R. E. KIMBALL.

GRAIN DECORTICATING MACHINE.

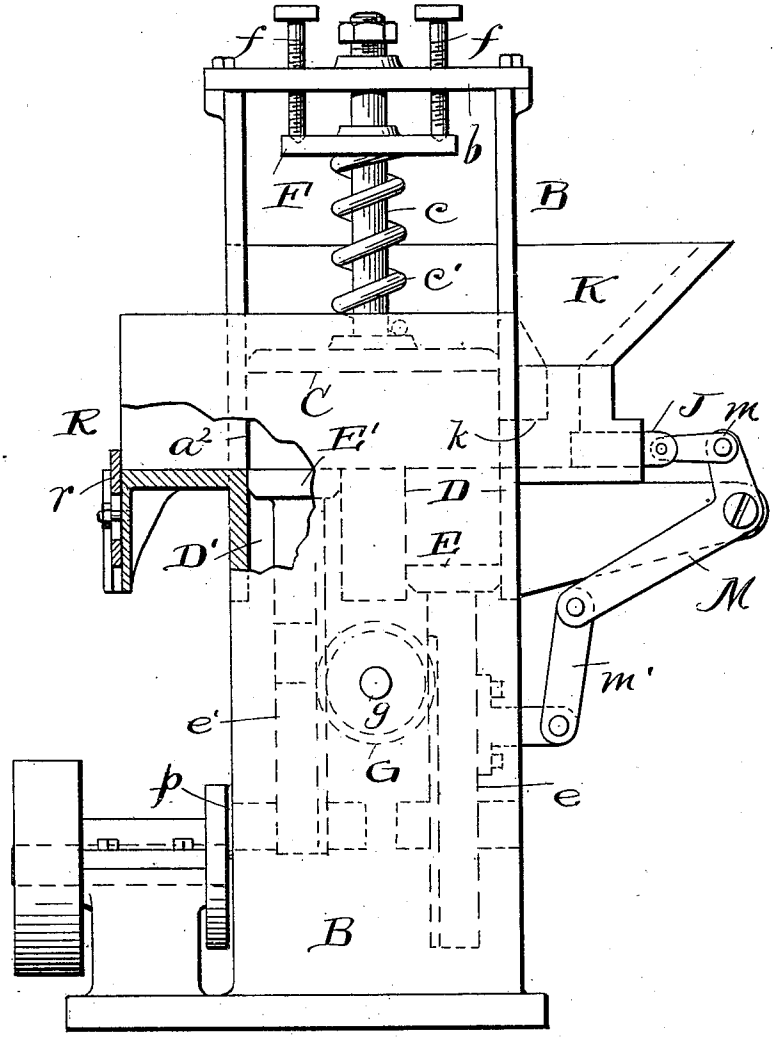
APPLICATION FILED JAN. 5, 1905.

977,197.

Patented Nov. 29, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
E. B. Gilchriest.
N. L. Brennan.

Inventor.
Robert E. Kimball,
By His Attorneys,
Thurston & Bates.

R. E. KIMBALL.

GRAIN DECORTICATING MACHINE.

