J. E. ROTHWELL & R. P. AKINS.

AGITATING APPARATUS FOR THE TREATMENT OF ORES.

APPLICATION FILED SEPT. 14, 1909.

951,742.

Patented Mar. 8, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

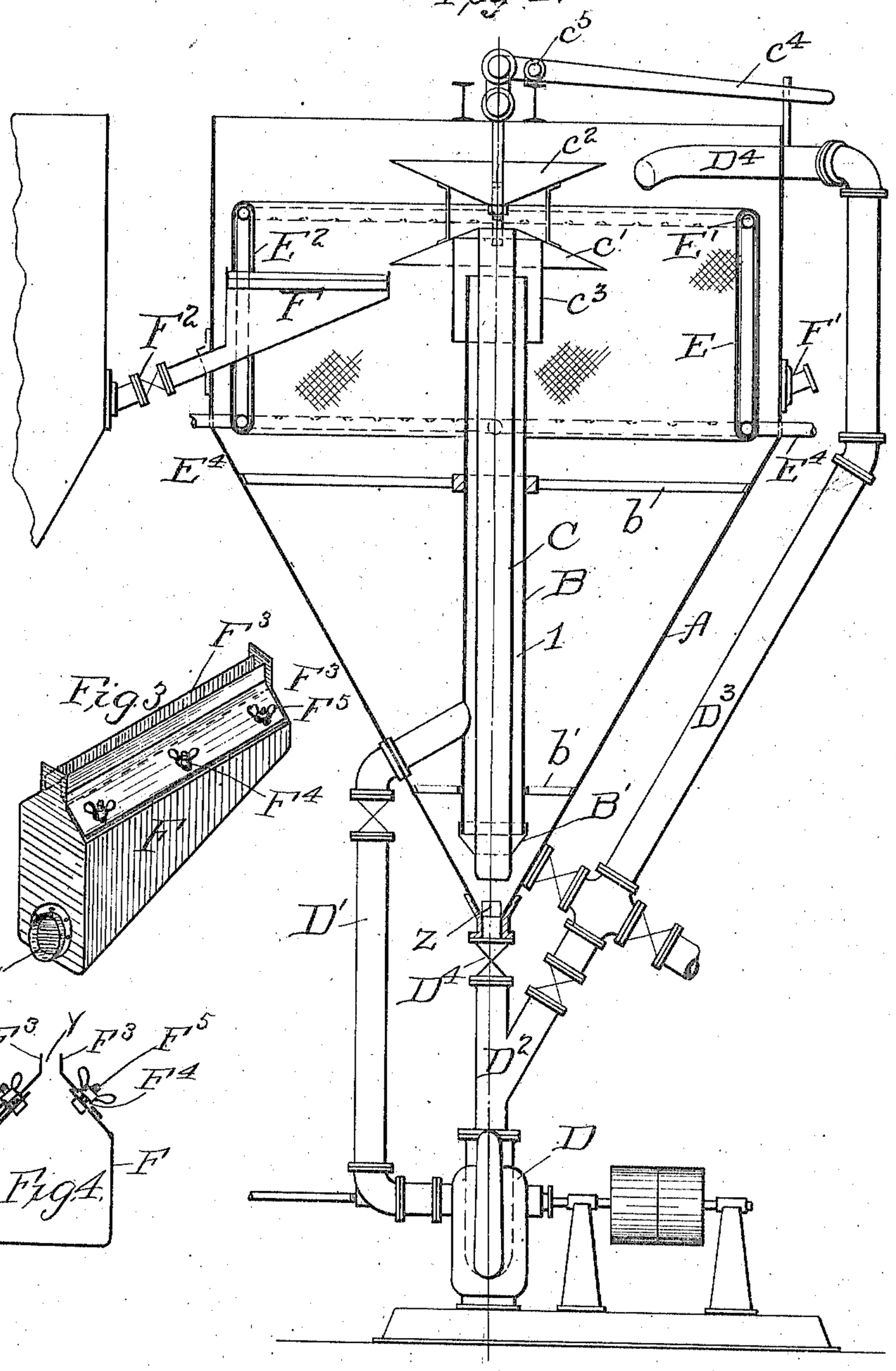

Fig. 3

Fig. 4.

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2 SHEETS—SHEET 2.

