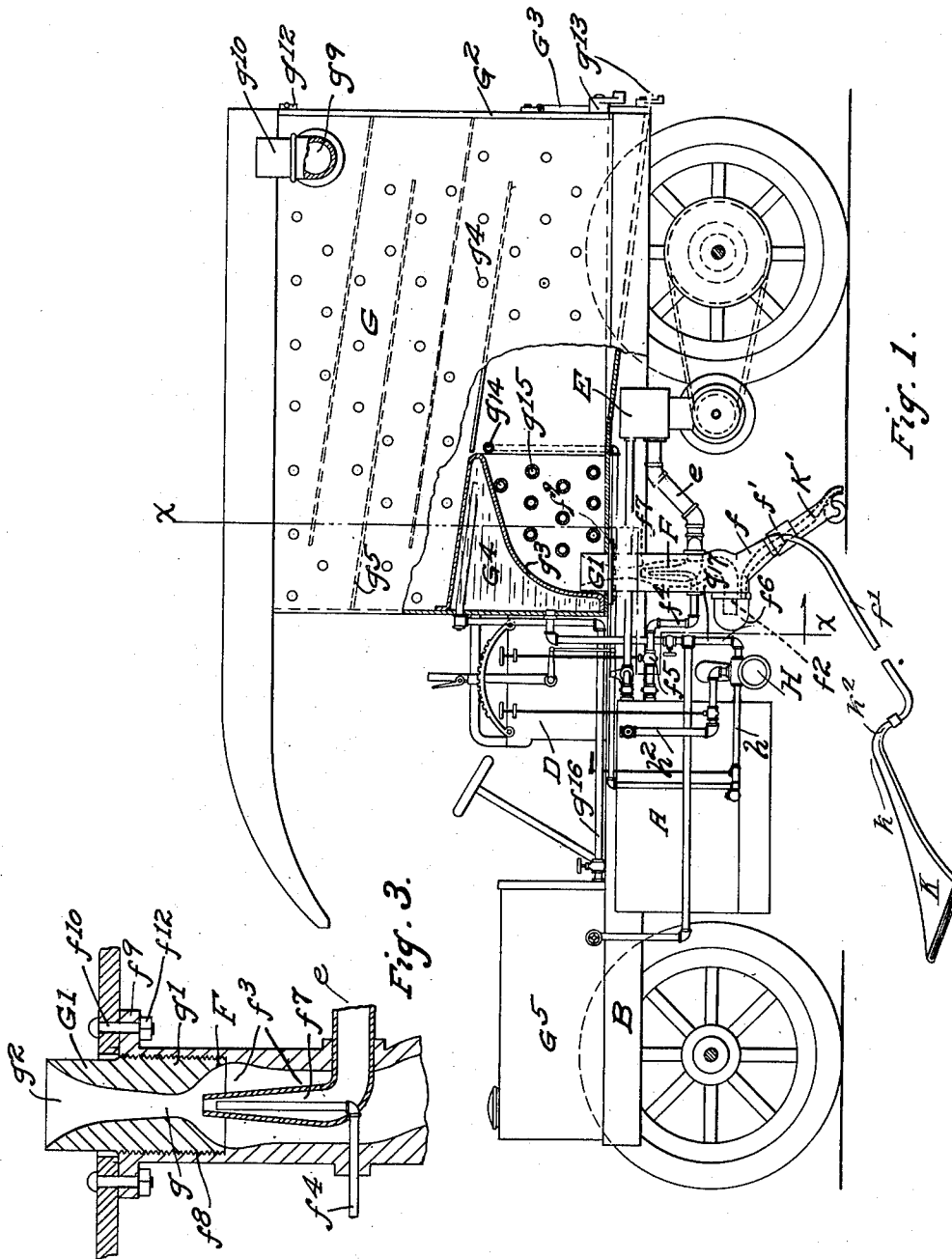


1,016,263.

Patented Feb. 6, 1912.

3 SHEETS—SHEET 1.



Witnesses
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VACUUM CLEANER.
APPLICATION FILED MAR. 22, 1905.

