L. W. SERRELL.

VACUUM CLEANING APPARATUS.

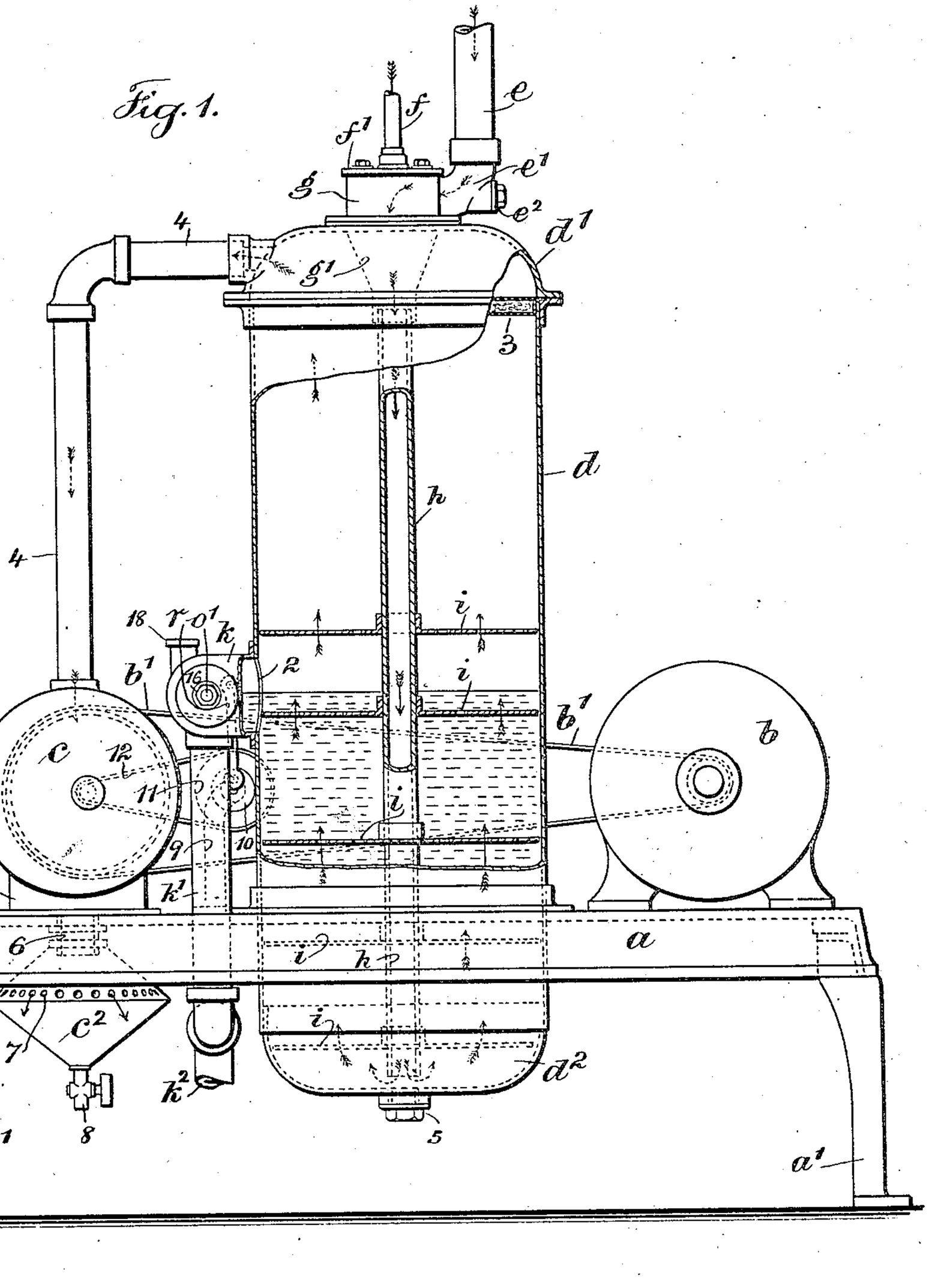
APPLICATION FILED NOV. 30, 1908.

979,210.

