(No Model.) 3 Sheets—Sheet 1.

W. L. CARD.

CONCENTRATOR.

No. 372,741. Patented Nov. 8, 1887.

Fig. 1.

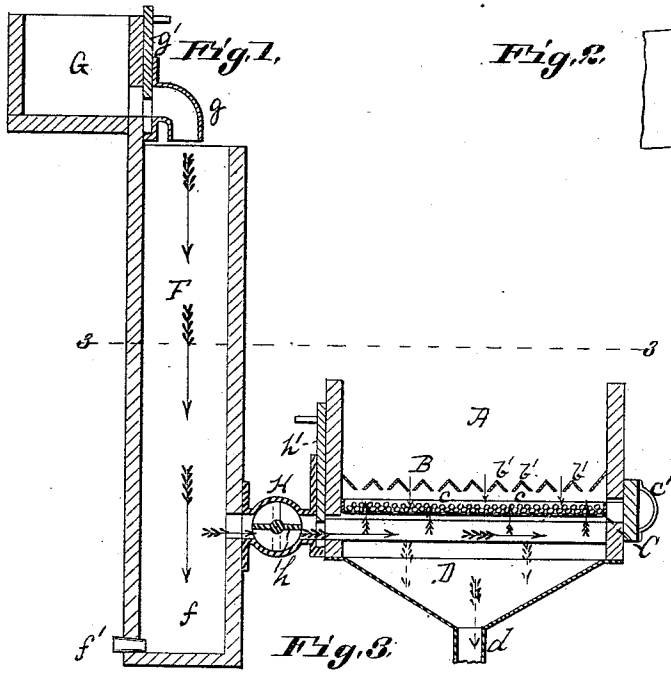


Fig. 2.

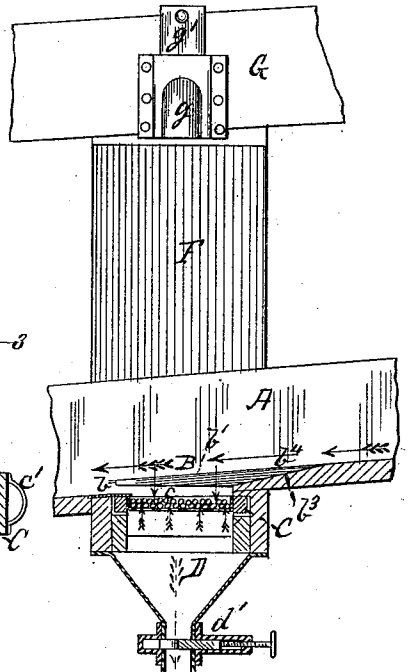
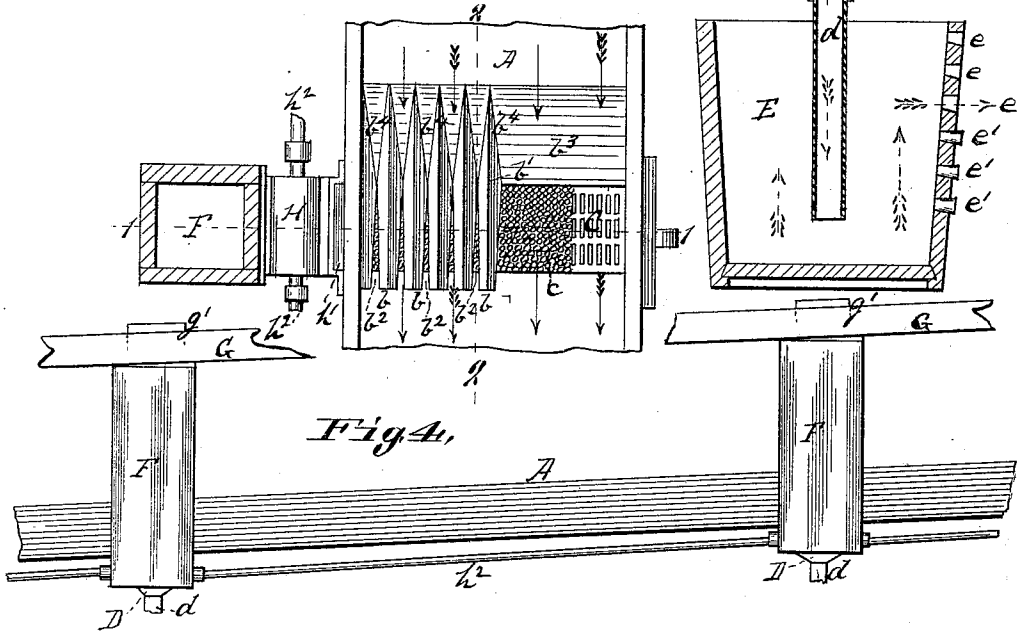


Fig. 3.