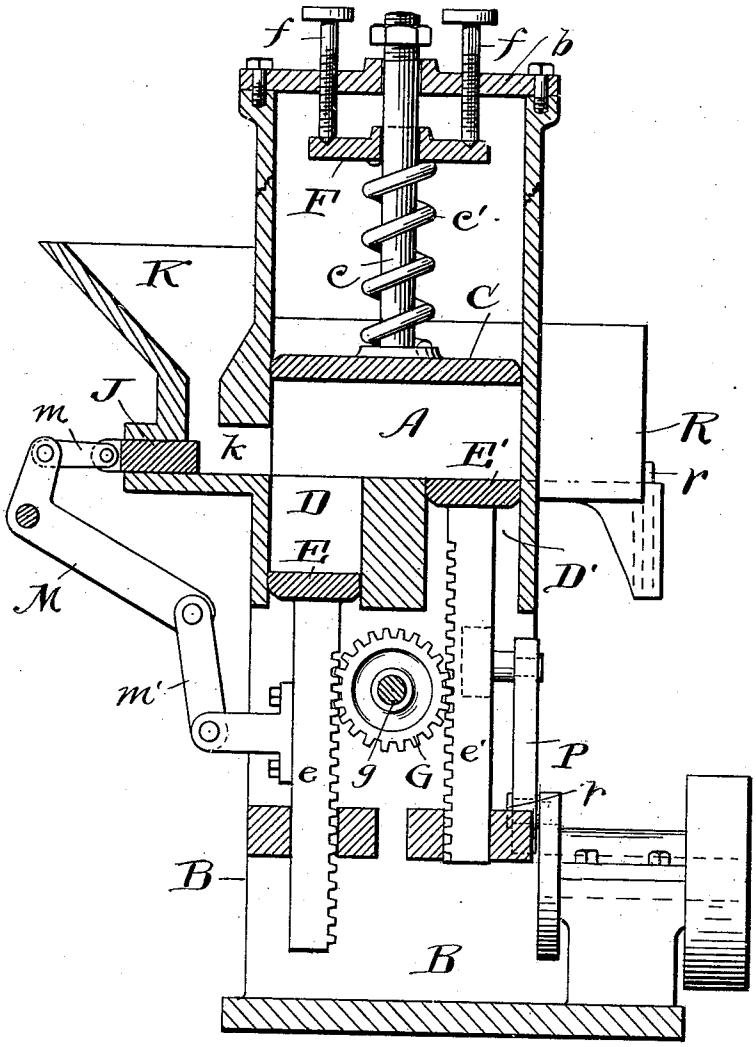
APPLICATION FILED JAN. 5, 1905.

977,197.

Patented Nov. 29, 1910.

3 SHEETS—SHEET 2.

Fig. 2.



Witnesses.
E. B. Gilchrist
N. L. Brennan

Inventor
Robert E. Kimball,
By his Attorneys,
Thurston & Bates

R. E. KIMBALL.

GRAIN DECORTICATING MACHINE.

APPLICATION FILED JAN. 5, 1905.

977,197. Patented Nov. 29, 1910.

3 SHEETS—SHEET 3.

Fig. 3.

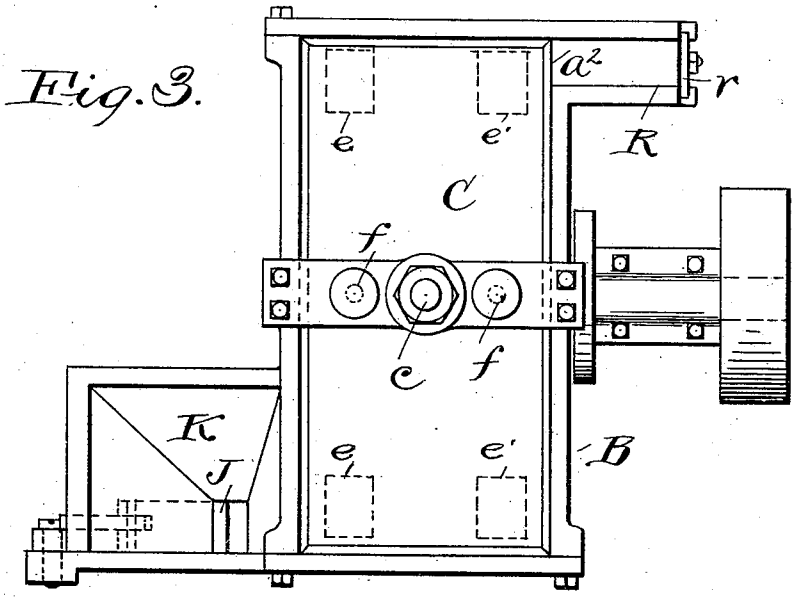
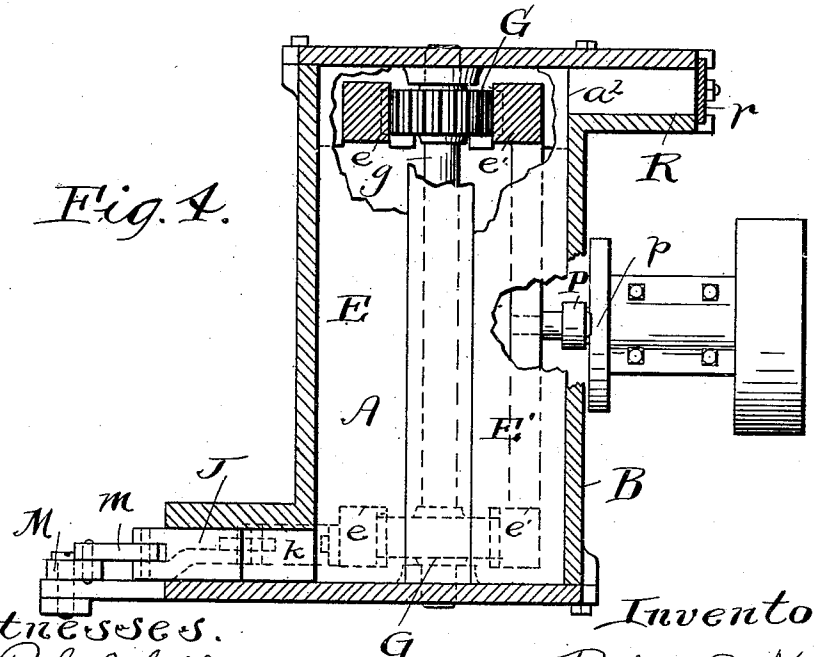