Patented Dec. 20, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

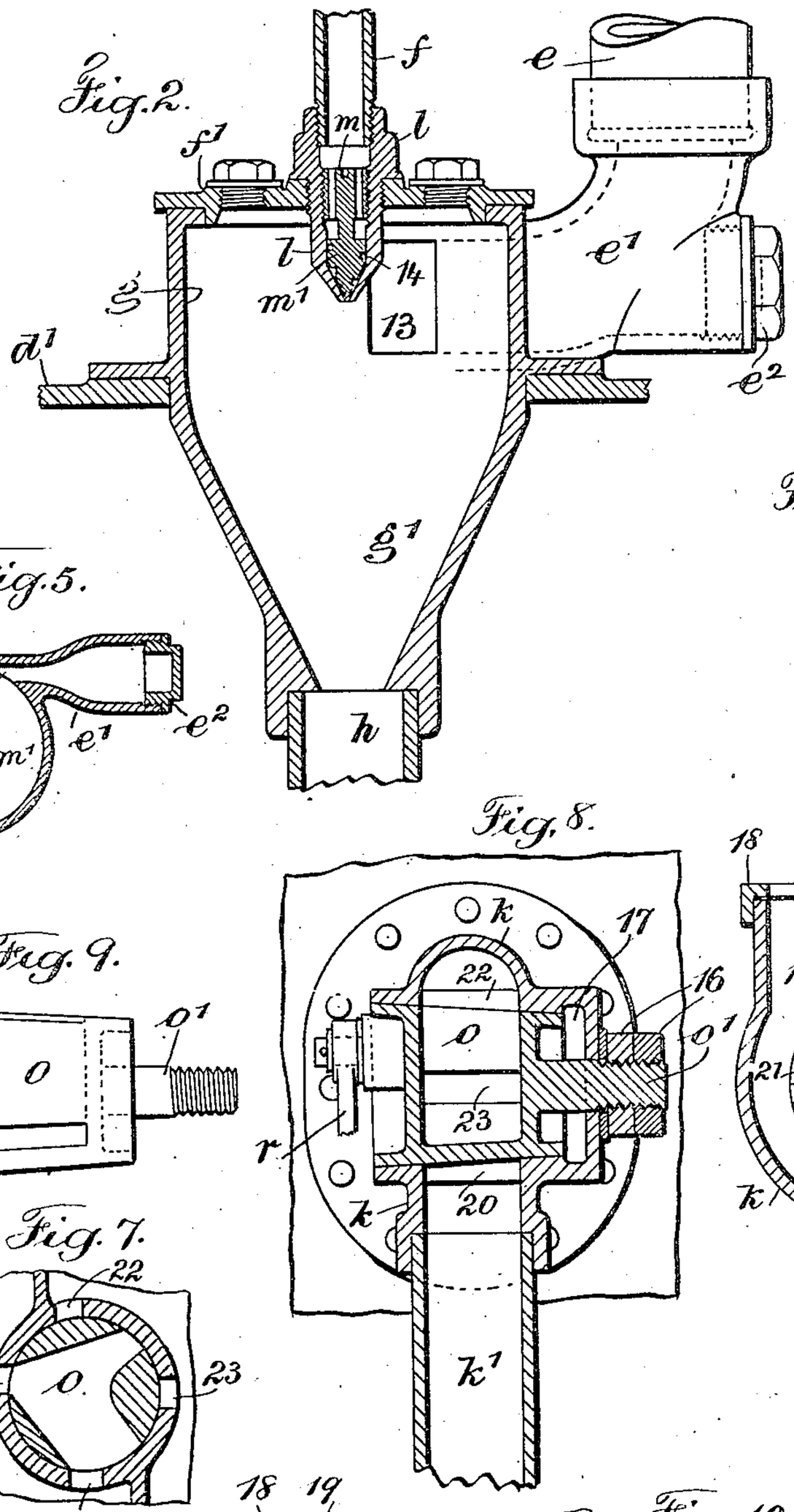


Fig. 3.

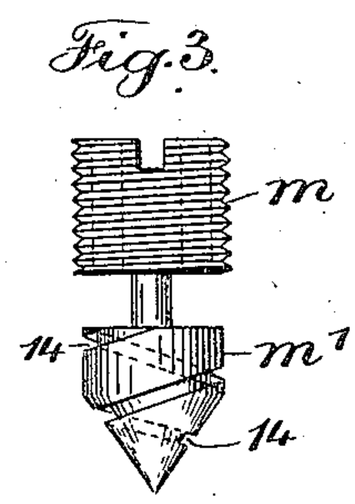


Fig. 4.

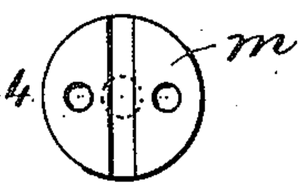


Fig. 5.

Fig. 8.

Fig. 6.

