No. 773,878. PATENTED NOV. 1, 1904.

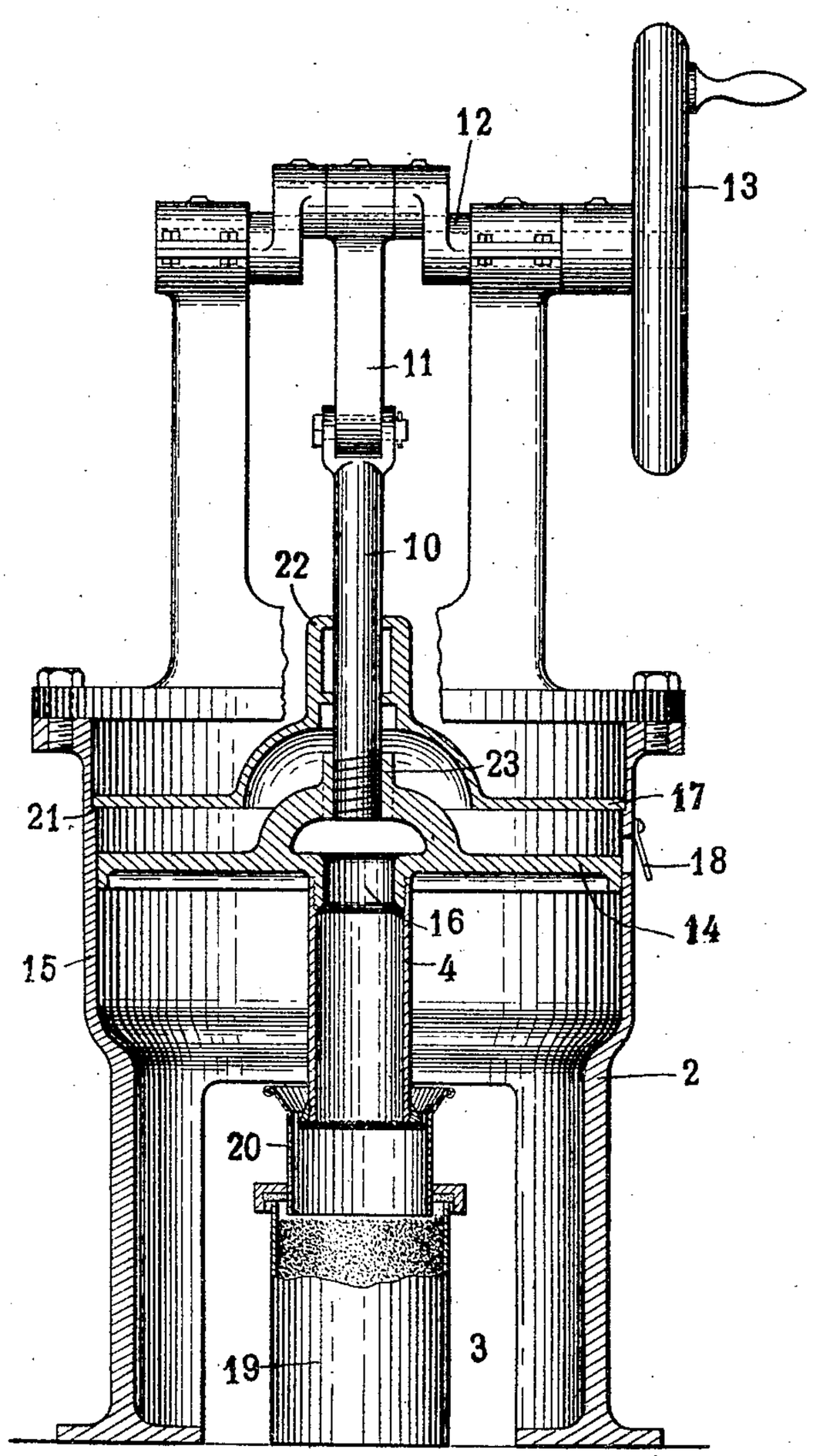
P. LORILLARD.

APPARATUS FOR COMPACTING FINELY DIVIDED MATERIALS.