Fig. 4.



Witnesses
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(No Model.)

3 Sheets—Sheet 2.

W. L. CARD.

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Fig. 7.

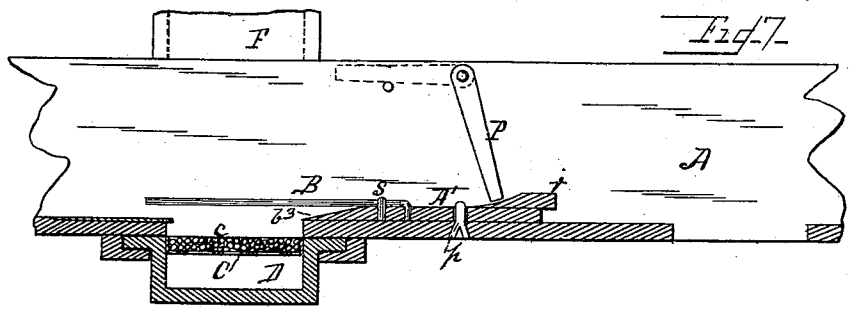


Fig. 8.

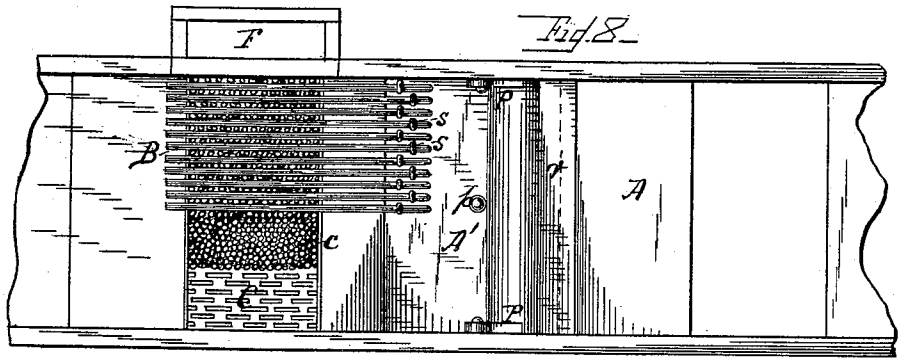


Fig. 5.

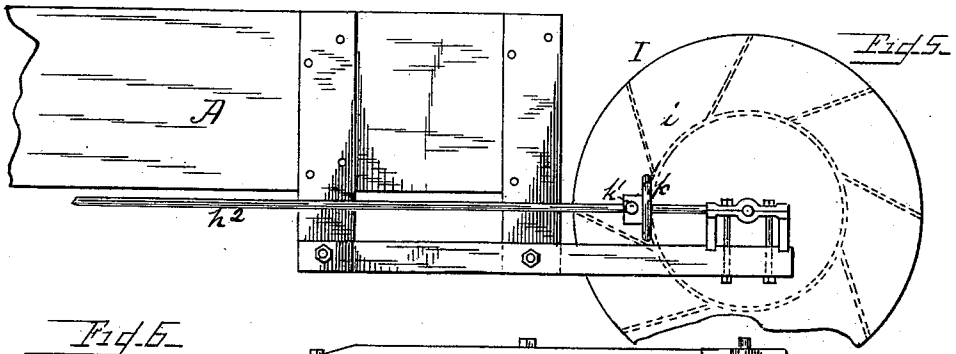
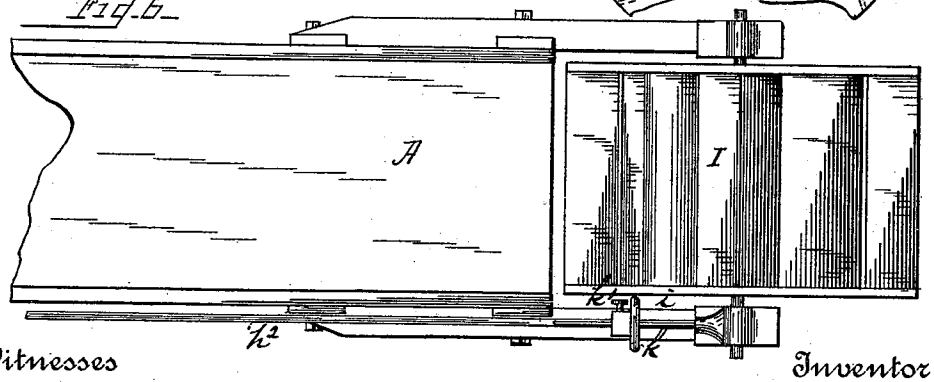


