

No. 702,898.

Patented June 17, 1902.

F. W. WOOD & E. H. STILES, JR.
AUTOMATIC STRINGED MUSICAL INSTRUMENT.

(Application filed July 2, 1901.)

(No Model.)

3 Sheets—Sheet 2.

Fig. 2.

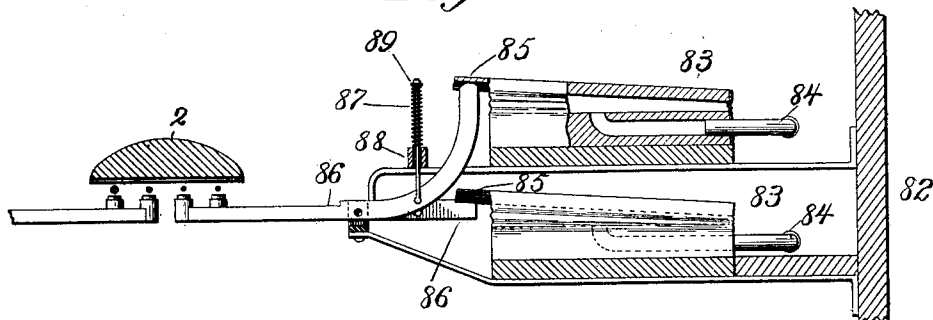


Fig. 3.

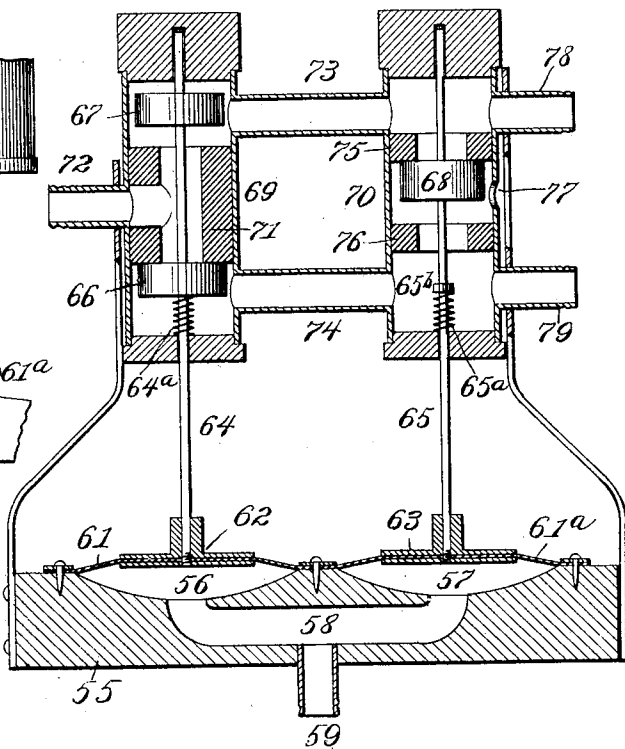


Fig. 4.

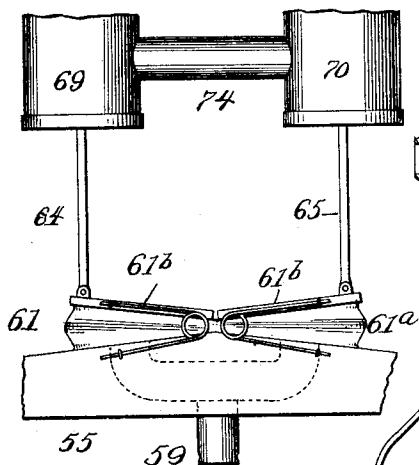
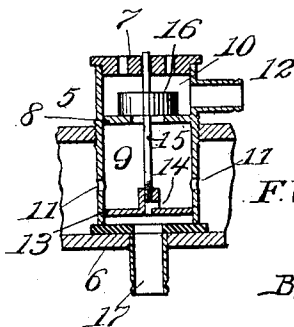


Fig. 5.



Witnesses:
Arthur M. Arthur
H. C. Rodgers.

Inventors:
F. W. Wood and E. H. Stiles, Jr.

By Fischer + Phelps
Attys.

F. W. WOOD & E. H. STILES, JR.
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3 Sheets—Sheet 3.

Fig. 6.