APPLICATION FILED JUNE 23, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

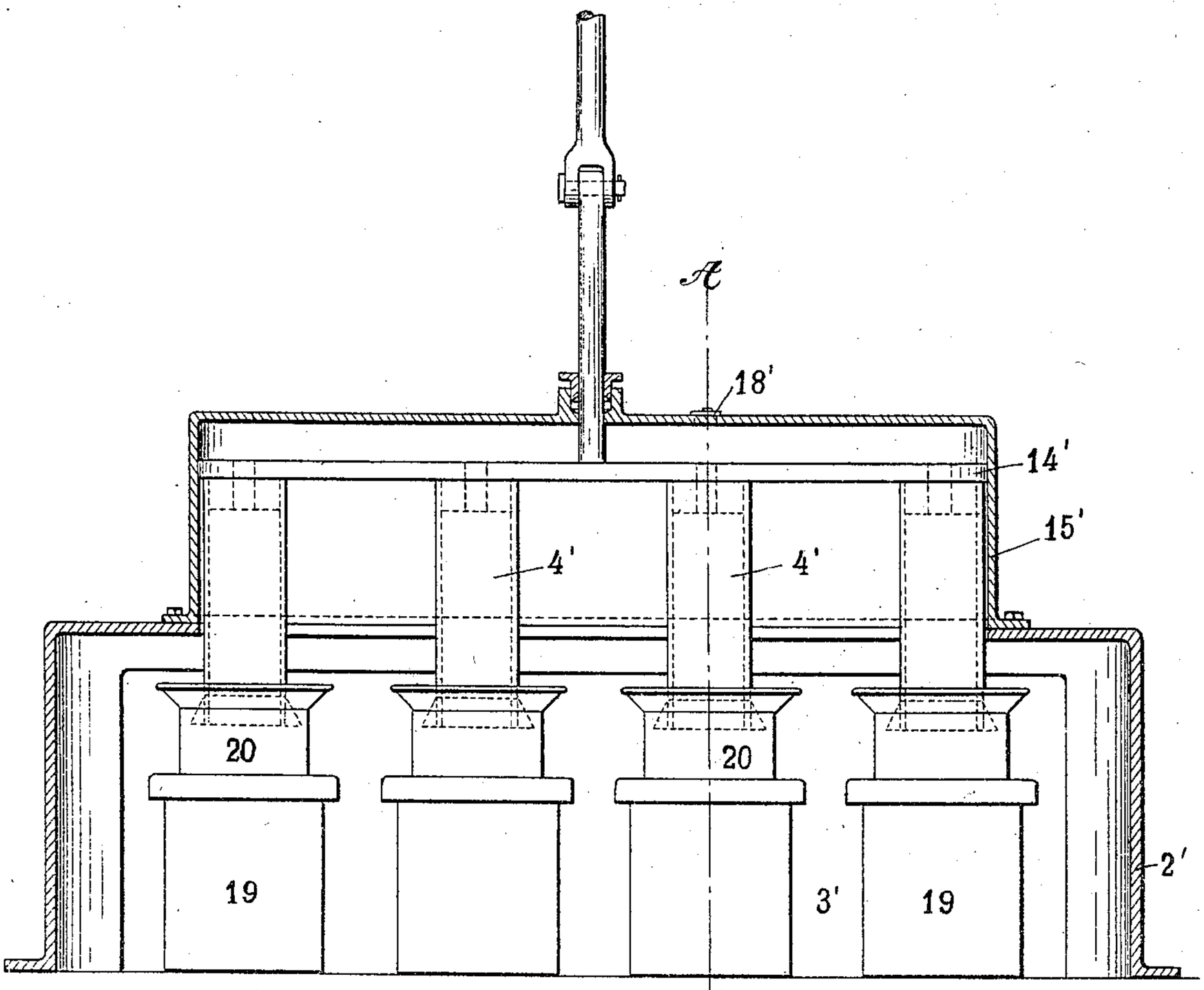


Fig. 3.