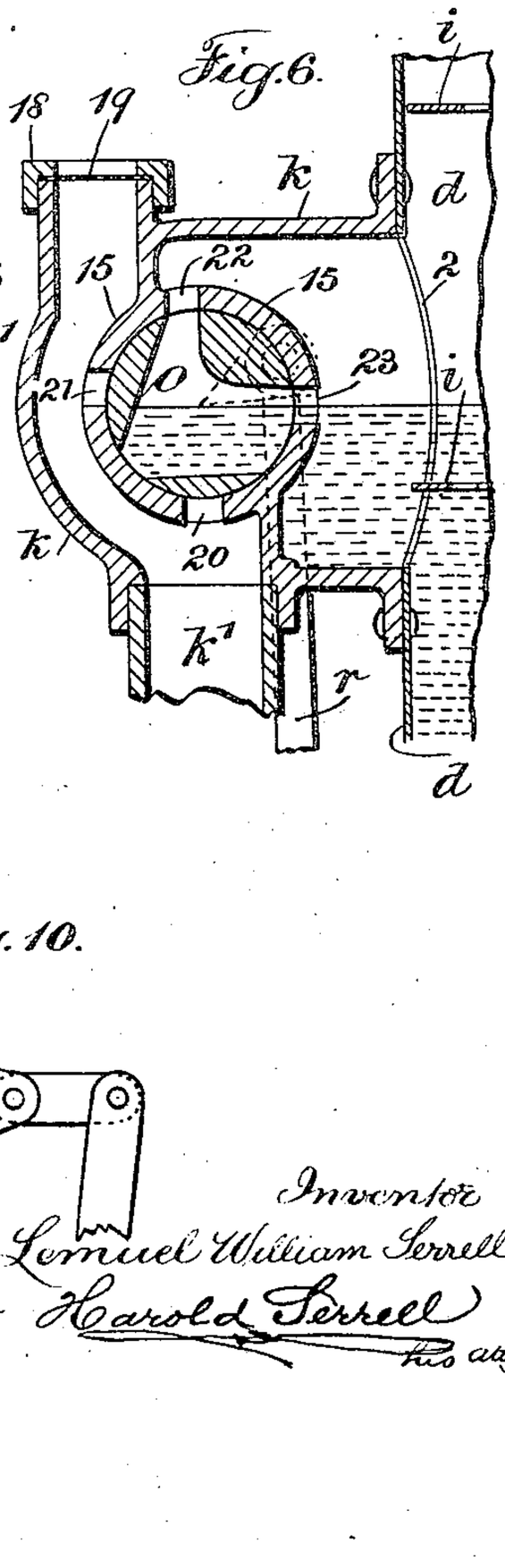
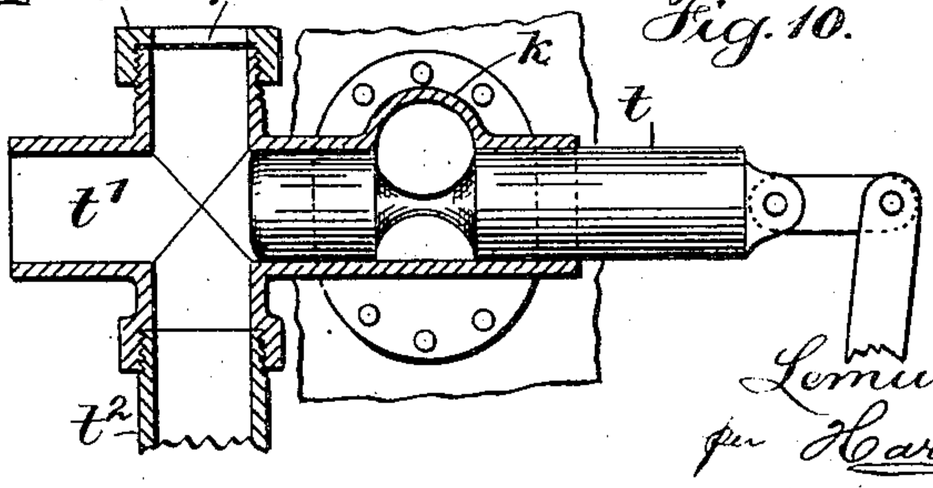


Fig. 9.

Fig. 7.

Fig. 10.



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3 SHEETS—SHEET 3.

Fig. 12.

