No. 713,148. Patented Nov. 11, 1902.

W. T. POWERS.

STEAM TRAP.

(Application filed Apr. 7, 1902.)

(No Model.)

Fig. 1.

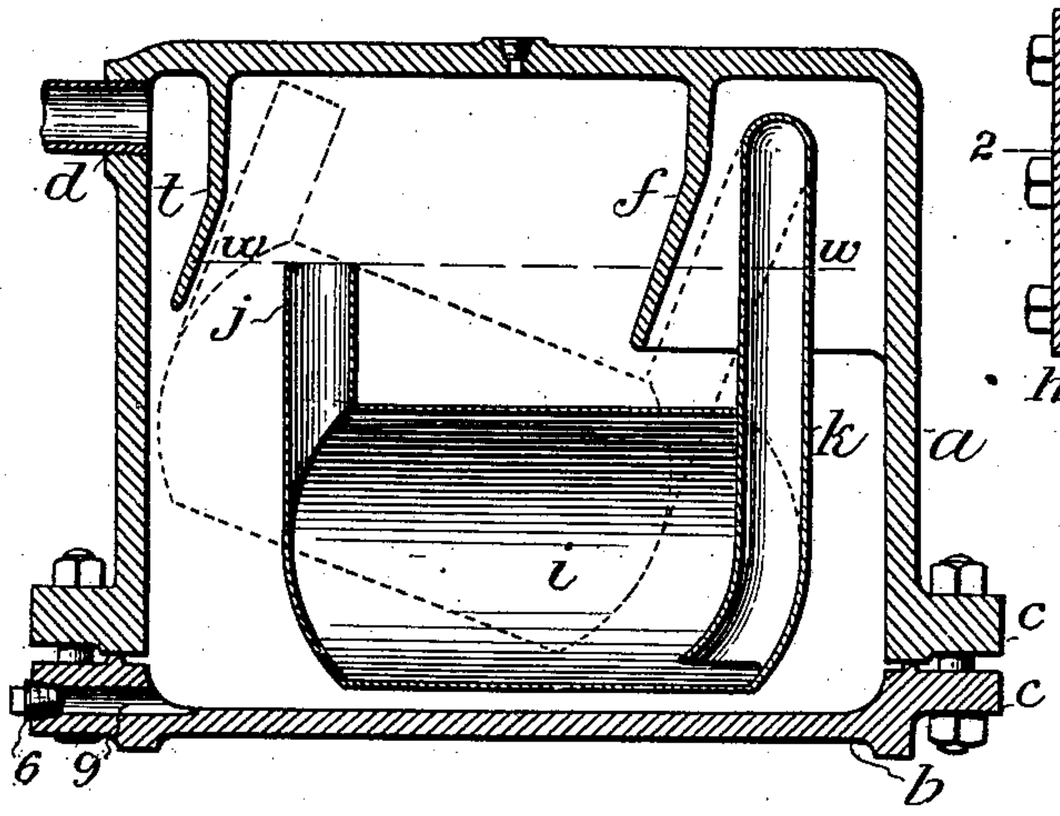


Fig. 3.