Fig. 4.



Witnesses.
E. B. Gilchrist
N. L. Brenan

Inventor
Robert E. Kimball,
By his Attorneys,
Thurston & Bates

UNITED STATES PATENT OFFICE.

ROBERT E. KIMBALL, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-THIRD TO L. H. WEBB AND ONE-THIRD TO E. L. THURSTON, OF CLEVELAND, OHIO.

GRAIN-DECORTICATING MACHINE.

977,197. Specification of Letters Patent. **Patented Nov. 29, 1910.**

Application filed January 5, 1905. Serial No. 239,702.

To all whom it may concern:

Be it known that I, ROBERT E. KIMBALL, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Grain-Decorticating Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The particular object of this invention is to remove the cuticle from rice grains without breaking the grains.

The various combinations of parts which constitute the present invention, and which contribute to the production of the stated result, are embodied, in the best form now known to me, in the machine shown in the drawing.

The invention, as embodied in that machine, consists broadly of a grain holding chamber having an inwardly pressed but outwardly yielding wall section, combined with means for agitating the grain in said chamber while the grain is subjected to pressure from said wall section.

It also consists of a chamber capable of being varied in shape, and means for subjecting the grains therein to suitable pressure, combined with means for causing the chamber to repeatedly change its shape, whereby the imprisoned grains will flow backward and forward from the contracting toward the enlarging part of said chamber in contact with one another.

It also consists in a main chamber having at least one outwardly yielding and inwardly pressed wall section, and two piston chambers communicating with the main chamber, combined with inversely movable pistons in said piston chambers, and operating mechanism for said pistons.

The invention also consists in various other novel characteristics of construction and combinations of parts embodied in the machine shown and described herein as definitely pointed out in the claims.

In the drawing, Figure 1 is a rear view of the machine; Fig. 2 is a sectional elevation looking in the opposite direction to that shown in Fig. 1; Fig. 3 is a plan view of the machine; Fig. 4 is a sectional plan view, partly broken away.

The decorticating chamber is indicated by A. In the form shown it is a substantially rectangular box supported by a suitable frame B. Its top wall section is a movable top cover plate C, which is slidably fitted to said box, and is subjected to a substantially constant but yielding pressure tending to move it inward. In the construction shown a vertical guide bar c, attached to said cover extends up through a fixed bar or plate b, which is a part of the machine frame. A spring c' surrounds this guide bar and is compressed more or less between the cover plate C and an adjustable plate F,—the position of which is determined by screws f, which screw down through the machine member b against the plate F, thereby adjusting the tension of the spring.

Leading downward from the main chamber A are two piston chambers D, D'. These chambers are substantially rectangular in form, and extend from one end to the other of the main chamber,—and the outer walls of each piston chamber are substantially coincident with the outer walls of the main chamber. The distance between the approximate edges of these two piston chambers is preferably somewhat less than their width. Within these piston chambers are the pistons E, E', which form the bottoms of said piston chambers. These pistons are inversely movable,—that is to say, when one moves up the other moves down, and vice versa. One of these pistons may be moved up and down by means of a pitman P attached to a rotating crank p. The inverse movement of the other piston is due to two rack bars e, e, which extend down from the piston E, two opposed rack bars e', e', which extend down from piston E', and two pinions G, G engaging said rack bars and attached to a shaft g. When either of the pistons is at the top of its stroke its upper surface is preferably in the same plane with the bottom of the main chamber.