Fig. 6.



Witnesses

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(No Model.) 3 Sheets—Sheet 3.

W. L. CARD.

CONCENTRATOR.

No. 372,741. Patented Nov. 8, 1887.

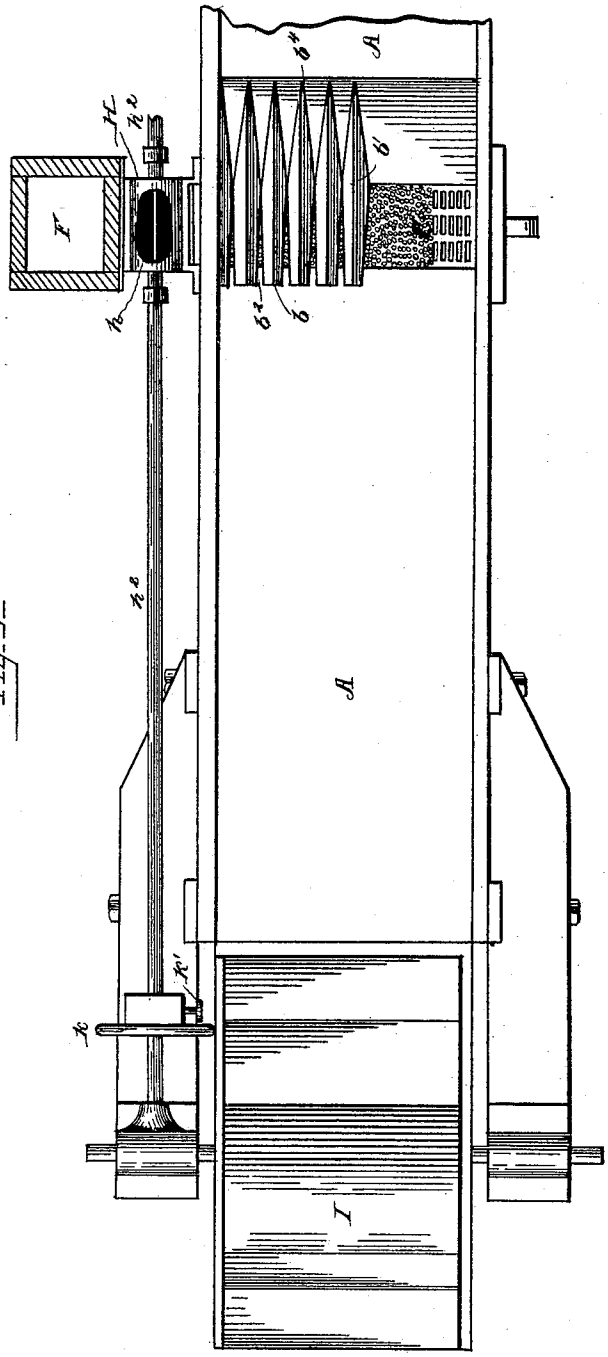


Fig. 5.

Witnesses
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UNITED STATES PATENT OFFICE.

WILLIAM L. CARD, OF LA CROSSE, WISCONSIN, ASSIGNOR TO THE TIERRA SECA MINING COMPANY, OF EAST ST. LOUIS, ILLINOIS.

CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 372,741, dated November 8, 1887.

Application filed July 22, 1886. Serial No. 208,798. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. CARD, a citizen of the United States, residing at La Crosse, in the county of La Crosse and State of Wisconsin, have invented certain new and useful Improvements in Concentrators for Eliminating Gold from its Matrices; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical transverse section of a sluice having a concentrator embodying my invention applied thereto, a water-column, and an auxiliary sluice for supplying the water-column. Fig. 2 is a longitudinal vertical section of a sluice and concentrator, a column and portion of the auxiliary sluice being in elevation and the settling-tank below the sluice in section, the sections being on the line 2 2, Fig. 3. Fig. 3 is a sectional view of the water-column on the line 3 3, Fig. 1, and a top view of a portion of the sluice, showing the concentrator. Fig. 4 is a side view of a portion of a sluice with two water-columns in elevation. Fig. 5 is a side view of the tail end of a sluice, a water-wheel, shaft, and friction-wheel for rotating the valves of the water-columns which supply the separators; and Fig. 6 is a plan view thereof. Fig. 7 is a longitudinal vertical section of a concentrator embodying my invention in a modified, simpler, and cheaper form; and Fig. 8 is a plan view of the same. Fig. 9 is a plan view, partly in section, showing the water supply or column, sluice, concentrator-bed, water-wheel, rotary valve, its shaft, and an adjustable friction-pulley thereon.

Like letters refer to like parts wherever they occur.

My present invention relates to the construction of concentrators for eliminating gold and black sands from placer earths, and belongs to that class of machines in which the pulsation of water is employed in conjunction with a permeable bed to first lift and float the auriferous mass to induce the separation of the particles by gravity and then to suck or draw the gold through the bed into a suitable receptacle below.

It has for its objects, first, to provide such a construction of the concentrator as will enable the operator to modulate the upward and downward impulse and volume of the water, or to suppress either, so that either or both may be varied to suit the character of the material operated on, and, secondly, to so construct the concentrator that it may be used independently, or, if desired, be combined with sluices of any of the several well-known classes.

The gist of the invention lies in the means for producing alternate upward and downward currents or pulsations through a permeable ore-bed, and in the means for controlling and adjusting the frequency, force, and volume of both the upward and downward pulsation of the water, whereby the machine may be adapted and adjusted to the concentration of the greatest variety of substances, both as to size and specific gravity. There are other minor points of novelty pertaining to the details of construction, all of which will hereinafter more fully appear.

I will now proceed to describe my invention more fully, so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates a sluice in combination with which I have chosen to illustrate my invention. At suitable intervals along the bottom thereof are openings, beneath which my concentrators may be placed, and the connections between the sluice and concentrator should be such as will avoid leakage, as far as it is practicable to do so.

The openings in the bottom of the sluice (or the top of the concentrator) should be guarded by a screen, B, which may be of ordinary rods, (see Figs. 7 and 8,) or, preferably, a series of bars, *b*, having raised or crowning central ridges, *b'*, and tapering so that the slots b^2 between the same gradually widen from head to tail of the screen. The sluice-bed is also, by preference, made sloping or inclined where the screen-bars *b* are attached thereto, as at b^3, and the bars *b* are cut diagonally toward the ridge *b'*, as the nib of a pen is formed, (see b^4, Fig. 3,) so that all the material passing along the sluice will be gathered at the pointed head ends of the screen-bars and guided to the slots between the bars. The laterally-sloping sides of the bars will prevent any flake gold being carried beyond the screen.

The concentrator-bed C, which is placed directly under this screen, may be a perforated sliding tray filled with shot or equivalent material, *c*, which will form a permeable bed of mobile particles of gravity greater than the matrix and less than the gold, and a door, *c'*, or other means, may be provided for removing the concentrator-bed for cleaning up. The depth and size of the shot or equivalent material in the tray will vary according to the character of the auriferous earth operated on, and this must be left in a great degree to the skill and judgment of the operator.

Below the concentrator-bed C is a chamber, D, which may be termed the "tank," said chamber preferably having inclined sides (or funnel-shaped) and terminating in a discharge-pipe, *d*, guarded by a valve, *d'*. The discharge-pipe *d* extends down into a settling-tank arranged below the concentrator.