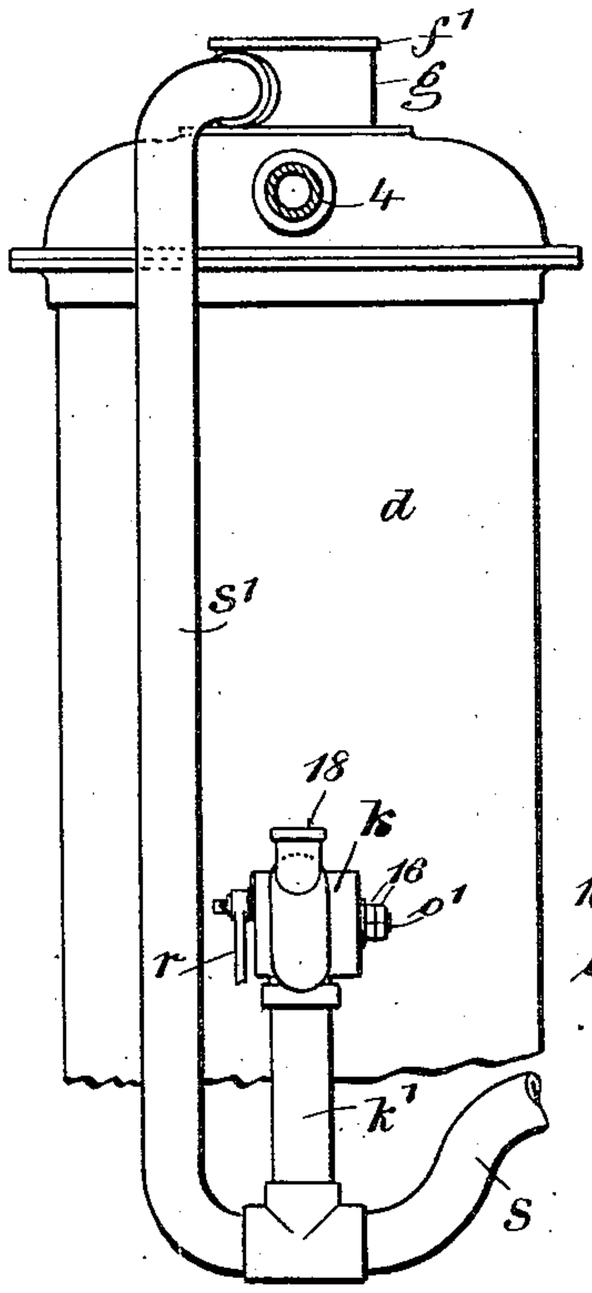
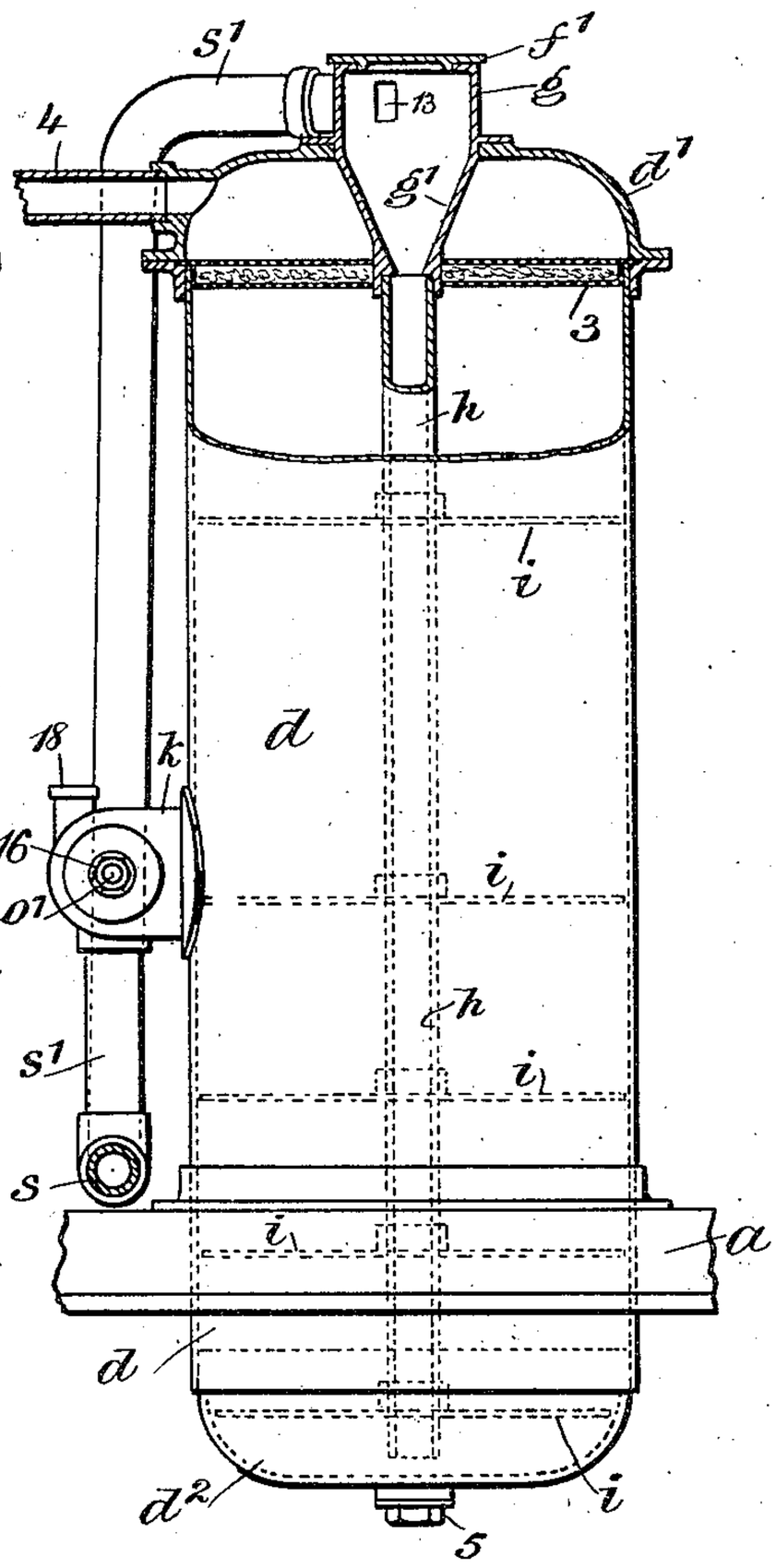