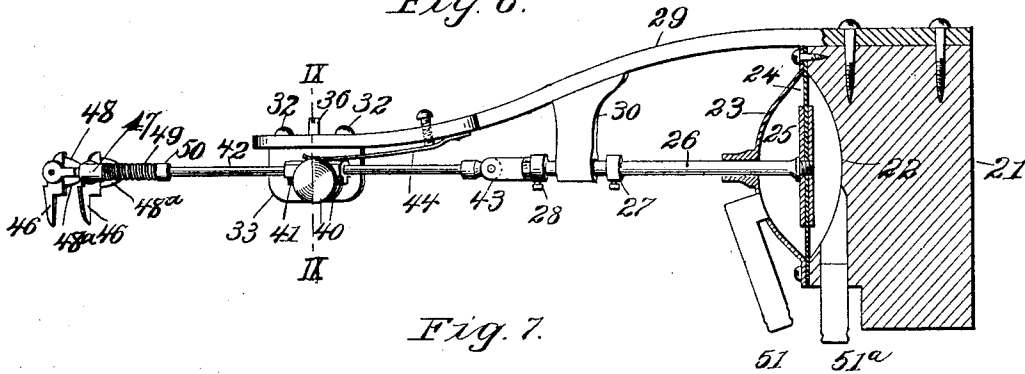


Fig. 7.

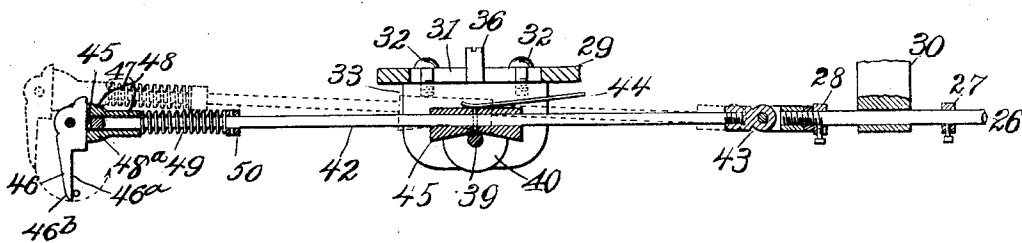


Fig. 8.

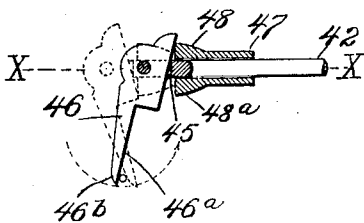


Fig. 9.

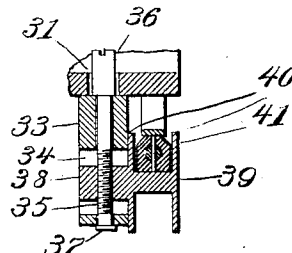


Fig. 10.

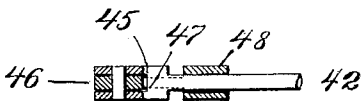
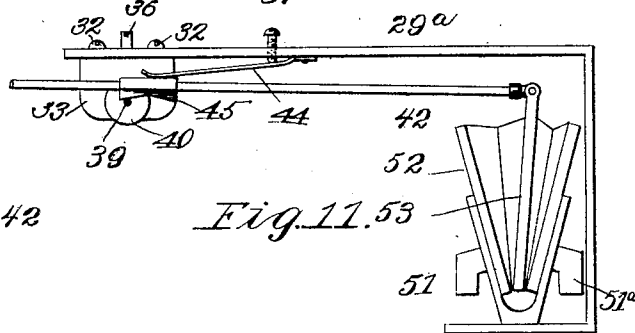


Fig. 11.



Witnesses:

Arthur M. Arthur
H. C. Rodgers.

Inventors:

F. W. Wood and E. H. Stiles, Jr.
By Fischer + Thorpe
attys.

UNITED STATES PATENT OFFICE.

FREDERICH W. WOOD AND EDWARD H. STILES, JR., OF KANSAS CITY,
MISSOURI; SAID STILES ASSIGNOR TO SAID WOOD.

AUTOMATIC STRINGED MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 702,898, dated June 17, 1902.

Application filed July 2, 1901. Serial No. 66,833. (No model.)

To all whom it may concern:

Be it known that we, FREDERICH W. WOOD and EDWARD H. STILES, JR., citizens of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Automatic Stringed Musical Instruments, of which the following is a specification.

