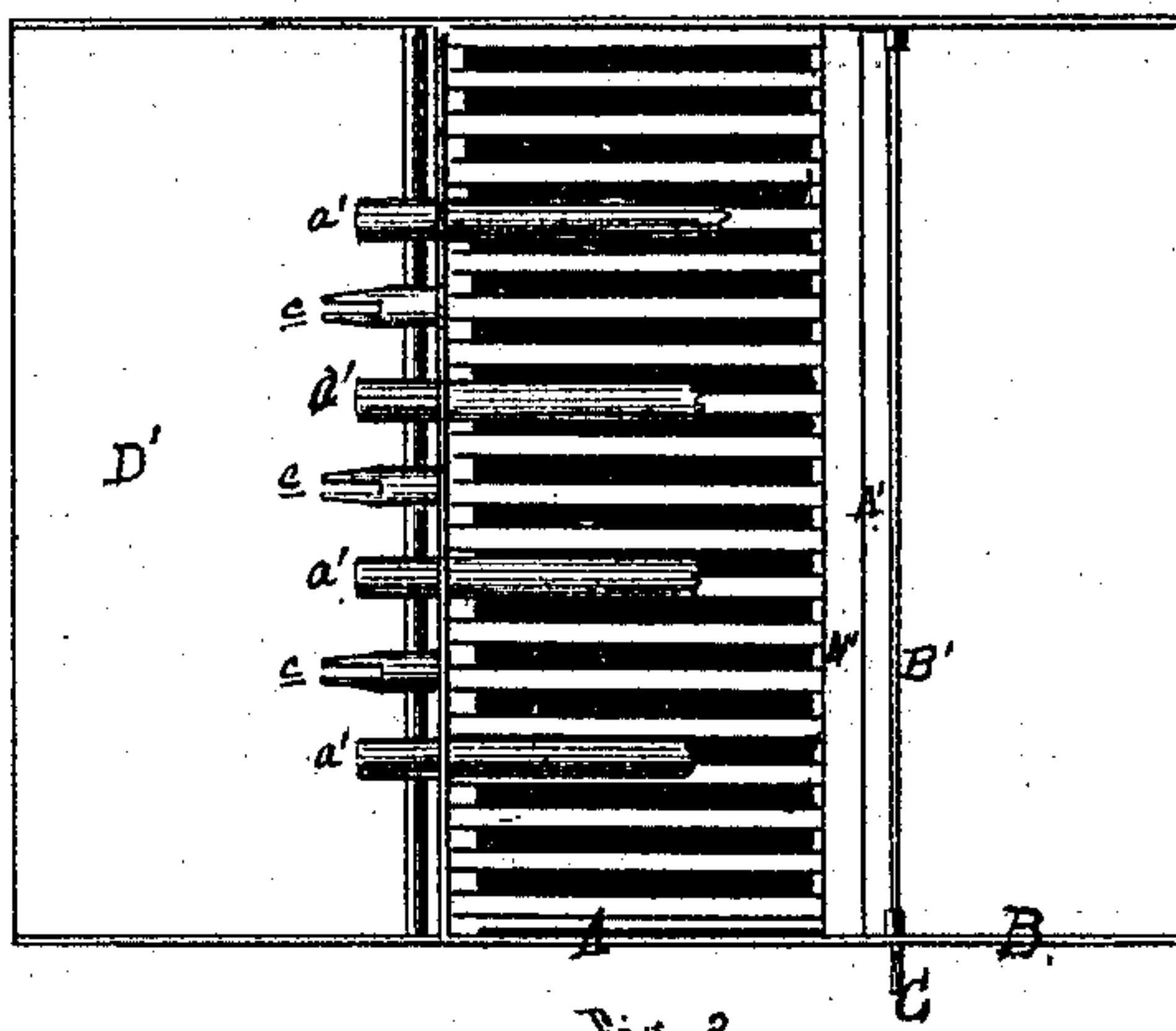
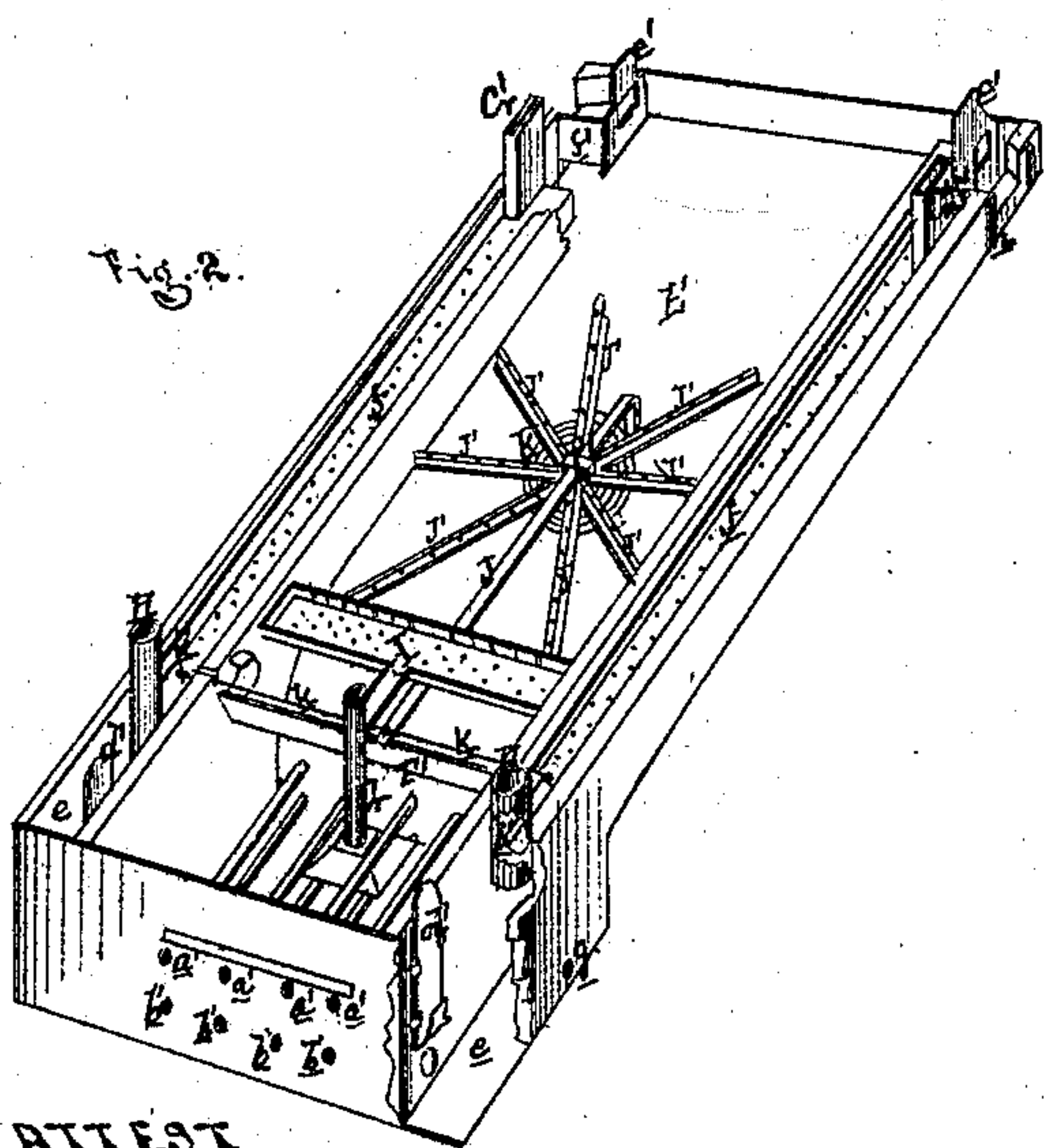