Fig. 11.



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UNITED STATES PATENT OFFICE.

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VACUUM CLEANING APPARATUS.

979,210. Specification of Letters Patent. Patented Dec. 20, 1910.

Application filed November 30, 1908. Serial No. 465,313.

To all whom it may concern:

Be it known that I, LEMUEL WILLIAM SERRELL, a citizen of the United States, residing at Plainfield, in the county of Union and State of New Jersey, have invented an Improvement in Vacuum Cleaning Apparatus, of which the following is a specification.

My invention relates to a vacuum cleaning apparatus of light weight and compact form, adapted for installation in dwellings or portable in character; an apparatus positive in action and adapted to be actuated by an electric motor on the ordinary circuit of a dwelling.

In the device of my invention, I employ an electrically or otherwise driven vacuum pump and an electric motor, a separator vessel holding water and receiving the moist dust-laden air entering the same, and a holding platform therefor; means for imparting a rotary movement to the dust laden air, other means for imparting a rotary movement and comminuted condition to the entering water in proximity to the air, whereby the dust is thoroughly moistened and the added water provides for a continuous overflow. I provide special devices for controlling this overflow as waste into the sewer or a receptacle, means for breaking up the air bubbles in the liquid holding vessel and means insuring the retaining of all the moisture in the said vessel.

In the drawing, Figure 1 is an elevation and partial section representing the device of my improvement. Figs. 2, 3, 4 and 5 are detail views of the part of the apparatus providing for the entrance of the dust-laden air and moistening the same and hereinafter more fully described. Figs. 6, 7, 8 and 9 are detail views of the devices controlling the overflow of water and hereinafter more fully described. Fig. 10 is a vertical section and elevation of a modified form of device for controlling the overflow of water. Figs. 11 and 12 are elevations and partial sections, the one at right angles to the other, showing a modification of the device of my invention used as a portable device.

The platform on which the apparatus of my invention is to be mounted can, without departing from the nature and spirit of my invention, be made to be stationary or portable at the discretion of the manufacturer.

I have shown in Fig. 1 the platform *a* and legs a^1 for the same at the corners. On this platform a motor *b* is mounted and a belt b^1 extends to a pulley on the shaft of the rotary vacuum pump *c*. The motor *b* is to be of any desired character suitable for use with this apparatus. It will probably be arranged for connection with the electric circuit of a dwelling and the rotary vacuum pump *c* is also to be of any desired pattern or character, as neither the particular character of the motor nor the pump form any essential part of my invention.

I provide a liquid holding vessel *d* preferably of sheet metal and advantageously placed in a vertical position and suitably secured to the platform *a*. This vessel is advantageously provided with curved ends or heads d^1 d^2.

e represents an entrance pipe for the dust laden air and *f* an entrance pipe for water.

g represents a tubular body having by preference a lower conical end g^1 and together constituting a mixing chamber.

The pipe *e* enters the tubular body *g* and the pipe *f* passes through a cover f^1 of the tubular body *g* and enters the same in proximity to the entrance of the air pipe *e*, the details of which are hereinafter more particularly described.

h is a central pipe in the liquid holding vessel *d*, preferably attached to and suspended from the lower end of the conical portion g^1 of the tubular body *g*. This pipe *h* passes to near the bottom of the liquid holding vessel *d*, and within this liquid holding vessel *d* around the pipe *h* are arranged and spaced apart perforated diaphragms *i* in series. I provide a throat 2 about midway in the height of the vessel *d* forming an entrance into the valve case *k*, a septum 3 in the upper part of the liquid holding vessel and a pipe 4 opening from the head or end d^1 of the vessel and extending to the rotary vacuum pump *c*.

The septum 3 preferably consists of parallel perforated plates spaced apart and the space between them filled with excelsior, hair or some other suitable moisture absorbing material so as to insure the air passing therethrough from the vessel *d* to the vacuum pump being as dry as possible. I provide a screw plug 5 at the lower end of the vessel *d* so that upon its removal the dirty water and sediment from the vessel *d* may be removed

and the same thoroughly cleansed out and the vessel is provided with a means for introducing water.