Our invention relates to automatic stringed musical instruments, and has for its object to produce an instrument of this character positive and reliable in action and embodying reciprocatory pickers, which pick the strings in their retrograde as well as advance movement and always produce the same volume of vibration and tone in striking the same note.

With this and other objects in view as hereinafter appear the invention consists in certain novel and peculiar features of construction and combinations of parts, as hereinafter described and claimed, and in order that it may be fully understood reference is to be had to the accompanying drawings, in which—

Figure 1 is an interior view of a case containing a banjo and mechanism for playing the same automatically. Fig. 2 is a horizontal section taken on the line II II of Fig. 1. Fig. 3 is a central vertical section taken on line III III of Fig. 1. Fig. 4 is an elevation of a modified form of Fig. 3. Fig. 5 is a vertical section of one of the main valves and a part of the vacuum-chest, taken on the line V V of Fig. 1. Fig. 6 is a section taken on the line VI VI of Fig. 1. Fig. 7 is an enlarged view showing the spring-actuated collar, the cam, and the coupling of the picker-rod and the guide-arm and support for the same in section. Fig. 8 is an enlarged section showing the picker in different positions. Fig. 9 is a vertical section taken on the line IX IX of Fig. 6. Fig. 10 is a section taken on the line X X of Fig. 8. Fig. 11 is a view showing a modified form of picker-operating mechanism.

Referring now to the drawings, where like reference characters designate corresponding parts, 1 designates a suitable casing; 2, a banjo supported therein, with its neck portion projecting upward; 3, the exhaust-chest, and

4 the tube connecting the exhaust-chest with any suitable mechanism (not shown) for maintaining a vacuum in said chest as long as the instrument is in operation.

Mounted in the exhaust-chest are the main valves in the usual number required, each of which valves is constructed as follows:

5 designates a vertical cylindrical casing screwed into the top of the case and having its lower end seated upon and closed by a centrally-perforated rubber disk 6 and its upper end provided with a central and eccentrically-perforated cap 7.

8 is a centrally-perforated partition dividing the casing into a large lower bottom chamber 9 and a small upper chamber 10, the lower chamber communicating with the exhaust-chest through openings 11 in the casing, the upper chamber being provided with a side tube-section 12, adapted for a purpose which hereinafter appears.

13 designates the piston fitting snugly in the lower chamber and provided with a small opening 14, which maintains open communication between the exhaust-chest and chamber 9 below the piston. The piston-stem 15 fits slidingly in the central opening of cap 7 and carries a dual-faced valve 16, which closes the perforation of partition 8 when the piston is depressed and permits external air to enter chamber 10 through the perforated cap and escape through tube-section 12 and when the piston is elevated closes the openings of the perforated cap and permits air to enter chamber 10 through tube-section 12 and pass down through perforated partition 8 and perforations 11 to the exhaust-chest, from which it escapes through tube 4, as hereinbefore stated.

Secured in the bottom of the exhaust-chest and communicating with the perforation of rubber disk 6 is a permanent tube-section 17, connected by a tube 17^a to the tracker-bar 18, provided with the usual opening 19, and over said tracker-bar is drawn in any suitable manner a perforated note-sheet 20. As the perforations of said sheet register with the opening of the tracker-bar atmospheric pressure is admitted to the lower part of chamber 9, a small portion of it passing through opening 14 and perforations 11 to the exhaust-

chest, the greater volume because of the diminutive size of opening 14 and the greater area of piston 13 than the valve 16 raising said piston and valve, so as to close the eccentric openings of the cap and open up communication between chambers 9 and 10 to permit air from the latter to be drawn into the former and pass to the exhaust-chest for a purpose which is hereinafter explained. As said registering opening of the note-sheet passes out of alinement with that of the tracker-bar, atmospheric pressure is shut off below the piston, and the pressure of the air entering through valve 16 by way of the perforated cap forces the latter and the piston to their original positions and cuts off communication between chambers 9 and 10. The action of the main valve and the resultant effect will be hereinafter explained.

Arranged at diametrically opposite points on the banjo-head are four pickers, two of which are formed on each block 21 and the supporting-frame, hereinafter referred to, carried thereby, and each block has its inner face concaved, as at 22, for each picker, said cavity, in conjunction with the oppositely bowed or convex cap 23, forming an air-tight chamber divided by a flexible diaphragm 24.