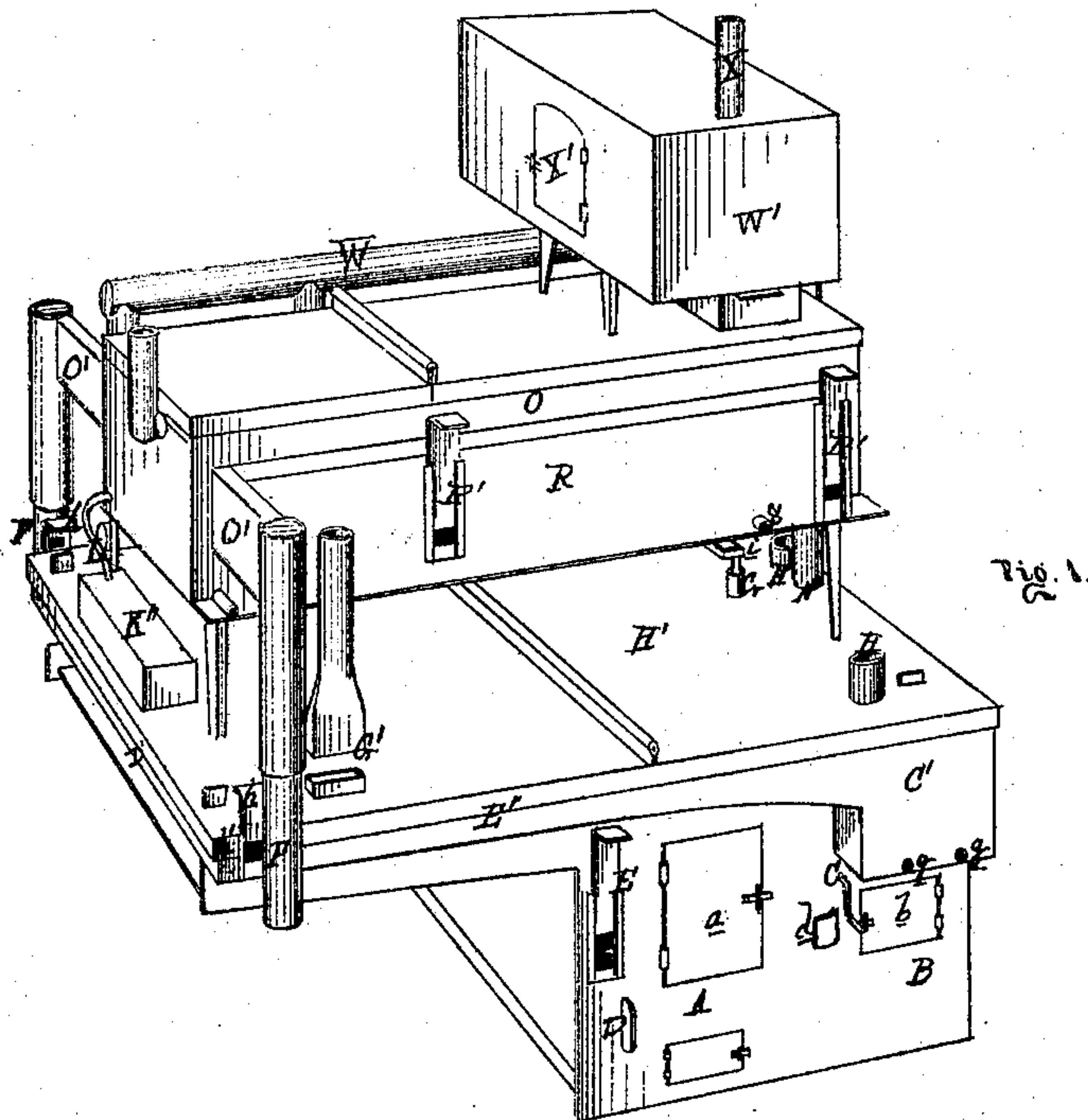


