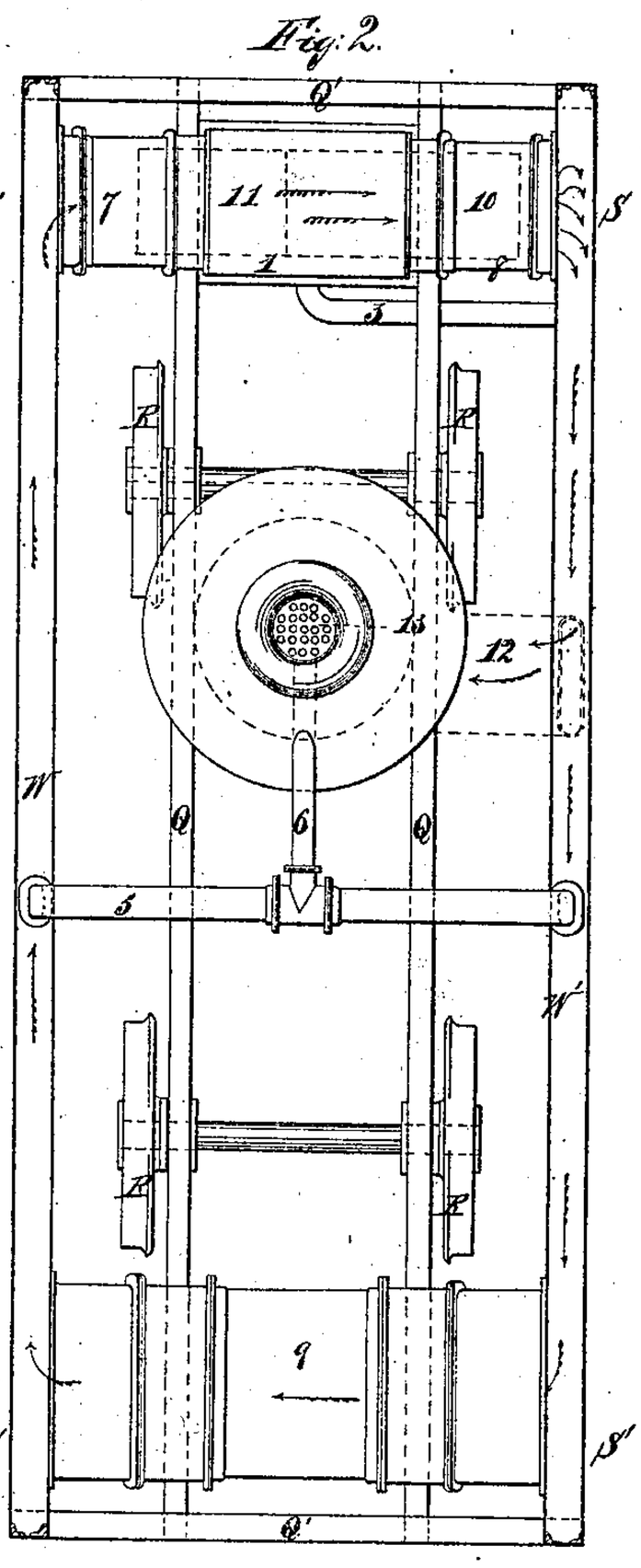
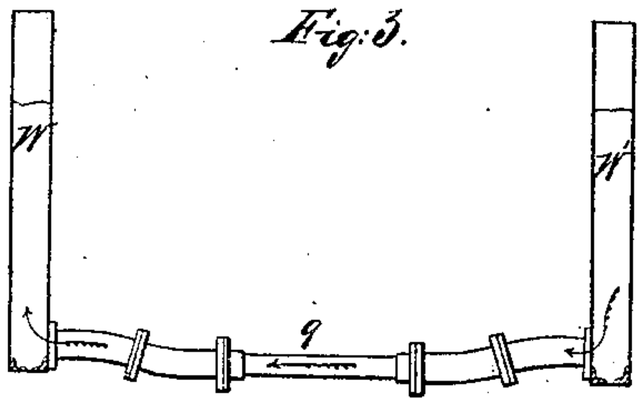


Fig. 3.



Witnesses:
D. W. Stetson
F. Hendrickson

Inventor:
Alba F. Smith

UNITED STATES PATENT OFFICE.

ALBA F. SMITH, OF NORWICH, CONNECTICUT.

IMPROVED CONDENSER FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **39,965**, dated September 15, 1863.

To all whom it may concern:

Be it known that I, ALBA F. SMITH, of Norwich, in the county of New London and State of Connecticut, have invented certain new and useful improvements in condensing or partially condensing steam-engines, intended mainly for those which are adapted, by reason of their silence and of their other qualities, to operate in the streets of cities, and which are known as "dummy-locomotives;" and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, forming a part of this specification.