Secured to opposite sides of the central portion of the diaphragm and forming in conjunction therewith what might be termed a "piston" are plates 25, the stem 26 of said piston extending through and having an air-tight joint with the cap 23 and carrying at suitable distances apart the adjustable collars 27 28, adapted by contact with bearing-arm 30 of frame 29, hereinbefore referred to, to limit the reciprocatory action of the diaphragm or piston. The head of said frame is provided with a slot 31, parallel with each piston-stem, through which project screwbolts 32, and engages a supporting-plate 33, provided with a slot 34.

35 designates an adjusting-screw extending through slot 31, plate 33, and centrally of its slot and having a head 36 and an enlargement 37 engaging the upper and lower sides, respectively, of the plate in order that when turned it shall through the medium of its screw portion occupying slot 34 simply move block 38 within said slot nearer to or farther from the plane of the strings, said block terminating contiguous to the head of the instrument in a pin 39, having flanges 40 to retain upon the pin the double cam 41, the inclined or cam surfaces of said cam converging together, as shown in Fig. 7. The cam is mounted rigidly on the picker-rod 42, hinged, as at 43, to the piston-stem 26, this pivotal connection of the rod enabling it to swing toward or from the face of the instrument as the cam rides upon said pin. The inverted-V formation of the cam causes the outer end of the rod in its reciprocation to describe a letter V as wide as the cam is long, but of greater depth, because said end is more remote from pivot 43. (See Fig. 7, where the

dotted lines show the cam at one end of its movement, and therefore elevated, and full lines show it midway its movement, and therefore depressed, this depression being effected most positively and reliably by means of the spring 44, secured to frame 29.)

The front end of the picker-rod is bifurcated, as at 45, and pivoted therein is the picker 46, that side of the picker which engages the string with a pulling action being straight, as at 46^a, and the opposite side, which engages the string with a pushing action, tapered or beveled, as at 46^b.

The picker is caused to engage the string with a yielding pressure when moving in either direction by means of a collar 47, slidably mounted on the picker-rod and terminating in a pair of opposite arms 48 48^a, the picker in its pulling action against the string engaging arm 48 and in its pushing action against the string engaging arm 48^a, said arms offering a yielding resistance to the pivotal movement of the picker under the pressure of a spring 49, mounted on the rod and bearing at its rear end against an adjustable collar 50. It will be observed by reference to Figs. 7 and 8 that the resistance of the string causes the picker to pivotally operate to the position shown in full lines in the last-named figure against the resistance of spring 49 and that the tendency of the picker is to ride over the string.

Communicating with the opposite sides of the diaphragm 24 are tubes 51 51^a, for a purpose which hereinafter appears, and in Fig. 11 the same tubes connect with opposite sides of the bellows 52 the equivalent of the diaphragm mechanism, said bellows being provided with an arm 53, pivotally connected to the rear end of the picker-rod, the pivotal connection permitting the same pivotal action of the rod that it receives from its pivotal connection 43 with the piston-stem 26.

Secured within the case and vertically over the picker mechanism, by preference, are brackets 54, carrying blocks 55, containing two cavities 56 57, united by a passage 58, connected by a short tube-section 59 and a tube 60 with the short tube-section 12 of one of the main valves.

61 61^a designate elastic covers or diaphragms for cavities 56 57, respectively, and 62 63 pistons centrally attached to said diaphragms and having parallel stems 64 65. Stem 64 carries two valves 66 67, and stem 65 a single valve 68, valve-stem 64 operating in cylindrical casing 69 and valve-stem 65 in casing 70.

Casing 69 is provided with a tubular block 71, having a valve-seat at its lower end for valve 66 and a seat at its upper end for valve 67, said valves alternately engaging the block. Communicating with the latter is a short tube-section 72, connected by a tube 72^a to the vacuum-creating mechanism, (not shown,) and connecting casing 69 above and below the block to the upper and lower ends of cas-

ing 70 are tubes 73 74, tubular valve-blocks 75 76 for alternate engagement with valve 68 being arranged within casing 70 contiguous to and between tubes 73 74, respectively.