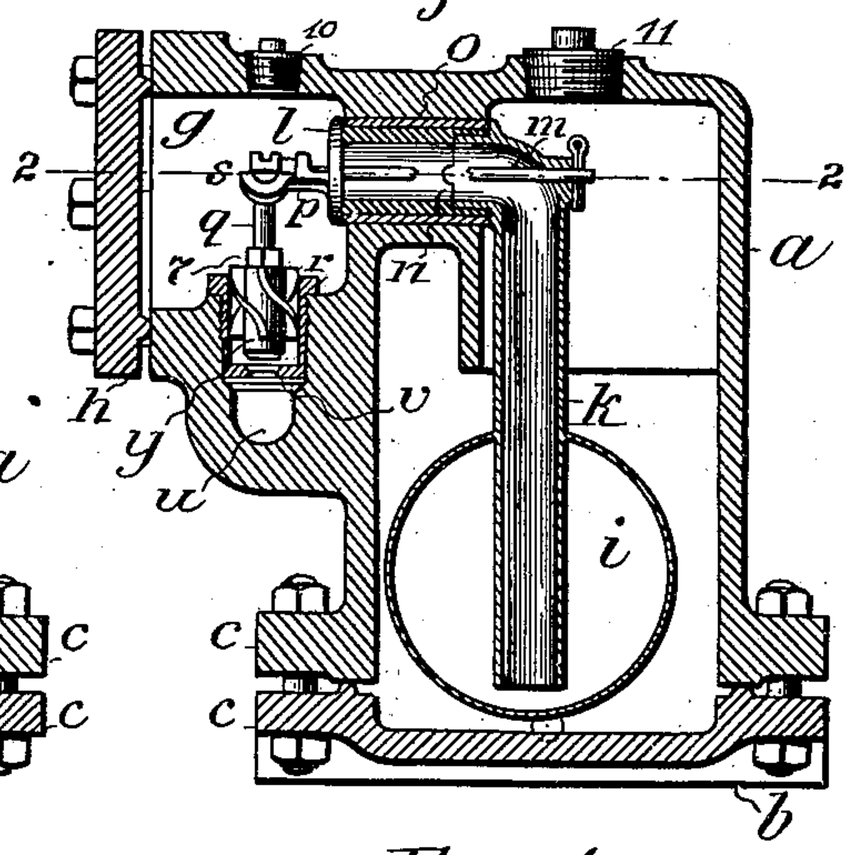


Fig. 2.

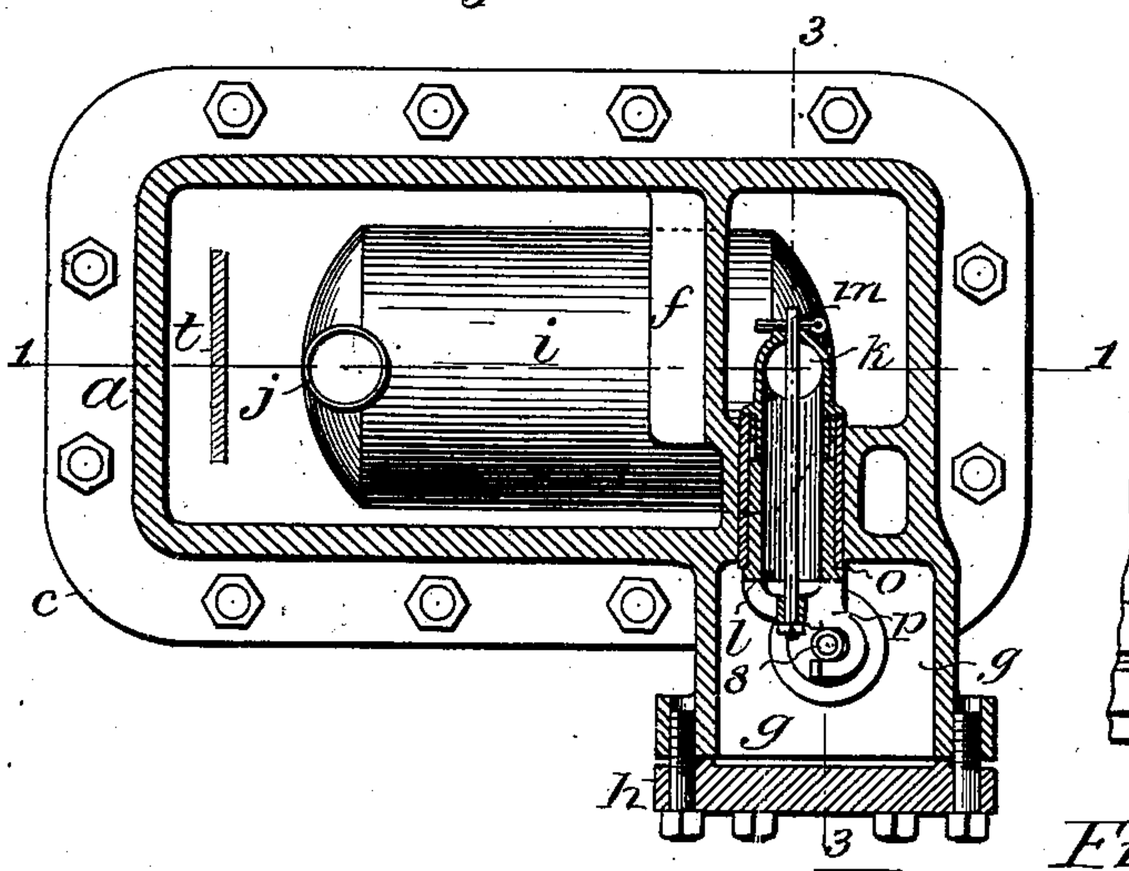


Fig. 4.