E indicates the settling-tank, into which the discharge-pipe *d* of the concentrator delivers, and said tank, which may be of any desired depth, has a series of holes, *e*, at different levels, which may be closed by means of suitable plugs, *e'*.

By means of the valve *d'* the volume of water escaping from the chamber D can be controlled, and the force of the suction, and hence the rapidity of flow of the water from chamber D, can be increased or decreased by opening or closing the holes *e*, so as to cause the water to stand at different levels in the settling-tank E.

F indicates a water-column of any desired height to obtain the greatest pressure or head which will be required, and G is an auxiliary sluice or trough for supplying any number of such water-columns that may be employed. The delivery-pipe *g* of the sluice is provided with a gate or valve, *g'*, which is so adjusted as to maintain the desired head in water-column F. The water-column F is connected below with the tank D by a pipe, H, provided with a revolving or vibrating valve, *h*, and also with a slide or other valve, *h'*, by which latter the concentrator can be cut off from the column F, when it is desirable to do so, for cleaning up or for any other purpose. At the bottom of water-column F is a mud-sump, *f*, having a plugged outlet, *f'*, for clearing the column of mud, &c.

When several concentrators are used in connection with each other, the revolving valves *h* may be connected by rods h^2, and when said concentrators are combined with a sluice the water escaping from the tail of the sluice may be utilized by any known means for revolving or vibrating said valves.

In Figs. 5 and 6 I have shown what I deem a good way of utilizing the escaping water—that is to say, at the end of the sluice I place a water-wheel, I, journaled in suitable bearings, said water-wheel having a smooth or disk end, as at *i*. On the same bearing as the journal of the water-wheel I, but at right angles thereto, is journaled the end of the shaft h^2. Said shaft h^2 has a feather near its outer end for the purpose of revolving with a sliding friction-wheel, *k*, which bears against the disk end *i* of the water-wheel I, and is used to revolve the valves *h*. The sliding wheel or friction-gearing *k* (which has a set-screw, *k'*, in its hub, by which it can be secured) can be adjusted nearer to or farther from the journal of the water-wheel I, accordingly as the valves are to be revolved fast or slow.

In the modifications shown in Figs. 7 and 8 the screen is represented as constructed of plain rods, free at one end and bent at the other ends to form hooks, which enter the plank and are held thereto by staples *s*. In this simple and cheap form I prefer to secure the screen-bars to a detachable bed-piece, A', provided at its head with a riffle-cleat, *r*, and to secure the same in position by a dowel-pin, *p*, projecting up from the bottom of sluice A, and by pawls or buttons P, pivoted on the sides of the sluice, as this construction greatly facilitates the operation of "cleaning up."

The devices, being of substantially the character hereinbefore described, will operate as follows: The auriferous earth will be directed over the screen B, and the finer matrix, together with the gold, will fall on the bed C of the concentrator. If the concentrators are combined with a sluice, as shown for the purposes of this description, the auriferous earth and sluice-water will pass over the screen, the black sand, gold, and fine matrix generally being gathered by the pen-pointed heads b^4 of the bars and the incline b^3 and directed to the slots b^2, while the refuse is allowed to pass on down the sluice with the water. Owing to the laterally-inclined sides of the bars, the flake gold will not float past, but will be deposited with the fine gold, &c., on the bed C of the concentrator. Meanwhile the valve *g'* of the auxiliary sluice G or water-supply of the concentrator has been set to give the feed for the desired head or pressure in the water-column F. The valve *d'* of discharge-pipe *d* has also been set to allow the proper volume of escaping fluid, and the ports *e* of the settling-tank E are opened down to the level which will give the desired draft or suction through the discharge-pipe *d* from the chamber D beneath the shot-bed C. The valve *h* is then set in motion at the desired speed and the valve *h'* raised to open a proper communication between chamber D and the water-column F. If a short, sharp, forcible upward impulse of the water through the permeable bed is required, the valve *g'* is set for a high column of water in F and the valve *h* is revolved rapidly. On the contrary, if a slow, gentle impulse or swell of the water is required, the valve *g'* is set for a low column of water in F and the valve *h* is revolved slowly. If a sharp, forcible downward impulse of the water through the shot-bed *c* is desired, the valve *d'* of the discharge-pipe is well opened and the plugs *e'* in the ports of tank E are withdrawn to a low level to insure a strong suction, and if a gentle,