In operating the machine the inclosed space, including the main chamber A and the piston chambers above the pistons, is to be filled with rice requiring treatment. This rice will be subjected to pressure from the cover plate C, which pressure will be regulated in accordance with the requirements of the particular rice being treated. When the pistons are operated as described, the

rice-containing chamber will be continually changing its shape. One end of said chamber will be enlarging as the piston in that end descends, while the other end of the chamber will be contracting as the piston in that end ascends. The result will be that the rice grains will flow backward and forward,—moving always from the contracting end toward the enlarging part of the chamber where room is being made for it by the descending piston. This flow of the rice grains backward and forward in contact with one another, wears off the cuticle of said grains. The rapidity with which said cuticle is worn off will depend in part upon the degree of pressure of said grains against one another, and this will depend upon the pressure of the cover plate C. This pressure should always be as great as is practical without causing a breakage of the rice grains. When either piston, as for example, piston E, ascends, it will tend to put an increased pressure upon the rice directly over it. If the cover plate C were immovable this pressure would cause a considerable breakage of the rice before it began to flow toward the other piston, but, by making this cover plate C yielding, as described, this result is avoided, because the yielding of said plate enlarges the space through which the rice may flow to such an extent that it will surely flow rather than remain above the rising piston until the pressure gets great enough to crush some of the rice grains.

In order to make the operation of the described mechanism continuous, the rice in small quantities is fed into the rice chamber near one end thereof and is allowed to escape at a remote point from the chamber. In the construction shown a hopper K is provided, and its lower end is connected through the horizontal passage *k* with the rice chamber in a plane substantially coincident with the bottom of the main chamber, and this opening *k* is close to one end of said chamber. A plunger J operates to force into chamber A the small quantity of rice which has fallen from the hopper down into the passage *k;* and the plunger J so acts when the adjacent piston is descending. This plunger J may take its motion from one of the rack bars *e;* and the mechanism for transmitting the motion may consist of a bell crank lever M, a link *m* connecting one arm of it with the plunger J, and a link *m'* which connects its other arm with the piston stem.

The outlet for the rice is at a point remote from the feed opening, preferably at a point diagonally across the chamber A. It is in its preferred form merely a narrow opening a^2 which may be made as high as the chamber A itself; and outside of this discharge opening is a horizontal trough R into which the rice flows as it passes through said opening. The rate of discharge from this outlet will depend upon the pressure required to force the rice along this trough, by comparison with the pressure required to lift the cover plate C. This may be varied by varying the length of the trough, or its inclination; or by means of a vertically adjustable gate *r* placed at its outer end. It is not important to the machine shown that this particular form of outlet be provided,—indeed it is not important that there be either an outlet or a feed inlet to the chamber. The cover plate might be removed and the chamber supplied with rice and the cover plate replaced. After this the machine may be operated until this charge of rice was decorticated and then the rice might be removed and a new charge supplied. It is desirable, however, to provide a continuous feed for the machine, and the means shown for the feeding of the rice into the chamber and for causing it to discharge therefrom are simple and effective.

The operation of the described machine will be as follows:—assuming the chamber A to contain a proper charge of rice, and to have been in operation long enough to have adjusted itself. Except for the necessity of adjusting the tension of the spring which holds the cover plate down, and of properly adjusting the gate of trough R the machine is self-adjusting. As the piston E, goes down, for example, the piston E′ rises. Before the latter piston began to rise, it is believed that the upper corner of the chamber A above said piston was empty. As the piston begins to rise it first pushes the rice up to fill this corner. If the rice thereafter does not freely flow laterally between the cover plate C and the bottom of the chamber, toward the descending piston, the cover plate will be pushed up slightly until this flow of rice begins. The rice so caused to flow toward the other piston chamber will fill the same and the chamber A above said piston chamber, except for the upper corner thereof, and the rice will be rather loosely packed above the piston E. The plunger J then pushes a small supply of rice into the chamber A, and then the piston E begins to ascend. The cover plate in the meantime will have settled down upon the rice. As this piston rises it pushes the rice into the empty corner above it, and thereafter the rice will flow toward the other piston which descends to make room for it, the cover plate C yielding slightly if necessary. When the piston E′ again ascends some of the rice adjacent to the discharge opening will be forced out. Whether much or little will be forced out will depend upon whether it is easier to force along the rice in the trough R than it is to lift the cover plate C so as to enlarge the chamber to accommodate the increased quantity of rice due to the feeding in of

rice by plunger J. If the spring of said cover plate has been adjusted properly to subject the rice to the maximum pressure permissible, the regular discharge of the rice must be arranged for by the adjustment of the gate of the trough.