These drawings represent the features claimed as novel introduced properly in a dummy, with only so much of the other features as seems to be required in order to properly explain the relations of the several parts.

Figure 1 represents a cross-section on the line S S in Fig. 2, with outline also of some of the important parts. Fig. 2 is a plan view, and Fig. 3 represents a cross-section on the line S′ S′ in Fig. 2.

Similar letters and numerals indicate like parts in all the figures.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation by the aid of the drawings and the letters and numerals denoted thereon.

R R, &c., are the driving-wheels, and Q Q the main frames. The wheels are rotated by the aid of mechanism, (not represented,) which may be of any known character. I prefer to mount the boiler in an upright position, and two cylinders in a horizontal position, as indicated.

W W′ are narrow but deep tanks of sheet metal, connected and supported by the aid of the cross-frames Q′ and of other frames or braces. (Not represented). These tanks are filled about two-thirds or three-fourths full of cold water, the surface thereof being indicated by a wavy line, and they are sufficiently capacious to contain many tons of water, so that the heat of all the steam expended in a vigorous use of the locomotive may be absorbed thereby for a considerable period, if properly diffused therein.

1 is a surface-condenser of any ordinary character.

2 is the aperture through which the steam is discharged from the engines through a pipe, (not represented,) and 3 is a pipe through which any steam which remains uncondensed escapes from the condenser. This pipe 3 is extended through the side of the tank W′, and is extended longitudinally through the water backward and forward several times. Its open end is at 4 above the water surface. All the steam which is used in the engines *k k* is led through 2 into the condenser 1, where it traverses through or between a net-work of tubes, (not represented;) thence through the pipe 3 a short distance through the air to the tank W′, and thence within this tank several times backward and forward, and finally upward through the mouth 4 into the upper part of the tank. The water that results from the condensation of the steam in the condenser 1 and the pipe 3 4 is drawn out through a pipe (not represented) and continuously forced back into the boiler, so that nothing but the uncondensed vapor issues through the mouth 4 into the upper part of the tank. The pipe 5 arches over the space between the tanks W and W′ and forms a free communication between them, so that the pressure of steam or air in the two tanks must be equal.

7 is a capacious flat pipe, leading from the tank W to the lower part of the condenser 1, and 8 is a corresponding pipe leading from the upper part of the condenser 1 to the tank W′ in the inclined position represented.

9 is a flat pipe of about equal capacity to the pipes 7 and 8, which extends across and connects the tanks W W′ at or near the end of the structure farthest removed from the condenser and its pipes. The water in the condenser 1, in the performance of the desired function of abstracting heat from the steam, necessarily becomes heated, and must be constantly and rapidly renewed. This fact is well understood, as is also the fact that the hot water therefrom will become sufficiently cooled to allow its use again and again, if it is caused to remain any considerable time between each period of use in broad sheet-metal tanks favorably exposed to the air, like W W′. I attain these ends by means of a constant and active circulation of the water through the condenser 1 and the tanks W W′, in the direction indicated by the blue arrows. This circulation is due, in part, to the arrangement

and connection of the parts 1 7 8 9, so as to render available the well-known tendency of heated water to rise and allow its place to be occupied by cooler, and in part to another cause, which will now be explained.

10 is a flat pipe communicating between the pipe 8 and the fan or other powerful blowing device, 11, in the manner represen'ed. The fan 11 is actuated by an independent engine, (not represented,) and a connection is made so that the acts of opening and closing the throttle to start and stop the engines *k k* correspondingly start and stop the action of the blower 11. This connection is not represented, but may be readily effected either by a rod communicating motion from one lever to another or by a pipe leading steam from the main pipe to the blower-engine. I prefer the latter plan, but with either I provide means of making the parts independent and separately controllable at will, so that I can start the blower a little before the engine is started, when necessary. The air is discharged from the pipe 10 at a sufficient pressure to enter the water-tanks below the surface, as represented. It is discharged in large volumes and at a high velocity into the pipe 8, in the manner represented, and, rising to the surface, escapes from the top of the tank W′, through a pipe which is outlined in red and marked 12. This pipe communicates with a close ash-pit, and the air, after traveling this round, is allowed to flow upward through the grate (not represented) and supply the fire. This process is continued during the whole time that the condenser 1 is required to operate, and the air by its direct contact with the water cools the water and is itself warmed, while its motion upward through the water conduces greatly to quicken the circulation of the latter through the condenser. The fact that the air for combustion is warmed induces a saving of fuel by well-known laws, and the fact that it is slightly moistened induces a cleaner and a more active fire with some varieties of fuel. If much steam escapes uncondensed from the mouth 4 of the pipe 3 it mingles with the air for combustion, flowing down through 12, and gives a more decidedly moist character to the latter; but this will rarely occur to such extent as to become an evil. I lead a pipe, 6, from the middle of the arched pipe 5 to the perforated plate 13 in the stack. A portion of the air blown into the tanks may be thrown through this into the stack in a series of small jets, serving thereby to promote the draft in the same manner as the well-known steam-jet, and the proportion thus used may, by obvious means, be made larger or smaller at will. The entire volume of air may be thus used when the presence of uncondensed steam or when any other reason makes it desirable.