2. Sheets. Sheet 1.

Evaporator:

No. 113590.

*Patented Apr. 11, 1871.*



ATT EST

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E. Perry  
per A. H. G.  
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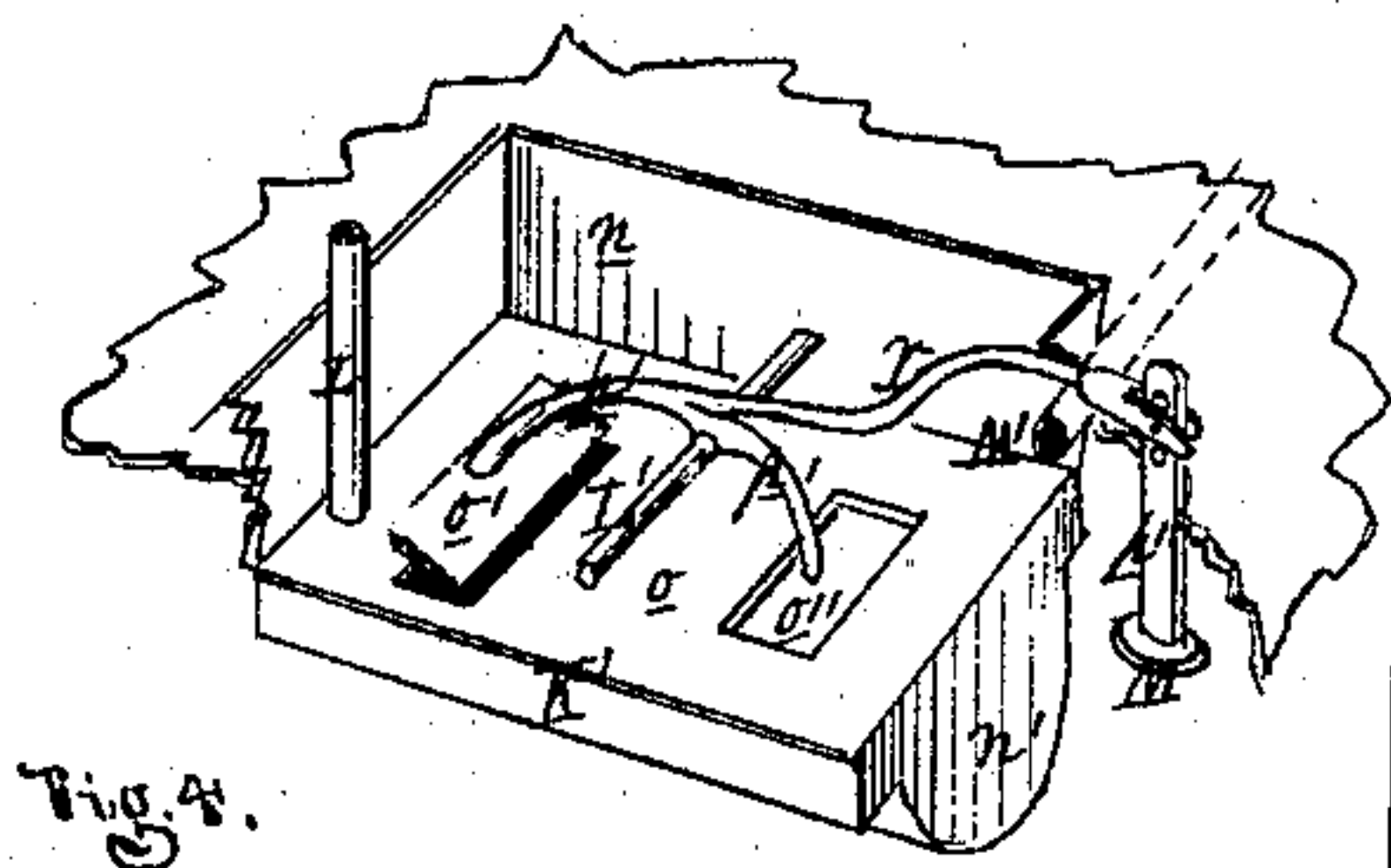
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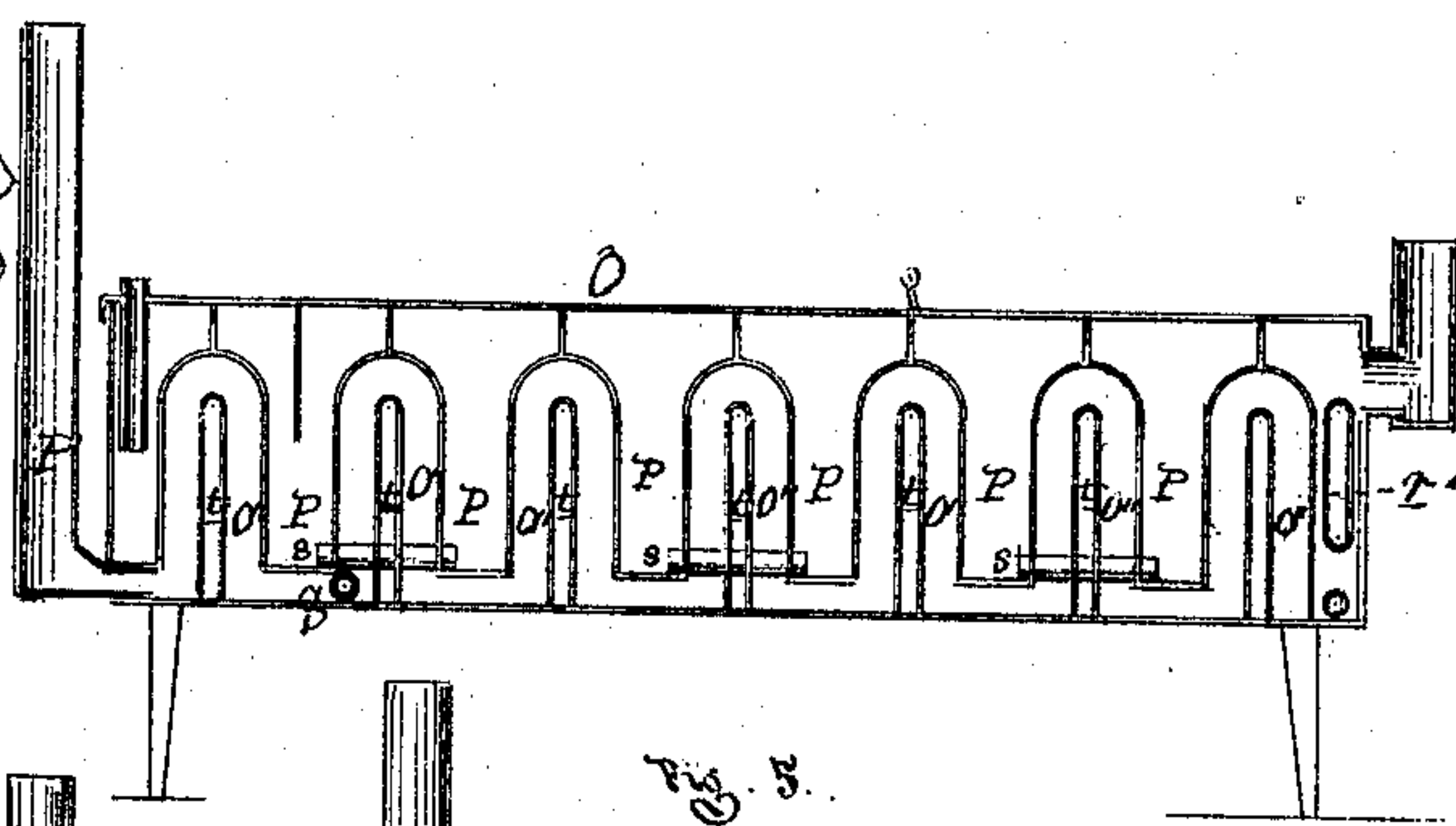
*2. Sheets, Sheet 2.*