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3 SHEETS—SHEET 2.

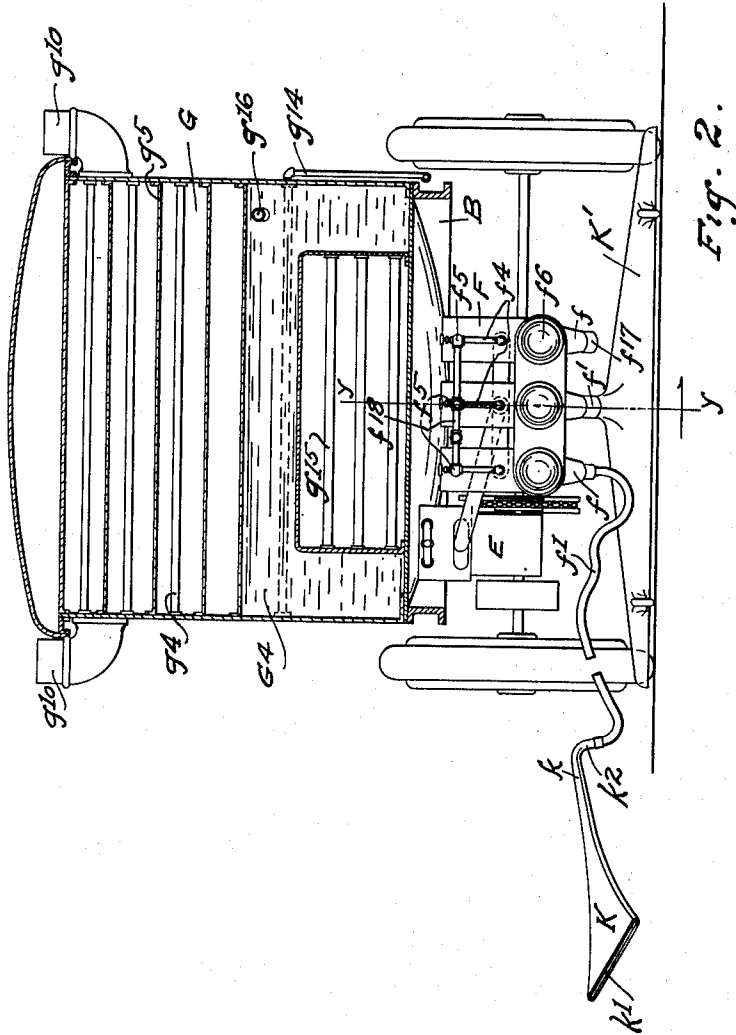


Fig. 2.

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3 SHEETS—SHEET 3.