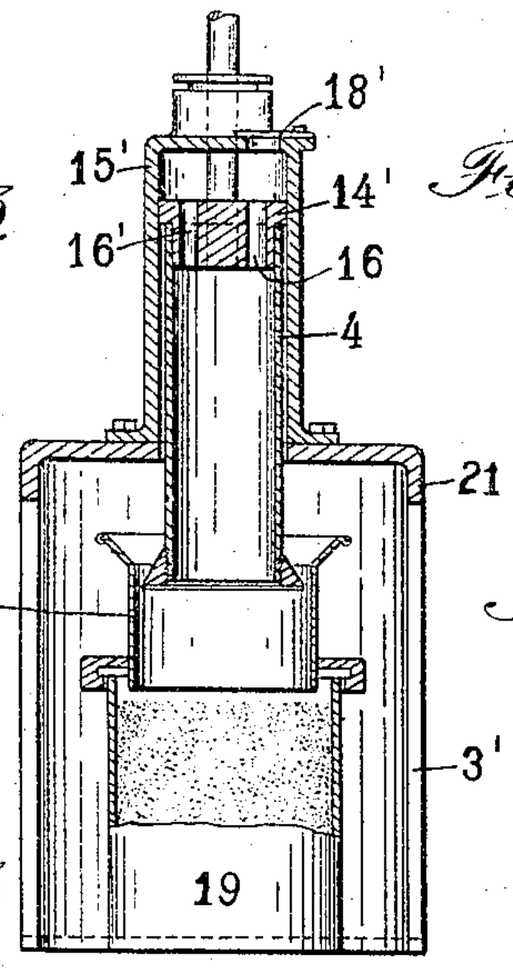


Fig. 4.

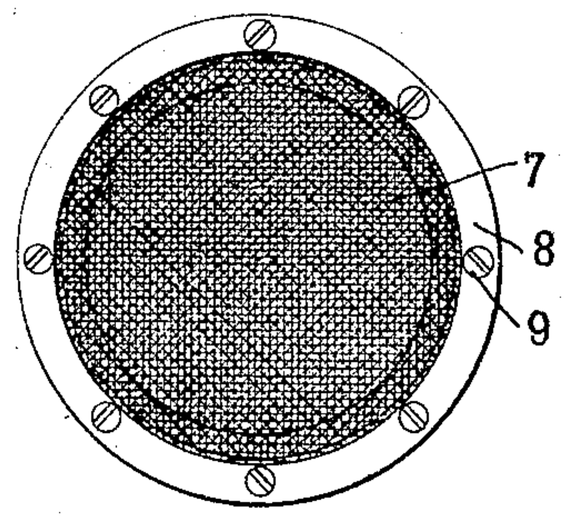
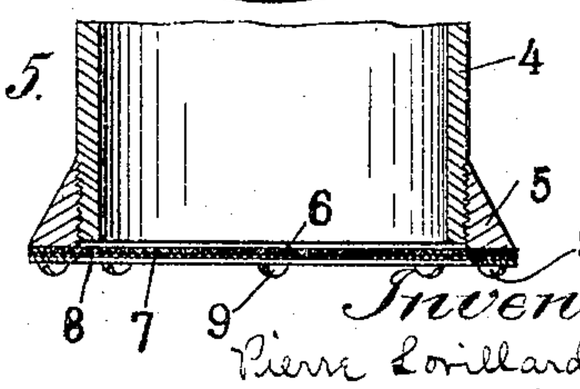


Fig. 5.



Witnesses:
Arthur J. Randall,
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No. 773,878. Patented November 1, 1904.

UNITED STATES PATENT OFFICE.

PIERRE LORILLARD, OF TUXEDO PARK, NEW YORK, ASSIGNOR TO AUTOMATIC WEIGHING MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

APPARATUS FOR COMPACTING FINELY-DIVIDED MATERIALS.

SPECIFICATION forming part of Letters Patent No. 773,878, dated November 1, 1904.

Application filed June 23, 1903. Serial No. 162,821. (No model.)

To all whom it may concern:

Be it known that I, PIERRE LORILLARD, a citizen of the United States, residing at Tuxedo Park, in the county of Orange and State of New York, have invented new and useful Improvements in Apparatus for Compacting Finely-Divided Materials, of which the following is a specification.

In packaging many kinds of light finely-divided materials much difficulty has been experienced by reason of the fact that such materials, and especially fine and dry powders—such as baking-powder, for example—become charged with air during the processes of manufacture or while being weighed or measured, and thus acquire an excessive bulk, with the result that each charge or quantity of material delivered has to be settled or compacted before it can be introduced completely into a receptacle of a proper and sufficient size to hold it after it has been settled. It has not been practicable heretofore to compress such a powder forcibly, as by a plunger, because if the air with which it is charged is expelled by the compressing action of the plunger it blows a considerable portion of the material with it out of the receptacle, while if the plunger is made to fit the receptacle with sufficient tightness to prevent such blowing then the included air has no chance to escape and the permanent compacting of the material becomes impossible. It has accordingly been customary to settle such powders by the slow and otherwise unsatisfactory process of jarring the receptacles into which they are delivered, the excess bulk being temporarily contained in funnels or "risers" applied to the tops of the respective receptacles.