I have shown a base c^1 upon the platform a for supporting the vacuum pump c, a pipe 6 connecting with this base from said pump and extending to the muffler c^2. This muffler is preferably provided with series of openings 7 for discharging the air from the muffler into the atmosphere and with a discharge valve 8 at its lower end. From the valve case k a pipe k^1 extends downward and with an elbow connects with the pipe k^2 which passes to a suitable receptacle or to the sewer.

Upon the platform a is a standard 9 with a bearing at its upper end for a shaft carrying a disk 10 and pulley 11. The pulley 11 and a pulley upon the shaft of the rotary vacuum pump c are surrounded by a belt 12 which communicates the rotation of the pump to the pulley 11, its shaft, the disk 10 and a connecting rod r, which connecting rod extends to the valve in the valve case k hereinafter described.

The tubular body g is formed with a neck e^1 receiving the pipe e providing for the entrance into the apparatus of the dust laden air. This neck e^1 in a vertical direction is throughout of corresponding height but horizontally the same is contracted as shown in Fig. 5, to a narrow long opening which enters the tubular body tangentially; the opening being rectangular as shown in Fig. 2, all with the object of increasing the speed of the entering dust laden air and imparting a rapid circular motion to the same, which is preferably increased by the downwardly contracted or conical shape of the tubular body at the end g^1; the rectangular orifice being indicated at 13 and the neck e^1 being provided with a clean-out e^2 and which upon its removal provides for the introduction of a wire or other instrumentality for removing any deposit of dust from the walls of the neck.

The cover f^1 is centrally perforated and interiorly threaded for a taper sleeve l which at its upper end receives the pipe f providing for the entrance of water. This sleeve l has a contracted lower end and central orifice and within the sleeve there is a screw-head m perforated, with a stem and a conical valve m^1, the inclination or taper of whose surface agrees substantially with the taper at the end of the sleeve l. These parts are shown particularly in Figs. 2, 3, 4 and 5, in which Fig. 2 is a vertical section and partial elevation, Fig. 3 is an elevation of the screw-head and the conical valve and Fig. 4 a plan and Fig. 5 a horizontal section through the tubular body and contracted portion of the neck thereof.

In and around the surface of the conical valve m^1 is a spiral groove 14 starting at the upper edge and extending into the conical portions; the water entering by the pipe f passes through the perforations of the screw-head m and through the spiral groove of the conical valve m^1 and through the orifice in the lower end of the sleeve l; the said spiral groove imparting to the water a rapid circular motion which converts the water into a spray or mist as it emerges from the orifice at the lower end of the sleeve l; a circular movement being given to this spray, or in other words, a whirling action within the tubular body g and its conical end g^1. The rapidly rotating dust laden air and the whirling water spray within the tubular body g and its conical end g^1 are by virtue of their respective movements thoroughly commingled and all the particles of dust and bacteria or other life in the dust of the dust laden air thoroughly wet, thus insuring absolute separation from the air, its specific gravity increased and the pressure causes a downward movement with force through the pipe h to the bottom of the liquid holding vessel d, where the air and moistened dust commingle with the water in the vessel; the water retaining the dust and the air rising through the perforations of the diaphragm i into the upper part of the vessel d above the water and then passing through the septum 3 and through the pipe 4 to and through the vacuum pump c; the said pump producing the necessary vacuum through the entire apparatus and the flexible hose that is to be connected to the free end of the pipe e and which in its turn carries one or other of the cleaning appliances applied to furniture or carpets for the removal of the dust; the air when it reaches the vacuum pump being practically purified and dry is fit to be delivered through the perforations of the muffler into the atmosphere.

In the valve case k I provide a central auxiliary case 15 with four ports, two, 20 and 22, being opposite and substantially in a vertical line and two, 21 and 23, substantially opposite in a horizontal line and within this auxiliary case 15 is a three-way rocker-valve o, or in other words, a rocker-valve with three openings, two of which are adapted to coincide with adjacent ports in the valve case 15 while the other two ports are shut off. This rocker-valve is of tapering form preferably provided with a stem o^1 passing through the right hand end of the valve case Fig. 8, and provided with tightening nuts 16, there being by preference a hollow portion 17 of the valve case to receive lubricating material for lubricating the valve. The construction of the valve case and valve is shown plainly in the vertical sections Figs. 6 and 7 and longitudinal section Fig. 8; said case providing on the right hand side of the auxiliary case 15

space for the water of the liquid holding vessel *d* and on the opposite side between the auxiliary case 15 and the valve case a curved air passageway opening up from the pipe k^1 and at the upper end of the valve case terminating in an annulus cap 18 and gauze 19; the said valve case at the annulus cap providing for the entrance of air into the passage-way beneath the gauze 19 communicating with the upper end of the pipe k^1. In the operation of this valve Figs. 6 and 7 show the respective positions of the valve as the same is rocked by the action of the connecting rod *r*, disk 10, pulley 11 and belt 12 from the shaft of the pump *c*. In the position Fig. 6 it will be noticed that the ports 20 and 21 are closed while the ports 22 and 23 are open, thus shutting off any communication of air from without to within the vessel *d* and permitting the water from the vessel *d* to flow into the hollow valve and the air in the valve *o* to enter the vessel *d* by the port 22.