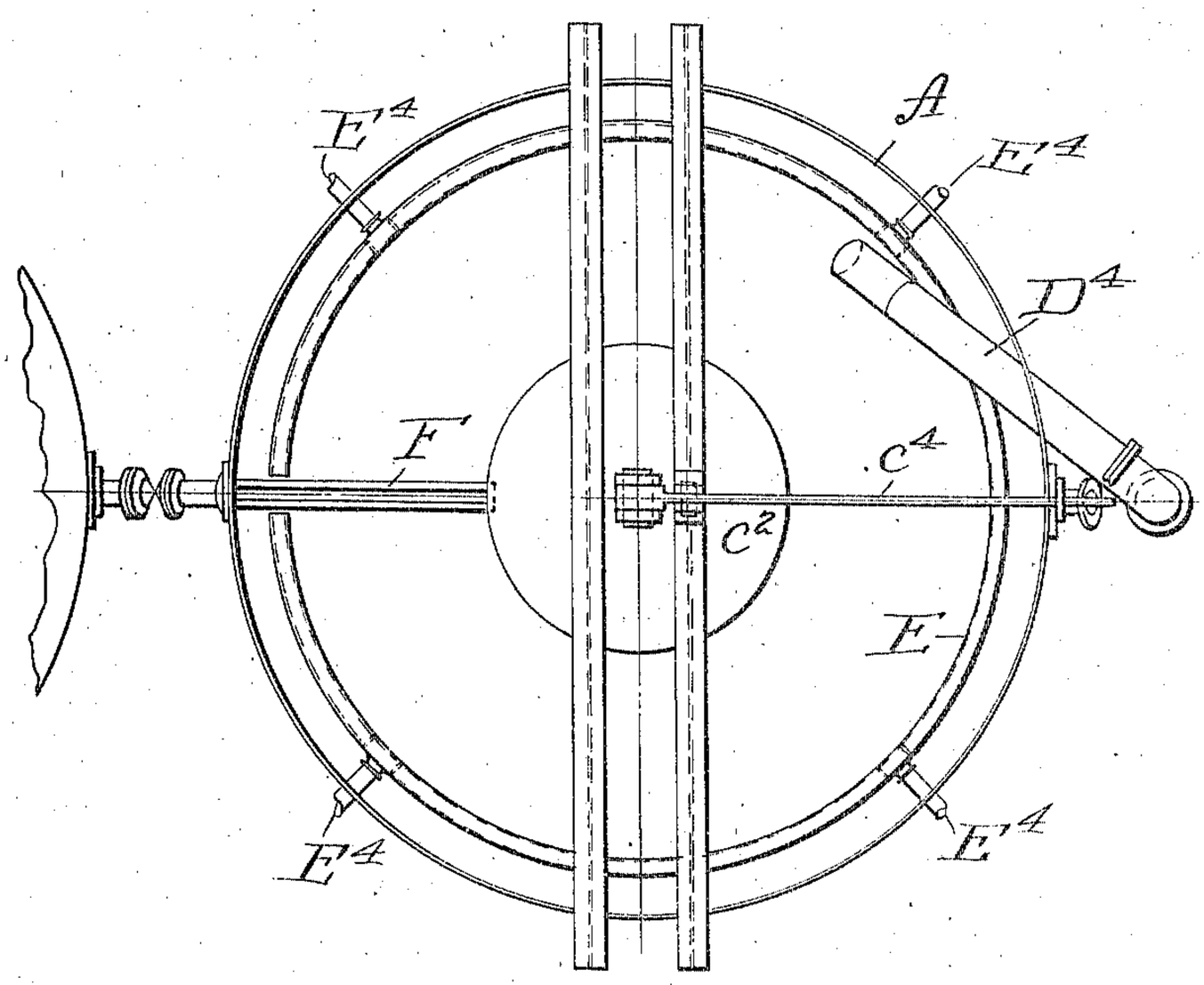

Fig. 2.

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AGITATING APPARATUS FOR THE TREATMENT OF ORES.

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To all whom it may concern:

Be it known that we, JOHN EDWARD ROTHWELL and RANDALL PORTER AKINS, citizens of the United States, residing at Denver, Colorado, have invented certain new and useful Improvements in Agitating Apparatus for the Treatment of Ore, of which the following is a specification.

Our invention relates to apparatus for agitating pulp or solutions in the treatment of ore, and it consists in the features and combination and arrangement of parts hereinafter described and particularly pointed out in the claims.

In the drawing, Figure 1 is a central vertical sectional view of an apparatus embodying our invention; Fig. 2 is a plan view of the parts shown in Fig. 1. Figs. 3 and 4 are views of a detail.