5 Between said blocks 75 76 casing 70 is provided with an opening 77, open to the atmosphere and above and below said blocks, respectively, with tube-sections 78 79, the former being connected by a tube 80 to tube-section 51 of the picker diaphragm or bellows, (see Fig. 6 or Fig. 11,) a similar tube 81 connecting tube-section 79 with the tube-section 51^a of the diaphragm or bellows.

Assuming now that a certain perforation 15 of the note-sheet has registered with an opening of the tracker-bar and that such action has been followed by the operation of the main valve described, it will be apparent that the air-draft through tube-section 12 has 20 created a vacuum under diaphragms 61 61^a, this action being instantly followed by the descent of said diaphragms or pistons and corresponding movement on the part of the valves connected thereto. As such movement takes place communication between 25 exhaust-tube section 72 and tube 73 is cut off by valve 67, and synchronously communication is cut off between opening 77 and tube 79 by valve 68. At the same time communication is opened up between exhaust-tube section 72, tube 74, tube-section 79, 30 and tube-section 51^a of the picker mechanism, creating a vacuum at one side of the piston or diaphragm thereof, and at the same instant external air is brought to bear against the opposite side of the diaphragm, the air entering opening 77 of casing 70 and passing through block 75, tube-section 78, tube 80, 35 and tube-section 51. At the instant a vacuum is created at one side and air-pressure is brought to bear on the other the picker is caused to operate with its "pulling-face" on the string, this action being instantly followed by its "pushing" action, the same taking 45 place as the note-sheet opening passes out of alinement with the tracker-bar opening, the result being the piston of the main valve drops, external air enters cavities 56 57 through main-valve cap 7, tube-section 12, 50 tube 60, and their connections and raises the diaphragms or pistons 61 61^a to the position shown in Fig. 3, this action opening up communication between exhaust-tube section 72, block 69, tube 73, tube-section 78, tube 80, 55 and tube-section 51 to exhaust air from the corresponding side of the picker diaphragm or piston. At the same time external air enters openings 77, passes through block 76, tube-section 78, tube 81, and tube-section 51^a 60 to the opposite side of the piston, the result being the pushing action of the picker is effected, as stated.

In lieu of the flexible diaphragm shown in Fig. 3 bellows 61' 61^{a'} may be employed, the 65 expanding action of the bellows being facilitated by means of springs 61^b, attached to block 55 and to the bellows, and in this con-

nection it is to be noted that the reëlevation of the diaphragms or pistons 61 61^a is facilitated by the employment of springs 64^a 65^a, 70 the former bearing at its opposite ends against the closed lower portion of casing 69 and the under side of valve 66, while spring 65^a bears against the closed lower end of casing 70 and the collar 65^b of the piston-rod. 75

82 designates a suitable frame above the valve mechanism last described and embodying a staggered series of bellows 83, the bellows being in staggered relation, as otherwise they could not be arranged in the desired 80 proximity to the frets of the instrument with which they coöperate, as hereinafter explained.

84 designates a tube leading from each bellows to one of the main valves, being connected to the tube-section 12 of said valve in 85 order that the action of the valve hereinbefore explained and caused by the registration of the note-sheet opening with the tracker-bar opening shall create a vacuum in the bellows and cause its collapse, this collapse by 90 the engagement of its arm 85 with the rear end of the pivoted fret-finger 86 pressing the string down upon the fret in an obvious manner. As said note-sheet opening moves out 95 of alinement with the tracker-bar opening the main-valve action operates as described and permits external air to enter the collapsed bellows and permit the spring 87, pressing at one end against the guide 88 and at its opposite end against the head of link 89, to force 100 said link outwardly and through its pivotal connections with the pivoted finger 86 re-expand the bellows, as will be readily understood by reference to Fig. 2. 105

As the operation of the various parts has been set out in detail and in the connections wherein they coöperate with each other it is believed a recapitulation of the entire operation is unnecessary. It is apparent, of course, that 110 while we have illustrated and described the preferred embodiment of the invention it is susceptible of various changes as regards its form, proportion, detail construction, and arrangement of parts without departing from 115 the essential spirit and scope or sacrificing any of the advantages of the invention.