My present invention is intended to provide an apparatus by means of which any kind of finely-divided material may be subjected to a forcible compacting action of any desired amount without being caused to blow or scatter, and to this end I compress the material within its receptacle, which is provided with a riser, if necessary, by means of a plunger, and in connection therewith I employ a strainer which is pervious to air, but impervious to particles of material, and is so arranged that the air which escapes from the material passes through this strainer, but necessarily leaves the material behind it. I also prefer to provide means for creating a more or less perfect vacuum behind this strainer concurrently with the action of the plunger, whereby the air with which the material is charged is caused to expand and escape more readily therefrom and its flow through the strainer is promoted. I have found that in this manner I cannot only remove a sufficient portion of the included air from fine and dry powders without blowing any of the material with it, but that I can also settle or compact any kind of light finely-divided material with greater speed than has heretofore been practicable and can subject such material to a greater compacting action than can be produced by merely jarring the receptacle which contains it.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side view, partly in elevation and partly in central vertical section, illustrating a preferred form of my apparatus. Fig. 2 is a similar view illustrating a modified arrangement thereof whereby a number of quantities of material may be operated upon simultaneously. Fig. 3 is a cross-sectional view on line A A in Fig. 2. Fig. 4 is a bottom plan view of a plunger hereinafter described, and Fig. 5 is a detail section of the lower end of said plunger.

The apparatus illustrated in Fig. 1 of the drawings, comprises a supporting-frame 2, provided at its bottom with an aperture 3, through which a receptacle filled with material to be operated upon may be inserted and withdrawn, and 4 represents a hollow plunger, the lower end of which is covered by a suitable strainer. My preferred form of strainer for fine and dry powders, such as baking-powder, is illustrated in detail in Figs. 4 and 5, in which 5 represents a ring which is adapted to be screwed onto or otherwise connected to the lower end of the plunger 4 and

is covered by a flat sheet of wire-gauze 6. Upon the outer or bottom face of the sheet of wire-gauze is placed a corresponding sheet of bolting-cloth 7, the bolting-cloth being held flat and it and the gauze being secured to the ring 5 by any suitable means, such as a supplementary-ring 8, which is fastened to the ring 5 by screws 9 and between which and said ring 5 the edges of the gauze and bolting-cloth are thus clamped. This strainer is preferably made detachable from the lower end of the plunger, as shown, in order that it may be removed and cleaned, if necessary, or replaced by another strainer of a different shape or size, corresponding to the shape and size of the receptacle in connection with which it is to be used. The bolting-cloth, as I have discovered, is previous to air, but impervious to most fine powders, or substantially so, and hence it forms the strainer proper, the wire-gauze being employed as a backing to support the bolting-cloth and give the necessary rigidity to the working face of the plunger. It will be well understood, however, that for coarser materials a coarser strainer may be used, the object in all cases being to permit the passage of air from the material into the hollow plunger and to prevent the passage of particles of the material itself. For example, the wire-gauze alone may serve as a suitable strainer in some cases. The plunger 4 is connected with suitable reciprocating means—such as a guided rod 10, a connecting-rod 11, a crank-shaft 12, and a hand-wheel 13—although in practice the apparatus will usually be operated by power.

The parts above described, without more, may be made to compact successfully a quantity of material by placing the receptacle containing the material directly beneath the plunger and forcing the latter downward, whereupon the resulting compression of the material will expel air from it and this air will escape through the strainer. A material like baking-powder, however, cannot be successfully operated upon in this manner unless the plunger is operated more slowly than would be desirable, and I therefore prefer to provide, in connection with the parts above described, means for exhausting air more or less perfectly from within the plunger on its downward or compressing stroke. My preferred arrangement for this purpose comprises a piston 14, mounted to slide in a casing 15, which is formed integral with or secured to the framework 2, the plunger 4 and rod 10 being connected to the piston 14, which thus forms a connecting link between them. The piston 14 is provided with an opening 16, establishing communication between the hollow plunger and the casing above the piston, and the top of the casing is closed during at least a portion of the downward stroke of the plunger by means of a cover 17. Thus as the plunger 4 descends the separation of the piston 14 from the cover 17 produces a partial vacuum within the casing above the piston, and therefore within the hollow plunger itself and behind the strainer. The area of the piston should be considerably greater than the transverse area of the plunger in order that a slight downward movement of these parts may effect a substantial reduction of pressure within the plunger. It is desirable to reëstablish a substantially normal atmospheric pressure above the piston 14 before it commences an upward stroke in order to prevent any tendency of the material to adhere to the plunger and be lifted by it out of the receptacle, and to this end I prefer to make the piston fit the casing somewhat loosely, so that during the slight dwell at the bottom of each stroke of the piston sufficient air will pass around it and into the casing to break the vacuum above the piston, and as the piston rises the air thus admitted above it is expelled, preferably through a check-valve 18, so that it does not have to pass out through the plunger, and thus blow the material in the receptacle. It is often desirable, however, to provide for a slight blow through the strainer near the end of the upward stroke of the piston in order to clear the strainer from adhering particles of material, and in this case the check-valve 18 may be located in the side of the casing, as shown, at such a point that it will be passed by the piston just before the latter reaches the end of its upward stroke, the result of this arrangement being that the last portion of each upward movement of the piston will slightly compress the air above it and produce the slight blow through the strainer above referred to.