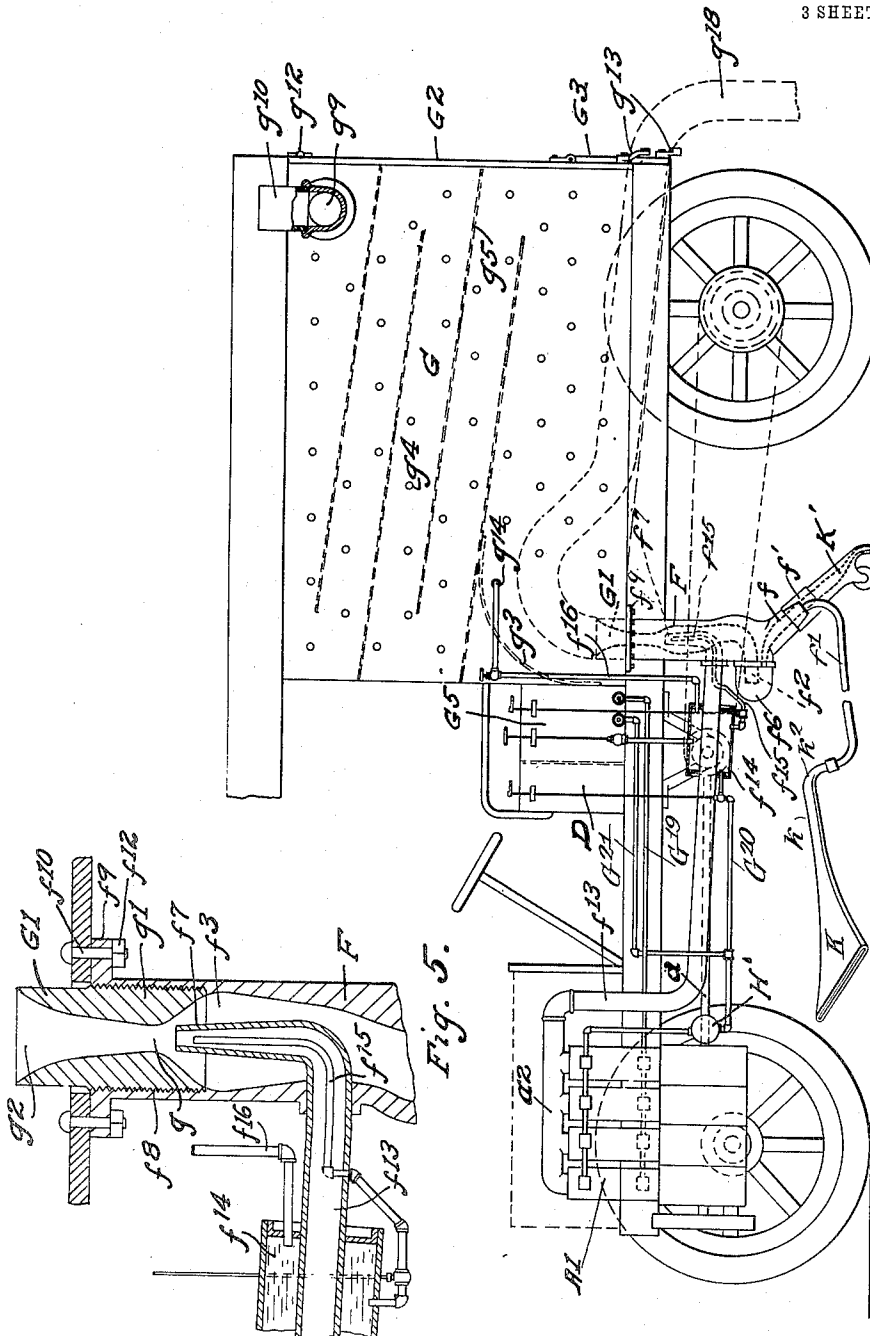


Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

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VACUUM-CLEANER.

1,016,263.

Specification of Letters Patent.

Patented Feb. 6, 1912.

Application filed March 22, 1905. Serial No. 251,536.

To all whom it may concern:

Be it known that I, JOHN H. GREEN, a citizen of the United States, residing at Springfield, in the county of Sangamon and State of Illinois, have invented a certain new and useful Improvement in Vacuum-Cleaners, of which the following is such a full, clear, and exact description as will enable others skilled in the art to which it ap-
10 pertains to make and use my said invention.

My invention relates primarily to apparatuses such as are employed in extracting and removing dirt by suction, from streets, or apartments, or from draperies, carpets, or articles of furniture, and consists in the novel features of construction and combinations of parts shown in the annexed drawings, and hereinafter described and finally recited in the claims.

Referring to the drawings, in which similar reference letters and characters designate like parts in the several views: Figure 1 is a combined side elevation and sectional view of an apparatus comprising a steam generator mounted on an automobile truck, and a vacuum-cylinder and coöperating mechanism mounted on the truck frame; Fig. 2 is a vertical transverse section on the zig-zag line X. X. of Fig. 1; Fig. 3 is an enlarged partial vertical section on the line Y. Y. of Fig. 2; Fig. 4 is a side elevation of a modified form of the apparatus adapted to employ hot air or hot gases as the vacuum producing and sterilizing agent; and Fig. 5 is an enlarged partial vertical longitudinal section through the water jacket surrounding the exhaust pipe and through the vacuum cylinder.