*No. 113590.*

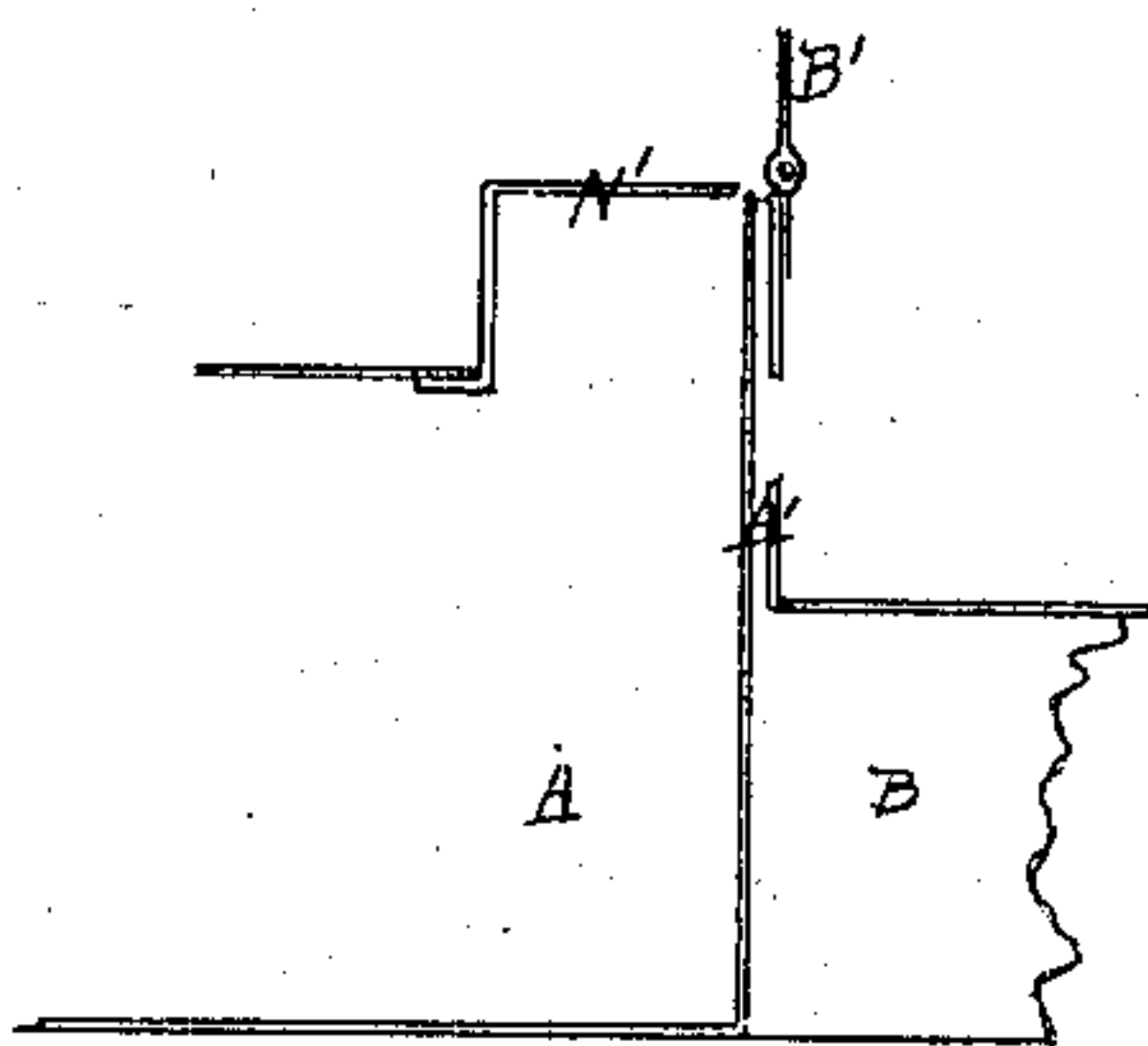
*Patented Apr. 11. 1871.*



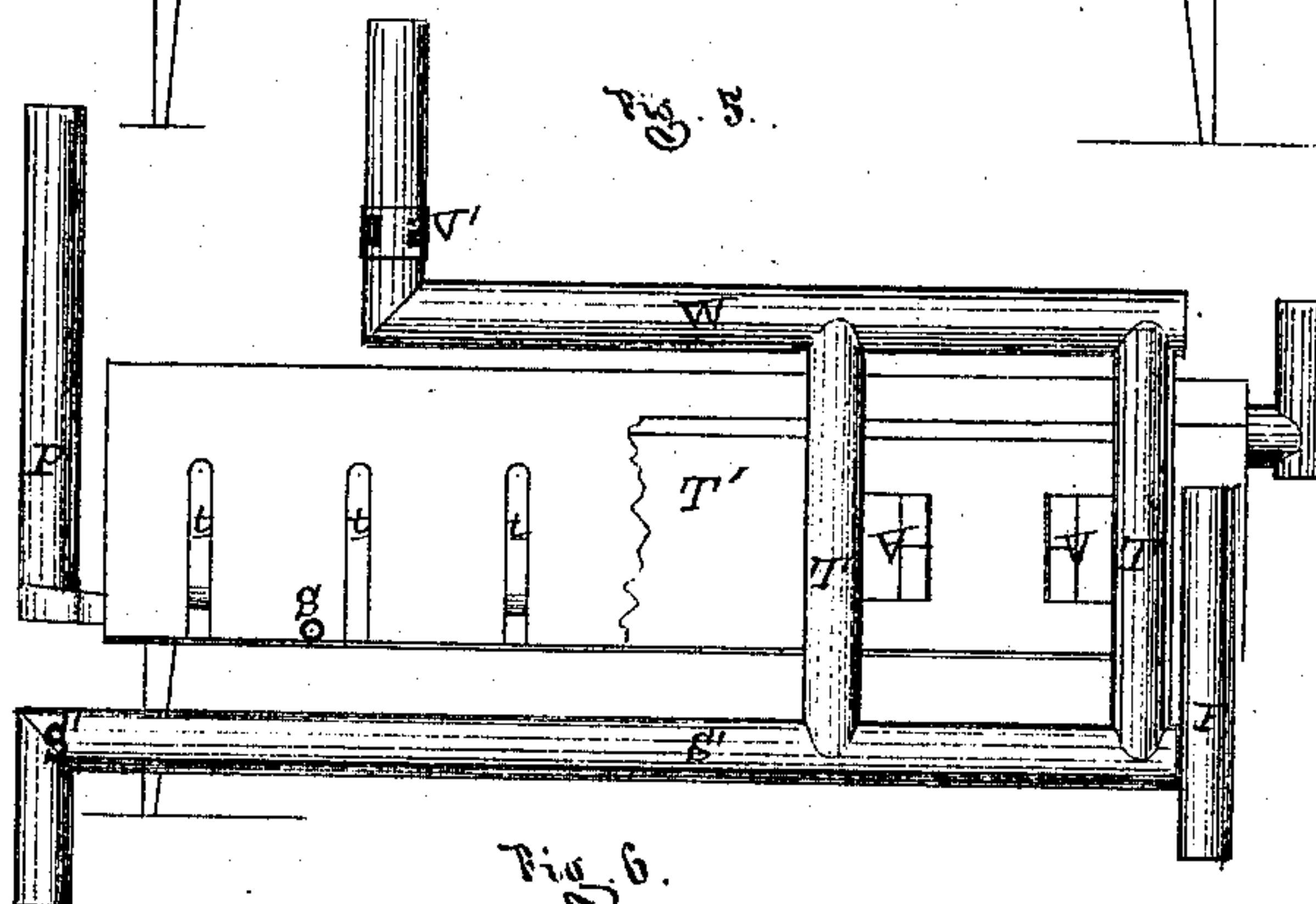
*Fig. 4.*



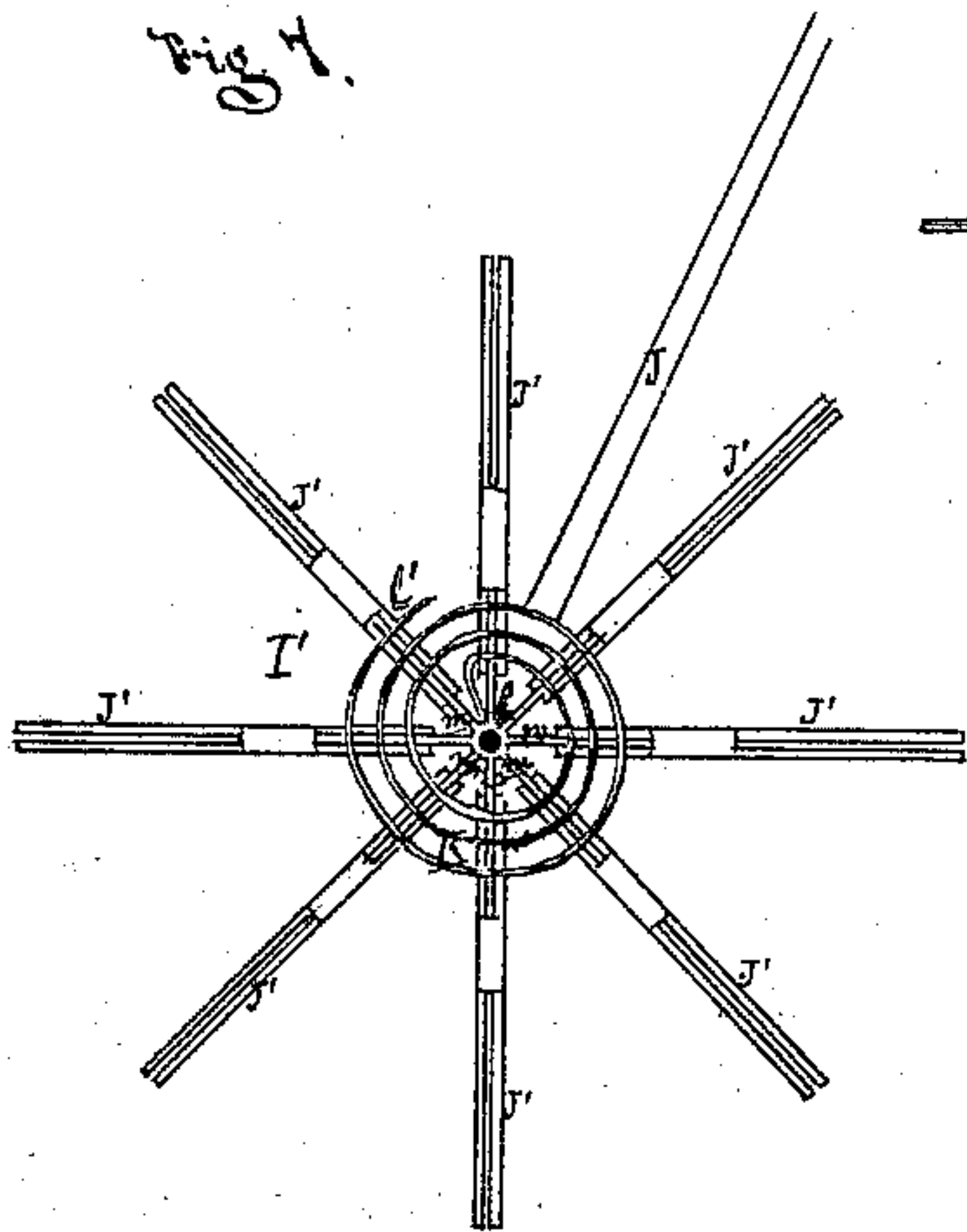
*Fig. 5.*