Having thus described the invention, what we claim as new, and desire to secure by Letters Patent, is— 120

1. In an instrument of the character described, a reciprocatory rod, a picker pivoted to said rod and held yieldingly against pivotal movement in either direction, and a cam for causing the point of the picker as it moves 125 forward to be depressed and then rise to its original plane, and as it moves backward to be again depressed and again rise to its original plane, substantially as described.

2. In an instrument of the character described, a reciprocatory rod, a picker pivoted 130 to said rod and held yieldingly against pivotal movement in either direction, a fixed pin, and a cam provided with converging cam-

faces and secured to said rod, and having its cam-faces engaging said pin, substantially as described.

3. In an instrument of the character described, a reciprocatory rod, a picker pivoted to said rod and held yieldingly against pivotal movement in either direction, a fixed pin, a cam provided with converging cam-faces and secured to said rod, and having its cam-faces engaging said pin, and a spring holding said cam and pin in yielding engagement, substantially as described.

4. In an instrument of the character described, a frame, an adjustable pin carried thereby, and provided with flanges, a reciprocatory rod provided with a cam engaging said pin, and a picker pivoted to the end of said rod and held yieldingly against pivotal movement in either direction, substantially as described.

5. In an instrument of the character described, a reciprocatory rod, a picker pivoted thereto, a spring-actuated sliding collar upon the rod, and provided with an arm above and below the pivotal point of the picker, substantially as described.

6. In an instrument of the character described, a hinged reciprocating rod, a picker pivoted to the free end of the rod and having pivotal movement in the same plane as that of the rod, a spring holding the picker against pivotal movement in either direction, and a cam to cause the point of the picker to descend and rise again in its retrograde as well as its advance movement, substantially as described.

7. In an instrument of the character described, an exhaust-chest, a valve therein, comprising a casing having a lower chamber communicating with the exhaust-chest, and an upper chamber communicating with the atmosphere, a perforated partition separating said chambers, and a perforated bottom for the casing, a tube communicating with the lower chamber through said perforated bottom, a piston mounted in the lower chamber and provided with a small passage, and a valve mounted on the piston-stem, and adapted to alternately close communication between said chambers or to prevent external air entering the upper chamber, substantially as described.

8. In an instrument of the character described, a pair of valve-casings, tubes connecting said casings, one of said casings being provided with an opening, and with a second pair of tubes, a tubular block between each of said second tubes and said opening, a tubular block in the other casing between the connecting-tubes, a tube connected to the last-named casing and communicating with said tubular block, a reciprocating stem ex-

tending longitudinally of each casing, a valve upon one stem adapted to alternately close the passage of the tubular blocks of said casing, and a pair of valves upon the other stem adapted to alternately engage the tubular block of said casing, the lower valve being adapted to be seated and unseated synchronously with the single valve of the other casing, substantially as described.

9. In an instrument of the character described, a pair of casings, tubes connecting said casings, one of said casings being provided with an opening, and with a second pair of tubes, a tubular block between each of said second tubes and said opening, a tubular block in the other casing between the connecting-tubes, a tube connected to the last-named casing and communicating with said tubular block, a reciprocating stem extending longitudinally of each casing, a valve upon one stem adapted to alternately close the passage of the tubular blocks of said casing, a pair of valves upon the other stem adapted to alternately engage the tubular block of said casing, the lower valve being adapted to be seated and unseated synchronously with the single valve of the other casing, a pneumatic chamber, a flexible diaphragm therein, a picker mechanism actuated thereby, tubes connecting said second tubes with said pneumatic picker at opposite sides of said diaphragm, and means as the valves of said casings are operated to synchronously exhaust the air at one side of the diaphragm and supply air to the other, substantially as described.

10. In a machine of the character described, the combination of a suitable support, a series of levers suitably supported and provided with fingers for pressure upon the strings of the instrument contiguous to the frets, a series of bellows provided with arms at one end for engagement with said levers at the side of their pivots opposite from said fingers, rods suitably guided and connected to said levers, springs engaging said rods and tending to inflate the bellows and hold the fingers out of contact with the strings and exhaust-tubes connected with the bellows and adapted by creating a vacuum therein to collapse them and cause them to operate said levers and thereby synchronously overcome the resistance of said springs and throw said fingers into engagement with the strings, substantially as described.

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

FREDERICH W. WOOD.
EDWARD H. STILES, JR.

Witnesses:

H. C. RODGERS,
G. Y. THORPE.