The apparatus herein described is adapted to clean streets during the travel of the apparatus upon the streets, and is also adapted to renovate carpets, or other articles, the dirt being all extracted and carried away by the suction of dry air applied directly to the thing to be cleaned, said dirt being immediately thereafter sterilized, dampened and settled by the same agent that induces the air suction.

The apparatus in its preferable form comprises a generator supplying steam, hot air, or hot gases to produce and maintain a practically constant vacuum in a suitable vacuum-chamber, or chambers, provided with an inlet tube, or tubes, through which dirt may be drawn by suction into and through an induction tube and thence con-

veyed into a suitable chamber to be sterilized by the heat of the sterilizing agent and to be thence driven by the impact of said agent into a suitable dirt receptacle provided with means for applying moisture to be absorbed by the dirt so as to moisten the dirt and cause it to settle in the dirt receptacle.

The term generator, used in the specification, is hereby defined to mean, any means adapted to generate hot expansive gases, such as steam, or the hot gases resulting from the explosion of mingled air and hydrocarbon, or the like; and within the scope of the specification and claims, a generator may consist of a steam boiler; or may consist of a gas engine, or similar explosive engine; adapted to produce expansible gases during the operation of the engine.

In the drawings I have illustrated two forms of the apparatus slightly differing from each other, but an apparatus of preferable form comprises a boiler mounted on the vehicle and generating steam to be applied to propel the vehicle and to extract and sterilize the dirt, said machine being equipped with a renovator usable for street cleaning when the vehicle is moving and a renovator, or renovators, usable for house cleaning when the vehicle is stationary; and a self propelling apparatus equipped with a gasoline engine and employing hot gases, or hot gases and steam together, and adapted for use either in house cleaning or street cleaning.

I will first describe the steam apparatus illustrated in Figs. 1, 2 and 3; and will then describe the modified form of the apparatus equipped with a gasoline engine and illustrated in Figs. 4 and 5. A fuel tank D, a steam engine E, a vacuum cylinder F, and a dirt receptacle G are mounted on a suitable truck B. The engine E is suitably connected to propel the truck. The vacuum-cylinder F is in communication with the generator A, the renovator K (or K', as the case may be), and the dirt receptacle G. The vacuum cylinder consists of a metal body F, having one or more inlet tubes *f*, communicating with the interior of the cylinder. In the apparatus shown in Figs. 1 and 2 there are three vacuum cylinders each having an eduction tube G¹ communicating with the interior of the dirt receptacle. In case the exhaust from an explosive engine is used as the sterilizing agent, the vacuum-cylinder may have

a single eduction pipe G^1 intercommunicating with the sterilizing chamber of the vacuum-cylinder and the interior of the dirt receptacle; and in that case the vacuum cylinder may have a plurality of inlet tubes f , communicating with a single sterilizing chamber in the vacuum cylinder. The tubes f are preferably tapering so that a rubber hose f^1 , used with the tubes will fit tightly around the tubes respectively and prevent leakage of air. Integral induction pipes f^2 project from the body of the vacuum cylinder and communicate with the sterilizing chamber f^3 within the cylinder body and at the juncture of the eduction pipe G^1 with the vacuum cylinder. Dome-shaped transparent covers f^6 surround the projecting induction pipes f^2 and have suitable air-tight connection with the vacuum-cylinder. The covers f^6 are preferably of glass and enable the engineer to observe the flow of dirt through the domes. If any one of the renovators is not working properly the interruption or stopping of the flow of dirt through the corresponding dome will apprise the engineer of that fact. Nozzles f^7 (Fig. 3) terminate in the chambers f^3 and are supplied with live steam by means of pipes f^4 communicating with the steam generator A. Valves f^5 (Fig. 2) mounted on a steam supply pipe f^{18} , control the supply of steam through the pipes f^4 so that any one or more of the induction pipes f^2 may be used, as may be most convenient. The eduction pipes G^1 (Figs. 1 and 3), preferably have screw-threaded parts g^1 (Fig. 5) fitting in screw-threaded holes f^8 in the vacuum-cylinder; but any other suitable means may be employed for connecting the pipes with the cylinder. The bores of the parts g^1 of the pipes G^1 are enlarged and flared to match the chambers in the lower part of the vacuum cylinder, the outer ends of the bores g^2 of the pipes G^1 are also flared, and the intermediate parts g are reduced, as shown. Under normal conditions with the apparatus using hot gases or hot gases and steam together, one eduction pipe G^1 will have capacity to draw dirt through all the inlet tubes f but in extraordinary cases where higher vacuum may be required one or more of the inlet tubes may be closed by a suitable cap f^{17} (Fig. 2), to restrict the flow of the dirt. The dirt receptacle G preferably consists of a box-shaped structure of sheet metal having a flat top and an inclined curved lower part. The inclined curved bottom facilitates the travel of the dirt in the receptacle. Air flues g^4 extend transversely across the receptacle and are suitably secured on the side walls thereof. The flues g^4 are open at both ends and outside air circulates through the flues. A curved metal sheet g^3 extends across the box and is secured to the walls of the box. Inclined longitudinal shelves g^5 extend across the box and are