In these drawings, A is the tank having a conical lower portion and a cylindrical upper part. Within the tank is mounted a central tube B by the struts or braces b, b'. Inside of the tube B is located a tube C with an annular space 1 between these tubes. The lower end of the outer tube B is located at some distance above the lower end of the tank, and a rubber sealing band closes the annular space between the said inner and outer tubes, but this valve will permit the movement of the inner tube vertically in relation to the outer tube and to the jet nozzle a at the lower apex of the conical tank, through which nozzle the finer pulp or mixture to be agitated and thoroughly commingled is discharged from the centrifugal pump D connected to the nozzle by the pipe D^2 by way of a valve D^4.

The solution is supplied to the centrifugal pump through the pipe D′ which passes through the tank wall, and connects with the annular space 1 between the concentric tubes B and C. The discharge from the pump enters and passes up the central tube C, and being discharged at its upper end at a point between the cone-shaped distributing plates or aprons C′ C^2, the solution spreads out laterally. Below the distributing plates a steel cylinder or trap C^3 is arranged, depending below the upper open end of the pipe B to form an annular inlet space surrounding and extending some distance below the said open end of the pipe.

The inner tube C, together with the trap C^3 and the conical deflecting plates, are supported from a lever C^4 pivoted at C^5 and connected by a link with the inner tube so that said inner tube may be raised to the position shown in the drawing from its lowermost position resting at the apex of the cone, and forming a valve to prevent sand accumulating in the nozzle and pump when the apparatus is stopped from working.

A decanting filter E is arranged at the top of the tank consisting of a fabric or suitable media F^2 surrounding perforated pipes E′, the general form of the filter being cylindrical. Outlet pipes E^4 lead off from the perforated pipes E′ to carry off the filtrate from the filter for the purpose of thickening the charge within the tank, if desired.

At the upper part of the tank a vane F is attached to the side of the tank extending toward the center substantially radially. It is made up of sides with a space between them for the passage of the agitated mixture from the tank through a pipe F^2 into the next tank. By this vane a proportional quantity of the contents of the tank may be transferred to the adjoining similar tank, the outflow through the vane F being equal to the inflow from tank to tank through the pipes F′, F^2.

In the operation of the apparatus, when the tank is filled with the desired charge, the pump is started and the inner tube C is then raised to allow the sand that has settled at the apex of the conical bottom of the tank to flow into the stream of solution or the liquid as discharged by the pump. The mixture is thus forced up through the central tube discharging between the distributing plates or cones C′, C^2, which causes the mixture to spread out over the tank area, the coarse material settling to the bottom of the cone, while the fine slime and solution flows beneath the lower edge of the trap C^3 into the annular space between said trap and the tube B, from whence it passes into the space 1 between the inner tube C and the outer tube B, from whence it is drawn by the suction of the pump, and this fine material and solution will now be forced by the pump up through the tube C again, carrying with it the coarser material that has settled to the apex of the tank. By this arrangement the material entering the pump is kept

free from the sand and coarser particles, only the slimes and solution being fed to the pump, so that there is practically no wear on the runner or interior of the pump.

The discharge from the pump may be diverted into the auxiliary pipe D^2 by closing the valve D^4 and opening the valve in said auxiliary pipe, and this discharge is used when it is desired to wash the solids off from the interior of the decanting filter. This discharge, as indicated in Fig. 2, takes place at a sharp angle to the interior face of the filter, and it produces a swirling motion of the material against the inner side of the filter to clear the same. Another effect of this discharge of the mixture through the pipe D^3 is that the swirling or rotary motion imparted to the contents of the tank causes the heavier particles to seek the outer periphery of the tank area, while the lighter particles and the liquid seek the inner portion of the tank area to flow to the central submerged downtake passage leading to the suction pipe of the circulating pump. The discharge from the pipe D^3 may take place simultaneously with the agitation due to the discharge through the nozzle Z and the suction through the pipe D′.

In using the continuous method of agitation and overflowing, the tanks are arranged substantially on a level, the overflow from one tank to the next taking place through the special shape vane that cuts out a part of the tank contents in which the relative proportions of solid and liquid matter is representative of the character of the mixture in the tank, there being no separation of fine slimes and coarse sands in this discharging action.

It will be understood that while we have shown means for carrying on continuous operation by the continuous overflow system, we do not limit ourselves in this respect, as the apparatus can be worked with intermittent charges.

The box F of suitable metal or material is made of section shown in Fig. 4, and with sloping bottom toward the outlet X.

The adjustable plates F^3 are made with slotted openings F^4 fitting over studs or bolts F^5 with wing nuts, thus permitting an adjustment to regulate the space Y, Fig. 4; the area of this space being thus made proportional to the horizontal area of the tank determines the amount of the sample that will be taken and transferred continuously to the adjoining tank.