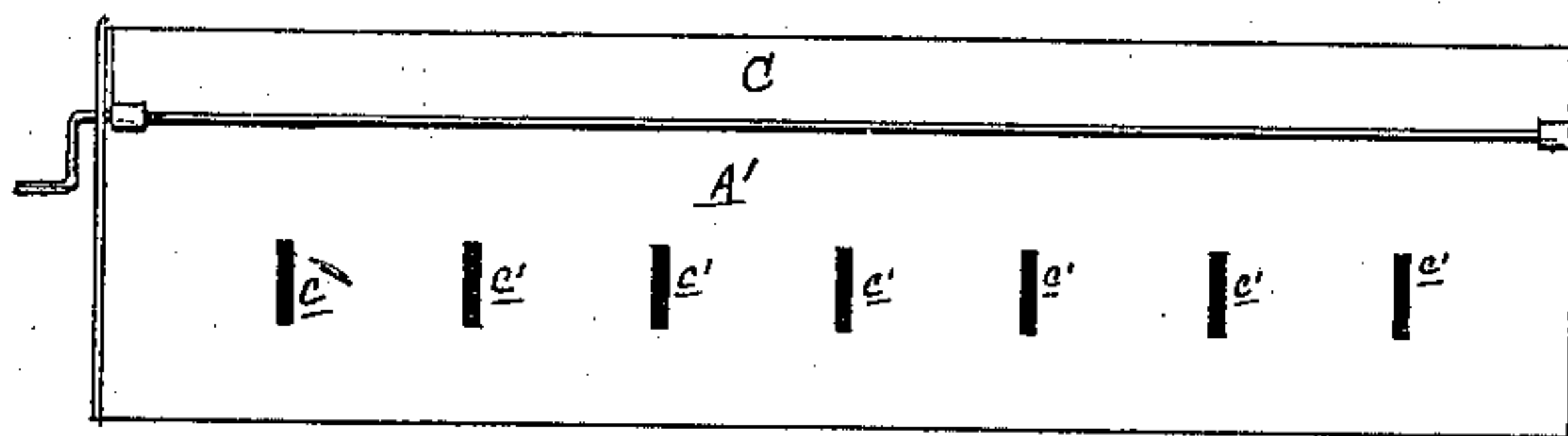
*Fig. 7.*



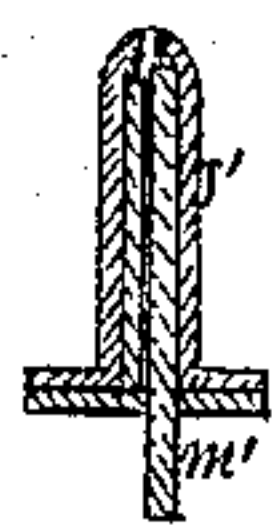
*Fig. 6.*



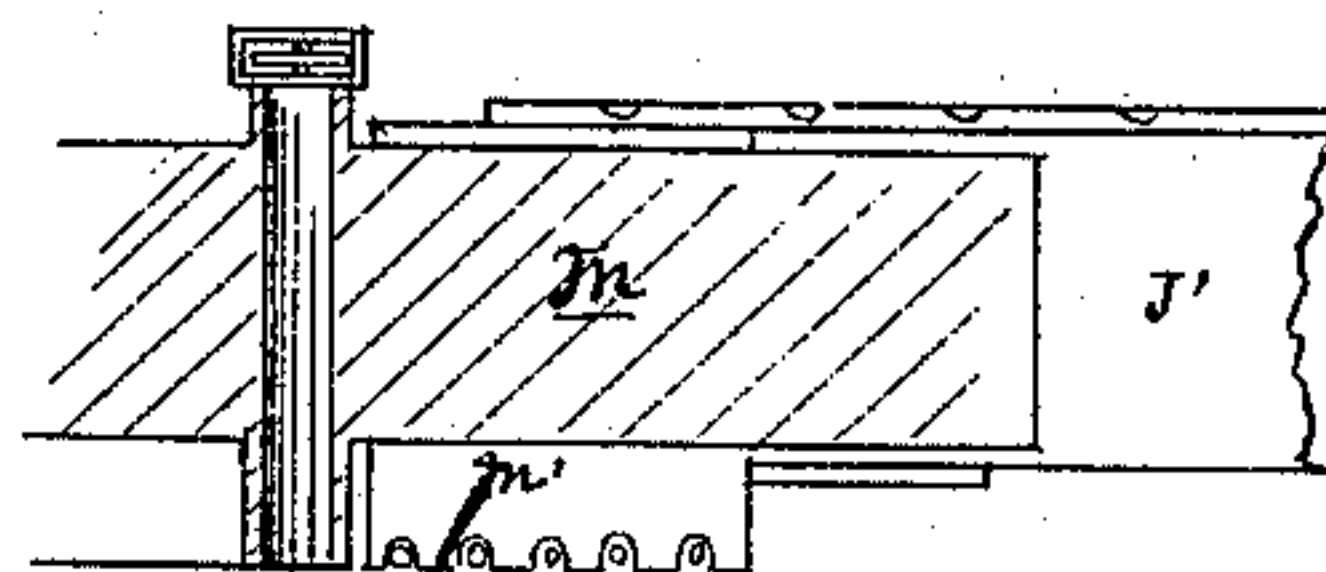
*Fig. 9.*



*Fig. 8.*



*Fig. 10.*



*Fig. 11.*

ATTEST

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# United States Patent Office.

EBENEZER SPERRY, OF CHICAGO, ILLINOIS.

Letters Patent No. 113,590, dated April 11, 1871.