subsiding impulse is required, then the valve *d'* of the discharge-pipe *d* is proportionately closed to reduce the outlet, and the ports *e* of the tank are closed to a high level, so as to reduce the suction or draft through the discharge-pipe. The various valves having been arranged, as before specified, to suit the character of the material to be operated on and the valve *h* set in motion, the impulse of the water or rise and fall of the wave through the permeable bed will induce the gold and black sand to settle by gravity and be drawn through the shot-bed and finally discharged into the settling-tank E, whence it can be taken in cleaning up.

If the gold is moderately coarse and it is not desirable to concentrate the black sand, the valve *h*, Fig. 1, may be set open, the valve *d'* of the discharge-pipe *d* closed, and the head of water in column F regulated to give a steady upward flow through the permeable ore-bed C of the concentrator, which operation of the machine will be that of the simpler, cheaper form shown in Figs. 7 and 8.

How the valve *h* may be operated by any known means or by the specific means shown for utilizing the force of the water escaping at the tail end of the sluice has been hereinbefore described.

Among the advantages of my invention are the perfect control of both the upflow and downflow of the water in its passage through the ore-bed, (as to volume, force, and frequency of pulsations,) and, as a consequence of this, the ability to concentrate a greater or less percentage of the black sand with the gold, as may be desired; the facility with which the concentrator may be adjusted to all kinds of materials and combined with any form of sluice; the ability, by means of the preferred form of screen-bars, to turn all the gold, as well as the black sand and like matrix, from the sluice into the concentrator, and the ability, if deemed desirable, to utilize the waste force of sluice-water.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an ore-concentrator, the combination, with a permeable ore-bed and its water-supply F, of a rotary valve, *h*, a water-wheel, I, and a shaft provided with an adjustable friction-pulley, *k*, substantially as and for the purposes specified.

2. The combination, with a permeable concentrator-bed, its tank, and water-supply, of a revolving inlet-valve and adjustable outlet-valve, substantially as and for the purposes specified.

3. The combination, with a permeable concentrator-bed, its tank, and water-supply, of a discharge-pipe provided with an adjustable valve, and a settling-tank into which the discharge-pipe dips, said tank provided with ports or holes at different levels, substantially as and for the purposes specified.

4. The combination, with a permeable concentrator-bed, its tank, and water-supply, of a revolving supply-valve and a discharge-pipe provided with an adjustable valve, substantially as and for the purposes specified.

5. The combination, with a permeable concentrator-bed, its tank, and water-supply, of an adjustable inlet-valve, a rotating inlet-valve, and an adjustable outlet-valve, substantially as and for the purposes specified.

6. The combination, with a permeable concentrator-bed, its tank, and water-supply, of an adjustable inlet-valve, a revolving inlet-valve, an adjustable outlet-valve, a discharge-pipe, and a settling-tank having a series of ports at different levels, into which tank the said discharge-pipe dips below said ports, substantially as and for the purposes specified.

7. In an ore-concentrator, the combination, with a permeable ore-bed and its water-supply, of a valve which alternately opens and closes the inlet-port and an adjustable valve by means of which the size of the inlet port or passage can be increased or decreased, substantially as and for the purposes specified.

8. In an ore-concentrator, the combination, with a permeable ore-bed and its water-supply, of a valve which alternately opens and closes the inlet-port to produce pulsations, a suction discharge-pipe, and a valve for regulating the force of the discharge, substantially as and for the purposes specified.

9. In an ore-concentrator, the combination, with a permeable ore-bed, its tank, and water supply or column, of an adjustable inlet-valve, a rotating inlet-valve to cause pulsations, an adjustable outlet-valve, an auxiliary sluice to supply the water-column, and an adjustable valve to control the water-supply from the sluice to the column, substantially as and for the purposes specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 21st day of July, 1886.

WILLIAM L. CARD.

Witnesses:
F. W. RITTER, Jr.,
EDWIN S. CLARKSON.