The operation of the apparatus above described is as follows: A receptacle 19, containing a quantity of material to be compacted and herein shown as provided with a riser 20 of a well-known construction, is placed beneath the plunger 4 while the latter is at the limit of its upward stroke. The piston 14 and plunger 4 are then moved downward, whereupon the working face of the plunger, which is formed by the strainer above described, engages the top surface of the material and forcibly compresses it, and at the same time the movement of the piston away from the top of the casing produces a partial vacuum above the piston and in the plunger, and consequently at and adjacent to the strainer at the lower end of the plunger, with the result that a considerable portion of the air with which the material is charged passes through the strainer and is drawn up through the hollow plunger instead of being blown out of the receptacle, while the particles of material being unable to pass through the strainer are compressed and compacted thereby. The reduction of pressure at the working face of the plunger also causes the air with which the material is charged to ex-

pand, and thus facilitates the removal thereof from the mass of material being operated upon.

In some cases it may be desirable to cause the piston 14 to perform a portion of its downward stroke before producing any reduction of the air-pressure behind it—as, for example, when the riser 20 is only partially filled with material—and in this case the cover 17, which closes the top of the casing, may be made separable from the casing proper, as illustrated in Fig. 1, and so located and arranged that when the piston reaches a certain point in its upward stroke it will engage said cover and lift it away from the top of the casing. This mode of operation is provided for, according to the construction shown in Fig. 1, by forming a ledge 21 on the inside of the casing, on which ledge the cover 17 is adapted to rest, and the cover 17 is provided with a central guiding portion 22, through which the rod 10 passes and which forms a stop adapted to be engaged by the upper end 23 of the piston 14 when the latter has reached a certain point in its upward stroke. As thus constructed when the point just referred to has been reached in the operation of the piston the upper end 23 of the latter engages the cover 17 and lifts said cover with it during the remainder of its upward stroke, and no vacuum can be produced during the downward stroke of the piston until said cover has been lowered sufficiently to cause it to rest upon the ledge 21, whereupon the remainder of the downward stroke of the piston produces the necessary vacuum, as above described. In all cases there should be some reduction of pressure within the plunger before the strainer engages the material.

It will often be convenient to operate upon a number of quantities of material at once, and I have accordingly shown in Fig. 2 a modification of my apparatus whereby this result is provided for. In this modification the framework 2′ and its openings 3′ are made large enough to accommodate the desired number of receptacles at once, and the casing 15′ and piston 14′ are made of corresponding size, the piston being provided with a number of plungers 4′ suitably spaced apart. Each of these plungers may be substantially like the plunger 4 (shown in Fig. 1) and provided with a similar strainer. Communication between each plunger and the space above the piston 14′ is afforded by means of passages 16′, and the casing is shown as provided with a check-valve 18′ similar to the check-valve 18. (Shown in Fig. 1.) In Figs. 2 and 3 the top of the casing is shown as immovable and the check-valve 18′ is shown as located in the top of the casing; but it will be understood that the arrangement of these parts shown in Fig. 1 might be employed, if desired. The transverse area of the casing is of course so proportioned to the sum of the transverse areas of the pistons 14′ as to produce the desired vacuum in the latter.