Fig. 7 shows the other position of this valve *o* in which the ports 22 and 23 are closed and the ports 20 21 open. This latter position prevents communication with the interior of the vessel *d*, permits the air passing through the gauze 19 to enter the port 21 of the hollow valve, balancing any internal and external pressure and the dirty water to be delivered from within the valve through the port 20 into the pipe k^1 to flow away, and this valve *o* is continuously rocked from one position to the other so as to receive the dirty water from the vessel *d* and deliver the same into the pipe k^1 in proportion to the extent of water which enters the vessel *d* through the pipe *f* and spraying device shown in Fig. 3.

I have shown in Fig. 10, a modification of this valve device in which a reciprocating valve *t* is movable longitudinally in the valve case *k*, crossing a vertically disposed discharge pipe t^2 into the tubular member t^1; these parts being provided with the same annulus cap 18, gauze 19 and the reciprocating valve having a reduced part, which in its extreme position in one end as shown in Fig. 10, alines with the openings in the valve case and receives a proportion of water equal to its reduced area. As this is moved along, this proportion of water will be moved with it within the case and will be closed off with this progressive movement and the reduced portion of the reciprocating valve be brought into alinement with the discharge pipe t^2 and with the return of the valve additional water will be taken and the operations repeated.

In the form of my invention shown in Figs. 11 and 12, similar letters of reference have been employed denoting similar parts in the other figures; therefore the description of said parts and their function is unnecessary. In this form of my invention (Figs. 11 and 12) I have shown the portable form of my invention. In this structure I dispense with the devices for the entering water and spraying shown in Figs. 2 to 5 inclusive, and use over and over again the water in the vessel *d* until the same requires removal and replenishing; the valve device shown in Figs. 6 to 9 inclusive in the valve case *k* being retained and other parts carrying similar numbers of reference also being retained. In this form of my invention, the pipe *s* connects by a T-union with the discharge pipe k^1 from the valve *o* and to this pipe *s* usual flexible connections and cleaning devices intended to be used therewith for cleaning are to be connected, a pipe s^1 extends from the T-union, rises outside of the liquid holding vessel *d* and opens into the mixing chamber; the pipe 4 as heretofore described extending to the rotary vacuum pump. The place of entrance of the pipe s^1 into this mixing chamber is preferably constructed tangentially as heretofore described with reference to Figs. 2 and 5. In this form of my invention, the air is drawn by the pump through the pipe 4 and through the liquid holding vessel and through the pipes *s* s^1 and the cleaning devices at the end thereof, and the same is moistened by the water discharged through the valve *k* into the pipe k^1 and trap formed at the lower end of this pipe at its union with the pipes *s* s^1, and this dust-laden air takes up this water and carries the same through the pipe s^1 into the mixing chamber; said materials passing down the pipe *h* into the vessel *d* and the overflow passing back through the valve in the valve case *k* and down into the trap formation produced as shown in Fig. 12 by the construction of the parts described.

The devices shown in Figs. 11 and 12, are particularly adapted for use with a portable apparatus. In such apparatus the body of water in the vessel *d* must be depended upon to do the work required and is used over and over again to moisten the dust of the dust laden air. When the water in this vessel is too dirty it is removed and replaced with fresh water and the operations repeated.

While I have shown one form of valve in Figs. 6 to 9 inclusive and located at the predetermined level of the water in the vessel *d*, and an alternate and equivalent form of valve in Fig. 10, I do not limit my invention to either form of valve, only to the employment of a suitable valve so located to perform this delivery function.

I claim as my invention:

1. In a vacuum cleaning apparatus the combination with a liquid holding vessel and a pipe for air extending axially therein, of a mixing chamber at the upper end of said vessel connecting with said pipe, means

providing for the entrance of dust-laden air into said mixing chamber tangentially to the same whereby a circular motion is imparted to said dust-laden air and means providing for the entrance of water also into said mixing chamber and for comminuting the same into a spray to moisten the entering dust of the dust laden air.