secured on the side walls of the box. The shelves g^5 do not extend the entire length of the chamber in which they are situated; there is at one end of each shelf a space not occupied by the shelf and adapted to permit the extracted dirt to travel through the box. In case water is employed to moisten the dirt, the water may be applied by a pipe g^{14} extending across the box and communicating with any convenient source of water supply and having small openings adapted to spray water on the dirt in its passage through the box. On each side near the top of the box is an opening g^6 through which the unexpanded steam, or gases and air pass to the exhaust pipes g^{10} and thence to the atmosphere. The mixed dirt, microbe-laden air and steam or gases, emerging from the eduction pipes G^1 strike against the curved wall g^3 and the several currents are thereby broken up, deflected and mingled so as to cause the material to slide downward along the bottom of the receptacle and circulate between and around the pipes g^4 . Part of the steam coming in contact with the air-cooled pipes g^4 to the rear of the wall g^3 condenses and produces moisture which is absorbed by the dirt. The dirt gravitates toward the bottom of the receptacle and the pressure of the steam, air and gases forces the intermingled dirt, steam and air rearward under the lower shelf g^5 , thence upward around the end of the shelf, thence forward above the shelf, and thence upward around the end of the next shelf; and in this way the travel of the dirt is prolonged and the surface of all the shelves are traversed before the outlet openings g^9 are reached. The pipes g^4 between the shelves g^5 cause additional condensation, constantly increasing the amount of moisture which is absorbed by the dirt; so that by the time that the steam reaches the outlets g^9 it is practically inert, and substantially all of the moistened dirt has been deposited on the bottom of the receptacle or on the shelves g^5 , the small quantity if any, escaping with the exhaust steam, being insignificant and harmless by reason of its previous sterilization. The reduced area of the parts g of the eduction pipes G^1 (Figs. 3 and 5) causes a degree of concentration of the material passing through the pipes and localizes it exactly in line with and near the upper end of the nozzle f^7 so that the maximum heat of the steam, or other agent, is most effectively applied in sterilizing the material. The vacuum cylinder F and the dirt receptacle G may be connected together by any suitable means, such as a flange f^9 integral with the cylinder body, and bolts f^{10} passing through the wall of the receptacle and through the flange and secured by nuts f^{12} . A door G^2 supported on hinges g^{12} , closes the discharge end of the receptacle G . A smaller