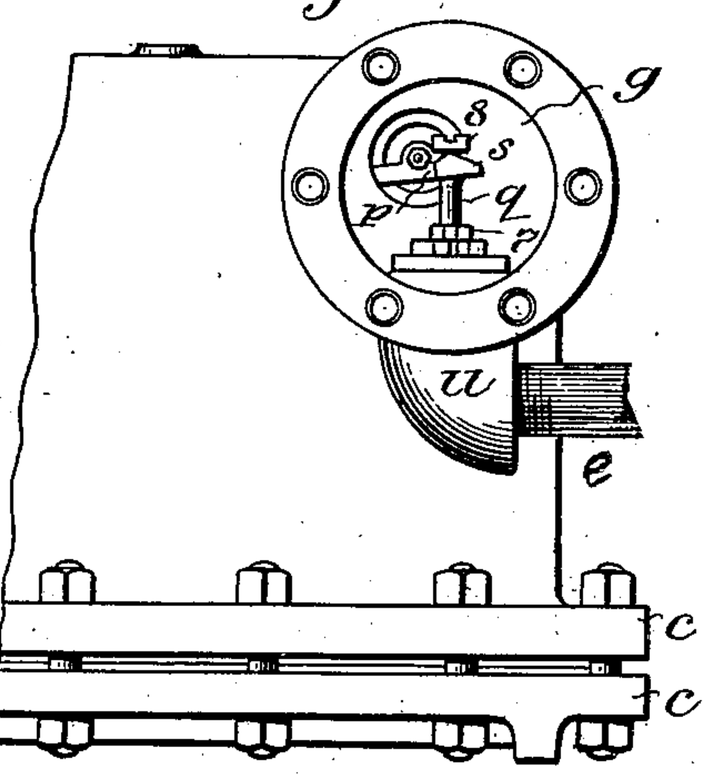
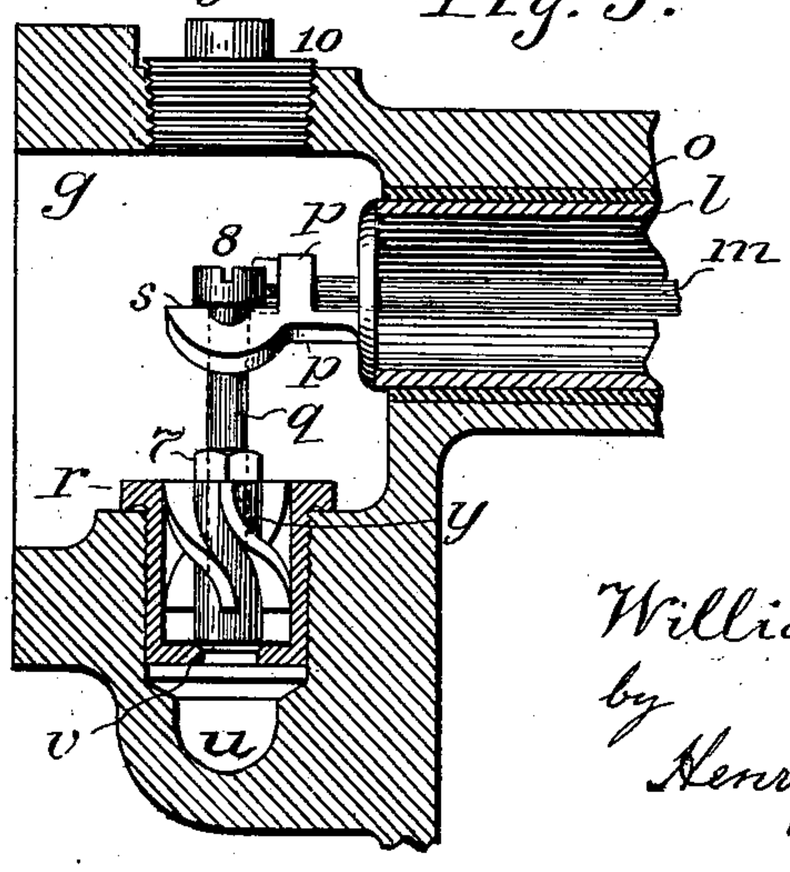


Fig. 5.