The rice entering the inlet opening will gradually travel backward and forward in a zig-zag path across the chamber A and toward the outlet opening. As it flows back and forth under pressure, the various grains will rub upon each other, with the result of wearing off of the cuticle, and this will be accompanied by very little breakage provided the tension of the spring upon the cover plate is properly adjusted.

The machine shown is primarily intended for use in decorticating rice, but it is useful for scouring or decorticating various kinds of grain, although some change in the size of the chamber and of the pistons and of the tension upon the cover plate may be required, to adapt it to different kinds of grain.

The generic invention herein described as pointed out in the claims may be embodied in machines which differ widely from this shown; and it is not intended that the appended claims shall be limited to the described machine to any greater extent than their language imports.

I claim:

1. A grain holding chamber having one inwardly pressed and outwardly yielding wall section, combined with means for moving the grain back and forth in said chamber while it is subjected to pressure from said wall section, said chamber being sufficiently closed during operation to enable the maintenance of pressure on the grain.

2. A grain holding chamber having one inwardly pressed and outwardly yielding wall section, combined with means for moving the grain back and forth in said chamber while it is subjected to pressure from said wall section, said chamber being provided with a feed opening, and with a remotely placed discharge opening, said chamber being sufficiently closed during operation to enable the maintenance of pressure on the grain.

3. The combination of a substantially closed chamber of variable shape, and means for subjecting the mass of grain therein to yielding pressure, with means for causing the chamber to repeatedly change its shape,—positively contracting in one part and concurrently enlarging in another part, and vice versa,—whereby the imprisoned grains will be caused to flow back and forth from the contracting part toward the enlarging part of said chamber in contact with one another and under pressure.

4. The combination of a substantially closed chamber of variable shape having one inwardly pressed but outwardly yielding wall section, and means for increasing the pressure upon the imprisoned rice in one part of the chamber and concurrently relieving the pressure in another part of the chamber, and vice versa.

5. The combination of a chamber of variable shape having one inwardly pressed but outwardly yielding wall section, with means acting periodically and regularly for enlarging one part of said chamber and for correspondingly contracting another part thereof and vice versa.

6. The combination of a closed main chamber and two piston chambers connected with said main chamber, with pistons respectively movable in said piston chambers, and means for simultaneously moving said pistons in inverse directions.

7. The combination of a closed main chamber having one inwardly pressed but outwardly yielding wall section, and two piston chambers connected with said main chamber, with inversely movable pistons in said piston chambers respectively, and means for operating said pistons.

8. The combination of a substantially closed chamber of variable shape, and means for applying yielding pressure to the mass of material contained in said chamber, with means for enlarging one part and for simultaneously contracting another part of said chamber and vice versa, and means for feeding the grain slowly into one part of said chamber, and an outlet opening at a remote point of the chamber from which said grain may escape.

9. The combination of a substantially closed chamber of variable shape, and means for applying yielding pressure to the contents of said chamber, with means for regularly enlarging one part and for simultaneously contracting another part of said chamber and vice versa, and means for feeding the grain slowly into one part of said chamber, and an outlet opening at a remote point of the chamber from which said grain may escape, and means for regulating the escape of said grain through said outlet.

10. The combination of a chamber, and two piston chambers communicating therewith with inversely movable pistons in said piston chambers respectively, means for operating said pistons reciprocally, means for feeding grain slowly into one part of said chamber, and a discharge opening at a remote part of the chamber from which the grain may slowly escape.

11. The combination of a closed main chamber having an inwardly pressed but outwardly yielding wall section, and two piston chambers whose outer walls are downward continuations of the walls of the main

chamber, pistons in said piston chambers, and means for operating said pistons inversely.