## IMPROVEMENT IN APPARATUS FOR EVAPORATING CANE-JUICE, &c.

The Schedule referred to in these Letters Patent and making part of the same.

*To whom it may concern:*

Be it known that I, EBENEZER SPERRY, of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Evaporators; and I do declare that the following is a true and accurate description thereof, reference being had to the accompanying drawing and to the letters of reference marked thereon and being a part of this specification.

The nature of this invention relates to an improved construction of evaporators, more especially designed for evaporating cane-juice; and consists in the peculiar arrangement of the fire-places and their connection with the evaporating-pan, by means of which the greatest result can be obtained from the least fuel; also, in an apparatus for cleansing the juice, which is used for the purpose of drawing off from time to time the sedimentary impurities which will be precipitated to the bottom of the wells during the boiling process; also, in an arrangement of self-operating skimmers, and a receiver, through which fresh juice is supplied to the boiler or evaporating-pan; also, to an arrangement for cooling off the liquid when it is boiled to the highest state of concentration; also, in air and heat-regulators and air-flues, and in a novel arrangement of its various parts, as more fully hereinafter described.

Figure 1 is a perspective elevation of my apparatus.

Figure 2 is a perspective plan of my boiler and evaporating-pan, with a portion of one of the walls broken out to show the gate between one of the sinks and the boiler.

Figure 3 is a plan of the fire-places and flues.

Figure 4 is a perspective section showing the receiver, through which fresh juice is fed to the boiler.

Figure 5 is a horizontal vertical section of the condenser.

Figure 6 is a side elevation of the same with a portion of the jacket broken out.

Figure 7 is a cross-section of double wall A'.

Figure 8 is a front view of the same.

Figure 9 is a bottom plan of the regulator.

Figure 10 is a cross-section of the same.

Figure 11 is a sectional elevation of the same.

This invention is designed to be an improvement upon an evaporator for which Letters Patent were issued to me on the 10th day of September, 1867.

In the accompanying drawing—

A represents a fire-place provided with a proper door, *a*, through which to introduce fuel, while

B is another fire-place, also provided with a similar door, *b*, for a like purpose.

A double wall, A', surmounted by a hinged damper, B', operated by a suitable handle, C, from outside the case, is interposed between the fire-places.

The damper C, when turned up, cuts off any direct communication between the two fire-places A B, except as hereinafter mentioned.

C' is a boiler, the well of which forms the top of the fire-place B, and it is provided with an upper and lower series of tubes, *a' b'*.

For ordinary purposes the fire should be made in the fire-place A, draught being admitted through proper openings in its rear wall, as shown, and regulated by the sliding damper D, the damper B' being closed or turned up so that its edge will rest against the bottom of the boiler C'.

The products of combustion are carried through the lower series of tubes *b*, and, striking against the front wall of the fire-box B, return through the upper series of tubes *a'*, which extends backward through the rear wall of the fire-box A, and are discharged into the flue D', where they mingle with jets of air admitted through the opening E and discharged through the flues *e*.

Should more fire be required it may be made in the fire-box B, which receives its draught is admitted through openings *c'* in the double wall, (see fig. 7,) which are regulated by the sliding damper *d*.

Air is admitted to these openings through an orifice in the base of the double wall.

The rear wall of the boiler C' has an upward and backward curve, terminating in an evaporating-pan, E', which has a slight inclination upward and rearward. This plan also forms the top of the flue D'.

The boiler and pan should be filled with cane-juice, the gates *d'*, which close openings from the boiler into the wells or sinks *e* being closed, until the whole surface of the evaporating-pan is covered. The depth of the juice in said pan may be governed by the adjustable gates *e'*, which afford communication between the pan and the drip-pipes F and into the leaders *f*, which connect, at the opposite and lower end, with the sinks or wells *e*.

As soon as ebullition takes place the steam swells the volume of juice and inclines it to run over, when the juice will find an exit through the gates *e'*, under the fixed gates *f'* into the leaders, and thence into the sinks or wells *e*, whose gates *d'* should now be opened and allow the juice to again pass into the boiler.

These gates *d'* being above the bottom of the wells, allow sedimentary matter to settle, while the clear juice will pass into the boiler C', and the sediment may, when desired, be drawn off through the openings *g*.

After the juice has passed under the fixed gates *f'*, before it reaches the leaders, it must pass over other fixed gates G' whose top projects a little above the bottom of the gates *f'*, thereby compelling the latter to skim the juice, turning the scum into the drip-pipes F, while the juice will pass onto the perforated bot-



toms o the leaders and thence into the wells. The scum by this means is carried through the gates *h*, which are adjusted vertically in slides *h'* and lead into the drip-pipes, the scum falling through said drip-pipes into a proper receptacle, while the vapor and steam pass upward into the condenser, as hereinafter described.

A valve, *F'*, which is suitably hung for the purpose, controls the greater or lesser flow of juice, as may be desired, from the boiler *C'* to the evaporating-pan *E*.

Should it be desired at any time to draw off a portion of the juice, it may be done through the stand-pipe *G*, whose base should be in the form of a cone, or substantially that, and whose upper end should lead into a conductor, *i*, and the pipe should be provided with any suitable cut-off valve. When the sirup is highly concentrated it will be easily burned, as there is not evaporation enough from it to keep the temperature below the burning-point.

To reduce this temperature without a reduction of the fire, as the liquid passes over the perforated bottoms of the leaders *f* and slowly passes into the sinks or wells, the hot-air is allowed to pass off through the pipes *G'*, while cold air is admitted through the short pipes *H*, which rise through the cover *H'* of the boiler and evaporating-pan.

When it is not desired to draw off any of the juice through the stand-pipe *G*, the conductor *i* may be removed and the end of the pipe turned to discharge the juice onto the perforated distributor *I*, through which it will be equally distributed over the width of the evaporating-pan, as shown in fig. 2.

Proper valves *v'* are placed in the air-pipes *H*, and are connected by suitable rods *k* and bell-cranks *k'* to a vibrating regulator, *I'*, which is suspended from the cover of the pan so that it will work freely above the bottom of the pan, allowing hot liquid to pass under and hot air to pass over said regulator.