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UNITED STATES PATENT OFFICE.

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STEAM-TRAP.

SPECIFICATION forming part of Letters Patent No. 713,148, dated November 11, 1902.

Application filed April 7, 1902. Serial No. 101,714. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM T. POWERS, a citizen of the United States, residing at Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Automatic Steam-Traps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to steam-traps for automatically and periodically discharging the water of condensation which accumulates in all apparatus employed in the production of steam for the generation of power or for heating purposes. It is quite important in this class of devices that the intermittent action of the discharge-valve shall be positive at periodic intervals, so as to freely discharge the accumulation of water by a full opening and then positively and promptly close after the discharge, thereby preventing undue loss of steam and excessive wear upon the valve. To secure the best results, it is quite as important to prevent all leakage of water when the valve is closed through the journal thereof which will lower the water or flotation line or tend to fill the bucket-float through its tubular arm, and thus sink it prematurely and open the valve without the power of automatic restoration. This I accomplish by the means about to be described, an important element of which is the placing of the discharge-valve and its journal of communication entirely above the low-water or flotation line, so that no leakage can occur around the said journal-bearing to lower the minimum water-level or destroy the buoyancy of the bucket-float in any way when the device is temporarily out of use.

In the accompanying drawings, forming a part of this specification, Figure 1 is a vertical longitudinal section of the trap, taken on line 1 1 of Fig. 2. Fig. 2 is a horizontal section taken on line 2 2 of Fig. 3. Fig. 3 is a vertical transverse section taken on line 3 3 of Fig. 2. Fig. 4 is a side elevation, left end broken away, valve-chamber open. Fig. 5 is an enlarged sectional view showing the valve-chamber open, the valve-casing, valve, and mechanism for operating the latter. The rim of the rotary sleeve, as also in Fig. 3, with the connected parts are not in section.

My improved trap consists of a tank formed, preferably, of two flanged castings *a b*, secured together at the flanges *c c* by bolts and nuts in the usual manner, so as to be water and steam tight, the principal cavity being in the upper casting *a*.

d is the inlet for water of condensation, and *e* is the outlet for the discharged water.

Within the casting *a* is located a cross-partition *f*, which extends some distance below the low-water line *w w*, and the space thus cut off is in communication with a valve-chamber *g*, closed by the removable head *h*, secured by detachable bolts or other suitable means. The discharge-pipe *e* forms the outlet from this chamber. There is also a cross-plate or shield *t* at the other extremity of the tank directly in front of inlet-pipe *d* to deflect the incoming water each way, so that it may not interfere with the free operation of the bucket-float about to be described.

Within the tank is the bucket-float *i*, closed except for an inlet-tube *j* and an outlet-pipe or hollow arm *k*. The inlet-tube *j* is of such a height that when the bucket reaches the limit of its downward movement a low-water level *w w* will be maintained at a height sufficient to keep the bucket submerged at the limit of its upward movement. The bucket is therefore practically submerged at all times, with a constant buoyancy when empty, and oscillates in its position between two limits, one defined by the low-water level *w w* and the other by a high-water level near the top of the tank, each determined by the position of the mouth of the tube *j* at its lowest and highest points, respectively. The two positions of the bucket are shown in Fig. 1, that in full lines being the lowermost and that in dotted lines the uppermost position. It is not stationary except at these two points, the range of oscillation being sufficient to fully open and fully close the discharge-valve, which is operated by the automatic action of said bucket-float, as hereinafter described. The tubular arm *k* is rigidly attached to bucket *i* and forms both a lever-arm for operating the discharge-valve and a discharge-

pipe for conveying the water from the interior of the bucket through the valve when open out at the discharge-pipe *e*. Said arm *k* terminates near the bottom of the bucket-float in order to cause the expulsion of the water therefrom to the lowermost desired limit.