door G^3 mounted on the door G^2 , affords access to the lower compartment of the box so that the lower compartment may be cleaned without opening the larger door. Securing devices g^{13} prevent accidental opening of the doors, but permit the opening of the doors when necessary for removing the dirt from the receptacle. In the steam apparatus a feed-water heater G^4 (Fig. 2), is situated within the dirt receptacle and has tubes g^{15} secured on the inner side-walls of the heater and open at both ends. The walls of the dirt receptacle form the outer walls of the heater, and water fills the tubes g^{15} and the space between the walls of the heater and the dirt receptacle. When the apparatus is in use the steam discharged through the pipes G^1 heats the tubes g^{15} and the inner walls of the feed-water heater, and this heat is imparted to the water circulating within the feed-water heater and through the tubes g^{15} . In the steam apparatus, a pump H is connected with the feed-water heater G^4 by a pipe g^{17} and pumps water from the feed-water heater into the boiler A . In the dirt receptacle either air or water, or both air and water, may be used as the cooling medium. In the apparatus illustrated in Fig. 1 the tubes g^4 are air cooled and the tubes g^{15} are water cooled. Water flows from the water tank G^5 through the pipe g^{16} into the feed-water heater G^4 . A pipe g^{17} communicates with the interior of the heater and is connected with a steam pump H or equivalent device, which is connected with the boiler by a pipe h , so that water from the heater may be forced into the boiler in the usual manner.

In an apparatus using a steam engine the water tank G^5 is preferably placed between the front wheels, and the fuel tank D is placed under the vehicle seat; as shown in Fig. 1. In an apparatus employing a gasoline engine both the fuel tank D and the water tank G^5 are preferably situated under the vehicle seat; as shown in Fig. 4, but the water tank and the fuel tank may be placed in other suitable or convenient positions without departing from my invention.

Any suitable instrument for applying air suction to the article to be cleaned may be used in connection with the apparatuses hereinbefore described. A suitable and convenient instrument for this purpose, known as a "renovator", consists of an approximately tubular metal part k , of suitable dimensions and having a flattened and expanded part K provided with a narrow slit k^1 extending the entire width of the renovator; also having an integral tubular stem k^2 externally tapering at its free end; and serving as a handle for manipulating the renovator. A hose f^1 fitting tightly on the stem k^2 and on one of the tapering tubes f

connects the renovator with the vacuum cylinder F . One or more renovators may be used in connection with each machine, as shown in the drawings; that is to say, a separate hand renovator K may be used in connection with each of the inlet tubes f for house cleaning when the vehicle is at rest; or a single renovator K' connected with the central inlet tube f and supported below the truck frame and preferably covering the full width of the track of the vehicle may be used for street cleaning when the vehicle is moving.

A slightly modified form of the apparatus shown in Figs. 4 and 5, is adapted to employ hot gases, or hot air under pressure, as the vacuum-producing and sterilizing agent; and comprises a heat and power generator such as a gasoline engine A^1 or equivalent device, employing hydrocarbon or other explosive gases as the heat and power producing agent. This form of the apparatus has a sterilizing chamber f^3 , (Fig. 5), a nozzle f^7 , and a dirt receptacle G substantially the same as used with the steam generator. A pipe f^{13} connects the sterilizing chamber with the exhaust pipe a^2 of the engine A^1 . A cylinder f^{14} surrounds the pipe f^{13} and receives water from any suitable source of water supply. A pipe f^{15} within the pipe f^{13} communicates with the interior of the cylinder f^{14} and extends upward within the nozzle f^7 . Water passing through the pipe f^{15} is heated to some extent in the cylinder f^{14} by heat radiating from the pipe f^{13} and as the water passes through the pipe f^{15} it is converted into steam by the direct action of the hot air and gases in the pipe f^{13} and emerges from the end of the pipe within the nozzle f^7 , and passes thence through the eduction pipe G^1 into the dirt receptacle where it is condensed as already described, to moisten the dirt within the dirt receptacle. A supply of water may be maintained in the cylinder f^{14} by means of the pump H' , pumping water from the water jacket of the engine into the cylinder f^{14} .