Some of the advantages due to certain features of my invention may be separately enumerated, as follows:

First. By reason of my arrangement of the passages 7, 8, and 9 relatively to each other and to the condenser 1 and tanks W W′, I induce a constant circulation of the water through the entire series by virtue of the difference in density of the heated and cool water, the former constantly rising from the top of the condenser 1 through the inclined passage 8, and flowing successively through the tank W′, passage 9, and tank W, rapidly cooling in the interim by radiation and convection, and becoming adapted for a further use in the condenser 1, and this result is attained in a very good degree without the use of the blower 11 and its connections.

Second. By reason of the fact that the water serves as a reservoir or receptacle of heat without sensibly obstructing the transmission thereof from the steam to the air, I am able to condense the steam efficiently, even when the current of air from the fan 11 is stopped temporarily, and to heat the air for combustion or for promoting the draft, even when the steam is shut off temporarily. The water receives heat readily from all the steam which may be thrown into the condenser 1 for a long time, whether any air is moving through the pipe 10 or not, and it gives off heat for a long time to the air which may be received through pipe 10 and discharged through pipe 12, whether any steam is exhausted into the condenser 1 or not. My invention makes the two operations of using steam and using air in the manner shown almost completely independent of each other in regard to the time in which each is effected. This allows my dummy, on the one hand, to efficiently heat the air employed for combustion while standing motionless on the track, and, on the other hand, to condense the steam perfectly while running with the fan stopped, as is practiced on approaching stations and near the end of the route.

Third. By reason of the fact that the air is forced by the blower 11 through the passage 10 into the tank W′ or its connections below the water-line, is presented in contact with the water in the tank during its passage to the surface, and is subsequently held for a time in direct contact with the surface of the water prior to its being allowed to escape through the pipes 12 and 6 into the furnace and stack, or either of them, I reduce the temperature of the water in the tanks W W′, which is employed in condensing the steam, and raise the temperature of the air for the fire or the stack very rapidly and effectively, and avoid the complication and expense due to the construction and repairs of tubular or other constructions of metal ordinarily used for analogous purposes. The direct contact, as distinguished from the interposition of even very thin metal, very greatly increases the efficiency of the surfaces exposed, and allows a comparatively small surface when contrasted with that required with metal interposed. The small quantity of water and uncondensed vapor absorbed by the air will not be

sufficient to appreciably diminish the supply of water in the tanks in one day, and with many kinds of fuel will add too rather than diminish, the efficiency of the fire.

Fourth. By reason of the fact that the air blown through the passage 10 is introduced into the passage 8 in the manner represented, and is allowed to rise through this passage and through the tank W′ in a path which coincides with the direction of the circulation of the water, I render available the rapid motion due to the levity of the air in the act of rising through the water as a powerful means of inducing and aiding to sustain a very active circulation of the water through the tanks and the condenser, so as to maintain a nearly uniform temperature in all the water in the entire circuit.

Having now fully described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. In condensing or partially-condensing steam-engines, the arrangement of the condenser 1 and passages 7 and 8, connecting the same with the tanks W W′, and of the passage 9, connecting with tanks W W′, substantially as and for the purpose herein set forth.

2. In such engines, the passing of the air for combustion or for promoting the draft through the water or equivalent receptacle for storing the caloric, and thus aiding the efficiency of the apparatus, substantially in the manner herein set forth.

3. In such engines, when a quantity of water or other fluid is used as a receptacle for so storing caloric, bringing the water, after its use to condense the steam, in direct contact with the air employed to receive the heat, substantially in the manner and for the purposes herein set forth.

4. In such engines, so introducing such air that the motion thereof toward the surface of the water, which is due to the difference in density between the air and the water, shall induce or promote a circulation of such water, substantially in the manner and for the purpose herein set forth.

In testimony whereof I have hereunto set my name in the presence of two subscribing witnesses.

ALBA F. SMITH.

Witnesses:
D. W. STETSON,
W. A. HENDRICKSON.