12. The combination of a main chamber having an outwardly yielding but inwardly pressed cover plate, and two piston chambers formed in the bottom of said main chamber with inversely movable pistons in said chambers, mechanism for operating said pistons, the main chamber being provided with an inlet opening near one corner and with an outlet opening near the diagonally opposite corner.

13. The combination of a main chamber, having one yielding wall section, and two piston chambers communicating with the main chamber,—there being a feed opening near one corner of the said main chamber, and an outlet opening at a remote point,—and a trough outside of said discharge opening to receive the grain passing through the same, with two inversely movable pistons in said piston chambers respectively, and mechanism for operating said pistons.

14. The combination of a main chamber having one yielding wall section, two piston chambers communicating with the main chamber, there being a feed opening near one corner of the said main chamber, and an outlet opening at a remote point, and a trough outside of said discharge opening to receive the grain passing through the same, and means to regulate the ease with which the grain will flow along said trough, with two inversely movable pistons in said piston chambers respectively, and mechanism for operating said pistons.

15. The combination of a closed main chamber having one movable wall section, means for yieldingly pressing said section inward, and means for regulating the inward pressure upon said wall section, with two piston chambers communicating with the main chamber, inversely movable pistons in said piston chambers respectively, and mechanism for operating said pistons.

16. The combination of a closed main chamber having an inlet opening and an outlet opening at a remote point, and having one inwardly pressed but outwardly yielding wall section, and two piston chambers communicating with the said main chamber, with a hopper communicating with the inlet opening, two inversely movable pistons in said piston chambers respectively, and mechanism for operating said pistons.

17. The combination of a closed main chamber having one inwardly pressed but outwardly yielding wall section, two piston chambers connecting with said main chamber,—which main chamber is provided with an inlet opening and a remote discharge opening, pistons in said piston chambers, a hopper communicating with the inlet opening, a reciprocating plunger movable back and forth in said inlet opening, and mechanisms for operating said pistons and plunger.

18. The combination of a rectangular main chamber, and two piston chambers which communicate therewith, and having their outer walls in the same planes as the walls of the main chamber, which piston chambers are separated a distance slightly less than the width of each piston chamber,—with an inwardly pressed, but outwardly yielding cover plate for said main chamber, inversely movable pistons in said piston chambers, and mechanism for operating said pistons.

19. The combination of a rectangular main chamber, and two piston chambers which communicate therewith, and having their outer walls in the same planes as the walls of the main chamber,—which piston chambers are separated a distance slightly less than the width of each piston chamber, with an inwardly pressed but outwardly yielding cover plate for said main chamber, inversely movable pistons in said piston chambers,—each piston having two depending rack stems, two gears mounted between the rack stems of the respective pistons and engaging therewith, and mechanism for reciprocating one of said pistons.

20. The combination of a closed main chamber having one inwardly pressed but outwardly yielding wall section, a feed opening and a discharge opening and two communicating piston chambers, with a hopper communicating with the feed opening, a reciprocating plunger movable in said feed opening, two pistons in said piston chambers respectively, mechanism for imparting inverse movement to said pistons, and mechanism for moving the feed plunger inward when the adjacent piston is moved outward.

21. The combination of means for confining a quantity of grain under pressure and means for simultaneously moving inwardly a portion of such confining means and outwardly another portion thereof, to cause the grain to flow on itself while under pressure.

22. A chamber in which a quantity of grain may be confined under yielding pressure, means for supplying such pressure, and means for simultaneously moving inwardly a portion of the wall of such chamber and outwardly another portion to cause the grain to flow on itself while under such pressure.

23. A pair of piston chambers adapted to contain grain and having free inter-communication, pistons in said chambers, and means for complementarily moving said pistons.

24. A main chamber having an inlet and an outlet, a yielding inwardly pressed wall for said chamber, a pair of piston chambers freely communicating with said main cham-

ber, pistons in said piston-chambers, and means for complementarily reciprocating said pistons.

25. A chamber, a yielding inwardly pressed member forming a portion of the wall of such chamber, a pair of members forming other portions of such wall, and means for complementarily moving said last mentioned members to vary the effective shape of the chamber.

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

ROBERT E. KIMBALL.

Witnesses:

E. B. GILCHRIST,

E. L. THURSTON.