The upper end of arm *k* extends up behind partition *f* to near the top of the cavity and quite above the water-line *w w*, where it forms an elbow, which is detachably connected, by means of rod *m* and lugs *n*, to a rotary sleeve *l*, journaled within the partition separating the water-cavity of the tank from the valve-chamber *g* by means of the bushing *o*. Water can be freely discharged from said bucket into said valve-chamber by pressure in the tank through arm *k* and sleeve *l* and thence out of the trap when the valve is open, but finds no exit when the valve is closed.

On the outer end of sleeve *l* within the valve-chamber, spaced from the sleeve, so as to permit the free passage of water, is a lug *p*. It is secured to the sleeve, and the latter is detachably held to arm *k* by the confining-rod *m*, centrally supported within sleeve *l* by said lug, which latter has a lever-like slotted projection with rocker-planes or knife-edges on top for sustaining and lifting the valve-stem *q*. Directly beneath said projection is the valve-case *r* of cylindrical form, placed upright at the mouth of discharge-way *u*. The valve-seat *v* is at the bottom of this cylindrical case, and within the latter is the rotary valve *y*, provided with spiral wings and guides, and to the valve is adjustably secured the upright valve-stem *q*, screw-threaded into the valve for adjustment purposes and provided with lock-nut 7 for fixing the adjustment. Said adjustment may, however, be provided for in any other equivalent way. An expanded head 8 sustains the stem and valve rotarily upon the rocker-surfaced slotted support *s*. As shown in Figs. 2, 5, the slotted projection of lug *p* for greater security surrounds the valve-stem on the side farthest removed from the fulcrum-rod *m*.

An outlet 9, with screw-closing plug 6, is provided to permit of the blowing out of any sediment which may have accumulated in the bottom of the trap. Screw-plugs 10 11 afford access to the valve and to the cotter-pin confining the rod *m*, respectively.

Operation: Water of condensation entering through inlet-pipe *d* accumulates in the tank, enough having been originally placed therein at starting to form a water seal, raising the bucket by flotation to the position shown in dotted lines in Fig. 1, in which position the valve is entirely closed. The bucket remains in this position until by further accumulation the water pours into the bucket through the open tube *j*. The bucket soon begins to sink and going down suddenly fills and operates by its weight the short lever-arm of lug *p* by means of the long lever-arm *k*, lifting the valve *y* from its seat. An outlet being thus formed the pressure in the tank forces the water therein up through tubular arm *k*, sleeve *l*, valve-chamber *g*, and valve-case *r* to the atmosphere or to a suitable receiver through exit-pipe *e*, rotating the valve *y*, by the way, by means of spiral wings thereon, giving it a twisting seat when it reseats itself. The water in the tank falls until it reaches the water-line *w w* and no farther; but the water in the bucket continues to flow out under pressure until the bucket is so far emptied that its buoyancy is restored sufficiently to operate the sleeve *l* and lug *p*, when it rises to the high-level position, permitting the valve *y* to close and firmly seat itself, where it remains seated until the operation is repeated. The weight of the bucket is made sufficient to positively raise the valve off from its seat under the pressure in the tank, while its capacity is such that it has sufficient buoyancy to relieve and close the valve before it becomes entirely emptied and steam passes to the valve-chamber. The position of the bucket-float and the high location of the rotary sleeve give the tubular arm *k* a long leverage relatively to the short arm of lug *p* on sleeve *l*, making it possible to open with a bucket of moderate weight a valve of considerable area against a corresponding high pressure.

The object of the partition *f* is to form a water seal, which isolates the inflow from that portion of the tank which communicates with the chamber *g* through bush *o*, thus preventing steam from escaping into the valve-chamber around the bush-bearing.

The placing of the passage between the tank and valve-chamber above water-line *w w* is most important as providing against the lowering of the water-level by leakage around the bush-bearing and thence into the bucket from the valve-chamber when the valve is closed. This would be liable to occur if the bearing were placed lower than said water-line, so that when the trap stood out of service for a time the bucket might fill sufficiently to sink and open the valve, with no means for closing the valve again, and when the trap was again called into service a large amount of steam would escape through the opened valve until there should be an accumulation of the water of condensation sufficient to float the bucket and automatically restore the valve to the closed position, which would be a wasteful operation.