When the apparatus of the form shown in Fig. 4 is at work cleaning a house, the engine is running but the vehicle is stationary; and the engine cylinders can therefore be most effectively cooled by water circulating around them. This water circulation is attained by means of the pump H connected to pump water from the water jacket through the pipes g^{20} and g^{21} into the tank G^5 , thereby permitting cold water to flow from the tank through the pipe g^{19} into the jacket of the engine A^1 . When the contents of the cylinder f^{14} (Figs. 4 and 5), is used only for moistening the dirt, or for applying to the dirt a disinfecting or sterilizing agent other than steam or hot air, or hot gases, the pump will not be used, and the

water will pass from the tank G^5 through the pipes g^{21} and g^{20} into the cylinder f^{14} .

In the apparatus shown in Fig. 4, the dirt receptacle G is above the truck frame; the vacuum cylinder receives the exhaust directly from the engine and discharges directly into the dirt receptacle.

Water alone may be used as a moistening agent, and in that case a pipe f^{16} connected to inter-communicate with the cylinder f^{14} and the spraying pipe g^{14} will convey water from the cylinder and through the pipes in sufficient quantity to produce the requisite moistening of the dirt after sterilization.

In the steam apparatus shown in Fig. 1, the vacuum-cylinder F receives live steam directly from the boiler through the pipe f^4 , to supplement the vacuum producing and sterilizing effect of the exhaust steam conveyed to the vacuum cylinder through the exhaust pipe e of the engine E ; and the vacuum cylinder F is connected to discharge vertically into the dirt receptacle G situated above the vacuum cylinder; and the steam pump H takes steam directly from the boiler through a pipe h^2 and is connected to pump water through the pipe h directly into the boiler. In practice exhaust steam may be introduced into the vacuum cylinder F through the pipe e ; or live steam may be introduced into the vacuum cylinder F through the pipe f^4 , as may be most convenient. Exhaust steam may be utilized when the vehicle is in motion and live steam may be utilized when the vehicle is stationary, or both may be used together when the vehicle is moving.

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

1. In an apparatus of the class described, the combination of a propellible vehicle, a steam engine connected to propel said vehicle, a boiler connected to supply steam to said steam engine, a dirt receptacle mounted on said vehicle, a vacuum cylinder mounted on said vehicle and having a sterilizing chamber in communication with the interior of said dirt receptacle, a renovator in communication with the sterilizing chamber of said vacuum cylinder, a nozzle within the sterilizing chamber of said vacuum cylinder and connected to convey exhaust steam from said engine into the sterilizing chamber of said vacuum cylinder, a feed-water heater in communication with said

boiler and acted upon by the exhaust steam from the engine passing through said nozzle and said vacuum cylinder, and condensers within said dirt receptacle adapted to condense said exhaust steam to moisten the dirt discharged into said dirt receptacle from said vacuum cylinder coincidentally with the heating of the feed-water by the same steam.

2. In a self-propelling apparatus of the class described, the combination of a propellible vehicle, an engine mounted on and connected to propel the vehicle, a boiler mounted on the vehicle and connected to supply steam to said engine, a dirt receptacle mounted on the vehicle and equipped with a feed-water heater and condensers and connected to supply water to said boiler, a water tank mounted on the vehicle and connected to supply water to the feed-water heater, a vacuum cylinder mounted on the vehicle and having a sterilizing chamber communicating with the interior of said dirt receptacle, a renovator in communication with the sterilizing chamber of said vacuum cylinder, controllable means for supplying live steam from said boiler to the sterilizing chamber of said vacuum cylinder when the engine is at rest, and means for supplying exhaust steam from said engine to the sterilizing chamber of said vacuum cylinder when the engine is running.

3. In an apparatus of the class described, the combination of an engine, a vacuum cylinder in operative relation to said engine and having a sterilizing chamber, a renovator communicating with the sterilizing chamber of said vacuum cylinder, a nozzle connected to conduct exhaust gases from said engine into the sterilizing chamber of said vacuum cylinder, means for supplying water to be vaporized within said nozzle, a dirt receptacle in communication with said vacuum cylinder and condensers within said dirt receptacle effective to condense the vapor induced by the water vaporized within said nozzle.

In witness whereof I have hereunto signed my name at Springfield, Illinois, this 18th day of March, 1905.

JOHN H. GREEN.

Witnesses:

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LYMAN L. BROWNE.