This regulator is composed of coiled wire, one end of which is secured to the center at *L*, from which the whole device is suspended from the cover, as before recited, while its other end is secured at *L'* to the operating-lever *J*, the opposite end of which is in turn secured to the connecting-rods *k*.

Radiating from the center of this device are short rigid arms, *m*, upon which are sleeved the conductors *J'*, which are in the form of an inverted letter *U*, with their upper edges perforated, as shown.

To the under side of these conductors are rigidly secured flanges *m'*, which are provided with notches upon their bottom edges, which notches engage with the convolutions of the coiled wire *K* in such a manner as to allow said wire to expand and contract freely, while the radiating arms which are attached to the lever at their outer ends will, by expansion, contract the coil and actuate the lever *J*, and, through the connecting-rods *k* and cranks *k'*, regulate the valves *v'* in the air-pipes *H*.

By means of the conductors *J'* the juice is distributed evenly over the bottom of the evaporating-pan, while the perforations in their tops allow the steam to pass off.

*K'* is a receiving-pan, (represented in section in fig. 4, with sides broken out,) through which the boiler and evaporating-pan is fed with fresh juice, as may be required. This pan has an upper chamber, *n*, and a lower chamber, *n'*. The juice is conducted into the lower chamber *n'* through the pipe *L*.

The partition *o*, which divides these two chambers, is provided with two openings, which are closed by valves *o'* and *o''*, the former opening upward and the latter downward.

These two valves are actuated through the connecting-rods *p'* and rock-shaft *L'*, which is properly journaled into the side walls of the upper chamber *n*.

The rock-shaft is actuated by means of a float, *M*, which rests upon the juice in the evaporating-pan.

The float is secured to an arm, *p''*, which passes upward through the cover of said evaporating-pan, and connects with the rocker-arm *r*; which in turn connects with the rock-shaft. As the float rises and falls it controls the valves which allow the juice to pass from the lower to the upper chamber and enter the evaporating-pan through the pipe *M'*, whose opposite end (shown in dotted lines in fig. 4) extends, in said evaporating-pan, nearly down the incline to the boiler, so that the juice so injected will be discharged as near the fire as is possible.

*K''*, in fig. 1, represents the receiving-pan with its cover on.

An air-pipe, *N*, which passes downward through the cover of the boiler *C'*, allows a current of cool air to strike upon a shelf near the front of said boiler and near its top. Striking the shelf in this manner, the column of air is broken up and diffused over the whole surface of the boiling liquid. This shelf is not shown in the drawing, except in fig. 3, and is lettered *N'*, and in fig. 7.

*O* is a heater or condenser. When used as a heater for juice to be discharged through the pipe *L* into the receiving-chambers *n n'*, and thence into the evaporating-pan, the vapor and steam escaping through the side-pipes *F'* is conducted by the branch pipes *O'* into the flues *r'* of the heater, which is composed of a series of inverted *U*-shaped flues, *O''*, having chambers *P* between and above the flues, in which the juice is placed.

These chambers also have communication with each other by means of pipes *s*, which pass through the flues, so that the juice is kept in circulation while being brought to a boil. The supply-steam will escape through the pipe *P'*.

The walls of these flues are double, as shown in fig. 4, and the jacket *R*, which covers one end of said flues, is provided with openings and valves *R'* opposite the ends of the flues, which, when required, allow cool air to be admitted to them; and

*S* are openings through which the condensed steam may be drawn off.

The steam, on entering the flue *r'*, follows the direction of the arrows in fig. 5.

Should more heat be required than is obtained by the manner just described, it may be had by attaching the pipe *S'* to the air-pipe *N*, which then, instead of feeding cold air into the boiler, will conduct the steam from the boiler to the branch pipes *T*, and thence through small branches into the flues *O''*, through the jacket *T'*, which is partially broken out in the drawing to show the openings into the open air-spaces *t* in the flues.

The pipes *T* are provided with valves, *V*, by means of which the steam is regulated in its passage into the flues.

To further utilize the heat and waste steam, the upper end of the pipes *T* terminate in a pipe, *W*, which enters through the bottom of the chamber *W'*, which may be employed for drying fruit or other materials. Within this chamber the pipe extends nearly to the top, and near the floor there are openings in the pipe which may be covered with the sleeved valve *V'*. By closing this valve the steam and hot air will be discharged through the open end of the pipe *T*, near the top of the chamber. By opening said valve the discharge will be near the floor.

*X* is an escape-pipe rising from the top of the chamber; and

*X'*, a door through which access is had to the interior of the chamber.

What I claim as my invention, and desire to secure by Letters Patent, is—



1. The arrangement of the two fire-boxes A B, separated by the double wall A' and hinged damper B', with the bottom of the boiler C' forming the top of said fire-boxes, when constructed and operating as herein set forth.

2. The boiler C' provided with tubes *a' b'*, in connection with the two fire-boxes A B, when constructed and operating as and for the purposes herein specified.

3. The combination and arrangement of the tubes *a' b'*, and flues *c*, and flue D', with the two fire-boxes A B and boiler C', when constructed to operate as herein described.

4. The arrangement of the boiler C', evaporating-pan E', gates *d'*, sinks or wells *e*, drip-pipes F, leaders *f*, gates *e'*, fixed gates *f' g'*, and adjustable gates *h*, when constructed and operating as and for the purpose herein set forth.

5. In evaporators, the valve or gate F', when operating for the purpose specified.

6. The arrangement of the pipes N G' H H, the

latter being provided with valves *i'*, for the purposes set forth.

7. The regulator I', when constructed and hung as described, in connection with the operating lever J, connecting-rods *k*, and valves *i'*, when operating for the purposes specified.

8. In evaporating-pans, the perforated distributor I; in connection with the stand-pipe G, for the purposes herein set forth.

9. The receiving-pan K', divided into two chambers *n n'*, provided with valves *o' o''*, operated by the float M through the arm *p''*, rocker-arm *r*, rock-shaft L, and connecting-rods *p'*, when constructed and operating for the purposes herein specified.

10. The heater O provided with flues *r' O'*, chambers P, pipes *s*, jackets R T, openings and valves R', openings S, when constructed and arranged as herein set forth.

Witnesses:

EBENEZER SPERRY.

HARRY S. SPRAGUE,

THOS. S. SPRAGUE.