The specified mode of engaging the sleeve *l* and lug *p* with the valve-stem is such that the valve readily responds to the lifting force, while free to rotate under the outgoing current. When the lifting force is removed, the pressure of the outflowing stream closes the valve firmly while in the act of rotation, thus giving it a clean and fresh seat by torsional contact.

The mode of detachably connecting arm *k* with sleeve *l* by lugs *n* and removable rod *m*

enables the mechanism in the valve-chamber to be removed and rearranged at any time without disturbing the mechanism in the tank.

I claim and desire to secure by Letters Patent—

1. In an automatic steam-trap, a tank, an oscillatory bucket-float therein forming the only outlet from said tank, a pipe-inlet to said bucket, the height of which governs the level of the water in the tank, a hollow lever-arm secured to said bucket-float, journaled in said tank-wall at a point above the low-water level by means of a rotary tube or sleeve, a discharge-outlet beyond said sleeve, having a valve seated therein, and a short lever-arm between said rotary sleeve and said valve, whereby the latter is lifted to open the discharge-outlet upon the descent of the bucket-float, and closed upon the rising of said float, substantially as specified.

2. In an automatic steam-trap, a tank, a valve-chamber separate therefrom, an oscillatory bucket-float in said tank, closed at top except for an inlet-pipe, the height of which governs the level of the water in the tank, a hollow lever-arm secured to said bucket-float, forming the only outlet from the bucket and tank, a passage from said hollow arm through the wall of the tank into the valve-chamber at a point above low-water level, a discharge-valve in said valve-chamber, and means between said hollow arm and said valve to open the valve when the bucket falls and close the same when it rises, substantially as specified.

3. In an automatic steam-trap, a tank, a valve-chamber separate therefrom, a rising-and-falling bucket-float in said tank having a pipe-inlet at top, the height of which determines the water-level in the tank, a hollow lever-arm secured to said bucket, forming the only outlet therefrom and from the tank, having an elbow journaled in the wall between said tank and said valve-chamber above the low-water level by means of a rotary tubular connection, a short lever-arm within the valve-chamber attached to the tubular connection, a cylindrical valve casing and seat within the valve-chamber, a rotary spiral winged valve in said valve-casing, a valve-stem on said valve, in engagement with said short lever-arm whereby the valve is revolubly suspended therefrom, and a discharge-outlet from said valve-chamber beyond said valve-casing and seat, substantially as specified.

4. In an automatic steam-trap, a tank, a valve-chamber separate therefrom, a rising-and-falling bucket-float in said tank, closed at top except for a pipe-inlet, the height of which governs the level of the water in the tank, a hollow lever-arm secured to the bucket-float, forming the only outlet from the bucket and tank, an elbow of said arm journaled in the tank-wall above the low-water level by means of a revoluble bushed sleeve detachably connected to said elbow, a short lever-arm secured to said sleeve within the valve-chamber, a valve-stem revolubly supported by said short lever-arm, a rotary spiral winged valve adjustably secured to said valve-stem, a valve-casing and valve-seat, and an outlet-passage below said valve-seat, substantially as specified.

5. In an automatic steam-trap, a tank, a bucket-float therein, having an inlet at top, a discharge-valve outside of said tank, connected to said bucket-float by means whereby the valve is opened when the bucket falls and is closed when it rises; a single outlet from said tank through a hollow arm mounted on said bucket-float, whereby the water-level in the tank cannot sink below the bucket-inlet, and a passage-way from said bucket-float through said hollow arm to the valve through the wall of the tank above low-water level, substantially as specified.

6. In an automatic steam-trap, a tank, a rising-and-falling bucket-float therein having an inlet-pipe at top, the height of which governs the water-level in the tank, a partition in said tank extending below low-water level, forming a chamber open at bottom and closed at top, a hollow lever-arm secured to the bucket-float, forming the only outlet from the bucket and tank, a tubular journaled passage from said hollow arm through the wall of the tank within said partitioned chamber, above the low-water level, and a discharge-valve outside the tank communicating with said hollow arm and bucket-float by said tubular passage, and operated by the movements thereof, to pass the contents of the tank at intermittent periods, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM T. POWERS.

Witnesses:
W. H. THOMAS,
JOHN E. SWEET.