In operating this device, the sand, slime and solution forced up the inner tube C spreads out over the cones C′—C^2, and falling back into the body of the tank, is in a mixed and practically uniform condition, so that the portion entering the slot of the vane is a proportional part of the solids and liquids thus agitated, thus preventing any concentration of the heavier or coarser solids in any one tank of the series, when arranged to work continuously.

We claim:—

1. An apparatus of the class described, comprising a tank, an inner and an outer pipe extending from a point near the bottom to a point at the upper part of said tank, and with the inner tube open to the tank at both ends, while the outer pipe is open to the tank at its upper end and closed at its lower end, and a pump having its discharge directed to the inner tube and its suction side connected to the space between the inner and outer pipes, substantially as described.

2. An apparatus of the class described, comprising a tank, an inner and an outer pipe extending therein with a space between them, the inner pipe communicating at both its lower and upper ends with the tank, and the outer pipe communicating, at its upper end, with the tank, spreading means, and a trap for protecting the upper end of the outer pipe against the inflow of the coarser material, and a pump having its discharge directed to the inner pipe and its suction side connected with the space between the inner and outer pipes, substantially as described.

3. In combination a tank having a bottom tapering downwardly, a pipe arranged with its lower open end adjacent the apex of the tank and communicating with the interior of said tank, a pump having its discharge directed to the said pipe and having its suction side connected with the tank, said pipe being movable to seat around the discharge to prevent sand from reaching the pump, said pipe having its suction end below the upper edge of the tank, substantially as described.

4. In combination the tank, the inner and outer pipes therein, arranged with a space between them, both pipes being open at the top within the tank, and the inner pipe being open at the bottom within the tank, the lower end of the outer pipe being closed from communication with the interior of the tank, and a pump having its discharge directed to the inner pipe, substantially as described.

5. In combination the tank, the inner and outer pipes therein, arranged with a space between them, both pipes being open at the top within the tank, and the inner pipe being open at the bottom within the tank, the lower end of the outer pipe being closed from communication with the interior of the tank, and a pump having its discharge directed to the inner pipe, said closing means for the outer tube comprising the rubber diaphragm valve, substantially as described.

6. In combination with a tank and means for agitating the pulp therein, a vane extending into the tank and connected with a

discharge therefrom to take a definite proportional quantity of the mixture from said tank, substantially as described.

7. In combination with a tank and means for agitating the mixture therein, a vane extending into the tank and consisting of a pair of plates with a space between them, and with an outlet leading from said space, substantially as described.

8. In combination with the tank having a conical bottom portion, a nozzle at the apex thereof, a pipe for receiving the discharge from the nozzle, means for distributing the discharge at the upper end of said pipe into the tank, and means for raising and lowering the pipe so that it may be seated around the nozzle, substantially as described.

9. In combination with a tank, a vertically movable pipe therein, means for delivering mixture to the said pipe, and means for adjusting the height of the pipe, substantially as described.

10. In combination with a tank and means for agitating the contents of the same, a double wall annular decanting filter suspended therein with means for drawing off the clear solution from the space between the walls of said filter, substantially as described.

11. In combination with a tank, a vertically extending inner tube communicating with the tank at both its upper and lower ends, an outer tube surrounding the inner tube with a space between and closed to the tank at its lower end, a trap consisting of a flange or rim c^3 surrounding the upper open end of the outer pipe, and closed at its top, and a pump having its discharge directed to the inner pipe and its suction connection extending to the annular space between the inner and outer pipes, substantially as described.

12. In combination with the tank, the inner tube, the outer tube, means for delivering the material to the bottom of the inner tube, said inner tube communicating with the tank at both its upper and lower ends, an outer tube open within the tank at its top and closed at its bottom, a pump having its discharge directed to the inner tube across a portion of the space at the bottom of the tank, and having its suction pipe connected with the intermediate space between the inner and outer pipes, and a discharge pipe leading substantially tangentially at the upper part of the tank for creating a swirling motion of the contents of the tank, substantially as described.

13. In combination a tank, an annular decanting filter at the top portion thereof, and a discharge pipe for solution directed substantially tangentially of the inner side of the said filter, substantially as described.

14. In combination a plurality of tanks, means for agitating the material in the tanks, and a vane for continuously drawing a definite proportional quantity of liquid containing agitated solids from one tank and delivering it to the next tank, substantially as described.

15. In combination with a tank, a discharge vane having an adjustable inlet thereto, substantially as described.

In testimony whereof, we affix our signatures in presence of two witnesses.

JOHN EDWARD ROTHWELL.
RANDALL PORTER AKINS.

Witnesses:
H. B. LOWDEN,
F. D. GROSS.