2. In a vacuum cleaning apparatus the combination with a liquid holding vessel and a pipe for air extending axially therein, of a tubular body mixing chamber at the upper end of said vessel connecting with said pipe, a pipe for the dust-laden air, a neck formed with said mixing chamber and to which said pipe is connected, said neck providing a tangentially disposed inlet from said pipe into said tubular body, and means providing for the entrance of water and for comminuting the same into a spray within said tubular body to moisten the dust of the dust-laden air.

3. In a vacuum cleaning apparatus the combination with a liquid holding vessel and a central pipe therein, of a mixing chamber at the upper end of said vessed connecting with said pipe, a pipe for the dust-laden air, a neck formed with said mixing chamber and to which said pipe is connected, said neck providing a tangentially disposed inlet from said pipe into said mixing chamber, whereby said opening in said neck is high and narrow and the opening in the chamber rectangular and in height of greatest extent, a water inlet device formed by a sleeve *l* contracted at its lower end and provided with an orifice, and a regulatable device within said sleeve comprising a screw-head and conical valve and a spiral groove formed around the conical valve and terminating in the conical part, and the screw head being perforated for the passage of the water, said devices imparting to the entering water a swift rotary motion so that the water as it emerges from the orifice at the end of the sleeve *l* is reduced to a spray.

4. In a vacuum cleaning apparatus, the combination with a liquid holding vessel, means for exhausting the air from said liquid holding vessel, a valve and a valve case therefor outside the liquid holding vessel and located at a predetermined level of the water in said liquid holding vessel and connected therewith, and means for actuating said valve for periodically discharging the overflow of water into the atmosphere while maintaining the vacuum in said liquid holding vessel.

5. In a vacuum cleaning apparatus, the combination with a liquid holding vessel, means associated therewith and providing for the simultaneous entrance into said liquid holding vessel of the dust laden air and water in the form of a spray, a suitably located casing comprising a mixing chamber in which the water and the dust of the air are commingled and the dust particles thoroughly moistened, a pipe conveying the air and moistened dust down through the liquid holding vessel and discharging the same into the liquid at the bottom of the vessel, a valve and valve case connected with said liquid holding vessel at a predetermined level of the water therein and means for actuating the valve for discharging the accumulation or surplus of dirty water into the atmosphere while maintaining the vacuum in said liquid holding vessel.

6. In a vacuum cleaning apparatus and in combination, a liquid holding vessel, means for exhausting the air from said liquid holding vessel, a centrally located casing comprising a mixing chamber within said vessel and near the upper end thereof, a pipe providing for the entrance of air into said mixing chamber, a pipe providing for the entrance of water also into said mixing chamber, adjustable devices for comminuting said entering water into a spray and delivering the same simultaneous with the delivery of the dust laden air for the thorough moistening of the dust and particles in the air in said chamber.

7. In a vacuum cleaning apparatus and in combination, a liquid holding vessel, a mixing chamber at the upper end of said vessel and a pipe therefrom passing down into the water of said vessel, a neck extending out from said mixing chamber, the opening in which is arranged tangentially to the mixing chamber, a pipe connected with the neck providing for the entrance of dust laden air into the mixing chamber for imparting thereto a circular motion, a pipe for water entering the mixing chamber and an adjustable device in the lower end of said pipe in part spirally grooved and a nozzle to said pipe for comminuting the entering water into a spray so that the spray also in rotary motion thoroughly mixes with the particles of the dust in the air and wets the same prior to the delivery of the dust into the liquid holding vessel.

8. In a vacuum cleaning apparatus and in combination, a liquid holding vessel, an interior chamber at the upper end of said vessel, a neck extending out from said chamber, the opening channel in which is arranged tangentially to the mixing chamber, a pipe connected with the neck providing an inlet into said chamber and a pipe depending from said chamber and extending down through the liquid holding vessel to near the bottom thereof.

9. In a vacuum cleaning apparatus and in combination, a liquid holding vessel, an interior chamber at the upper end of said vessel, a neck extending out from said chamber, the opening channel in which is arranged tangentially to the mixing chamber, a pipe

connected with the neck providing an inlet into said chamber, a pipe depending from said chamber and extending down through the liquid holding vessel to near the bottom thereof, and a valve and valve casing at a predetermined water level of said liquid holding vessel and a discharge pipe therefrom.

10. In a vacuum cleaning apparatus and in combination, a liquid holding vessel, an interior chamber at the upper end of said vessel in part parallel sided and in part tapering toward the lower end thereof, a neck extending out from said chamber the opening channel in which is arranged tangentially to the mixing chamber, a pipe connected with the neck providing an inlet into said chamber and a pipe depending from said chamber and extending down through the liquid holding vessel to near the bottom thereof.

Signed by me this 28th day of October 1908.

LEMUEL WILLIAM SERRELL.

Witnesses:
GEO. T. PINCKNEY,
E. ZACHARIASEN.