My apparatus is not only useful for compacting fine and dry powders which "blow" under slight pressure when charged with air, but it also has an important application in compacting many other kinds of finely-divided materials, especially those which are light and flaky and which, although normally of excessive bulk and containing a considerable amount of air, are not so troublesome on account of blowing as are fine and dry powders. The light and flaky type of materials is well represented by many of the cereal foods now commonly used, which are usually put up in paper or pasteboard packages or cartons, as distinguished from rigid metallic receptacles. It is possible to compress such materials by ordinary plungers in most cases; but it has been necessary heretofore to support the yielding walls of the cartons externally, in order to prevent them from bursting under the pressure exerted by the compressing-plunger. I have found, however, that when my apparatus is employed for compacting such materials in non-rigid cartons a sufficient vacuum can be produced within the mass of material operated upon to cause the normal atmospheric pressure acting upon the exterior of the carton to afford an ample support for the walls of the latter, thus rendering the use of mechanical supports unnecessary. So, too, materials such as flour and flour preparations may be very solidly compacted in cloth or paper bags by means of my apparatus without either bursting the bags or requiring them to be supported externally by mechanical means.

I prefer to employ a piston moving in a suitable casing for producing the desired vacuum at the working face of my plunger, because in such case the vacuum produced increases with the movement of the plunger, so that it is impossible to cause the compressing action of the plunger to get ahead of the reduction in pressure which should be associated with it no matter how rapidly the plunger may be operated. I do not limit myself, however, to any particular means for producing a reduction in air-pressure in connection with the operation of the plunger, nor to any specific form or arrangement of compressing plunger or strainer, since, so far as I am aware, I am the first to combine such a plunger and strainer or such a plunger and means for removing air from the material operated upon by it concurrently with its compressing action.

I claim as my invention—

1. In an apparatus for compacting finely-divided materials, the combination of a plunger adapted to engage and compress a mass of material, a strainer arranged to form a confining-surface for said mass and to permit the passage of air removed therefrom, and means for reciprocating the plunger.

2. In an apparatus for compacting finely-divided materials, the combination of a hollow plunger, means for reciprocating the same, and a strainer carried by the plunger.

3. In an apparatus for compacting finely-divided materials, the combination of a plunger adapted to engage and compress a mass of material, means for reciprocating the same, a strainer arranged to form a confining-surface for said mass and to permit the passage of air removed therefrom, and means for reducing the air-pressure behind said strainer.

4. In an apparatus for compacting finely-divided materials, the combination of a plunger, means for reciprocating the same, a strainer, and means operated by the compressing stroke of the plunger for reducing the air-pressure behind said strainer.

5. In an apparatus for compacting finely-divided materials, the combination of a hollow plunger, a strainer carried thereby, means for reciprocating the plunger, and means operated by its compressing stroke for reducing the air-pressure within it.

6. In an apparatus for compacting finely-divided materials, the combination of a hollow plunger, a strainer carried thereby, means for reciprocating the plunger, and means for withdrawing air from it during its compressing stroke.

7. In an apparatus for compacting finely-divided materials, the combination of a casing, a piston working therein and means for reciprocating it, a hollow plunger carried by the piston and communicating with the interior of the casing above the piston, and a strainer carried by said plunger.

8. In an apparatus for compacting finely-divided materials, the combination of a casing, a piston working therein and means for reciprocating it, means for admitting air to the casing above the piston during a portion of each stroke of the latter, a hollow plunger carried by the piston and communicating with the interior of the casing above the piston, and a strainer carried by the plunger.

9. In an apparatus for compacting finely-divided materials, the combination of a casing having a removable top, a piston working therein and means for reciprocating it, said piston being arranged to lift the top of the casing during a portion of its stroke, a hollow plunger carried by the piston and communicating with the interior of the casing above the piston, and a strainer carried by the plunger.

10. In an apparatus for compacting finely-divided materials, the combination of a hollow plunger, means for reciprocating the same, a strainer carried by the plunger, means for withdrawing air from the plunger during its compressing stroke, and means for readmitting air to the plunger prior to the beginning of its back stroke.

11. In an apparatus for compacting finely-divided materials, the combination of a plunger, means for reciprocating the same, a strainer carried by the plunger, means for withdrawing air from the plunger during its compression-stroke, means for readmitting air to the plunger prior to the beginning of its back stroke, and means for creating a slight blow through the strainer near the end of said back stroke.

12. In an apparatus for compacting finely-divided materials, the combination of a casing, a piston arranged to slide somewhat loosely therein and means for reciprocating it, a hollow plunger carried by the piston and communicating with the interior of the casing above the piston, a strainer carried by the plunger, and a check-valve opening outward from said casing.

13. In an apparatus for compacting finely-divided materials, the combination of a casing, a piston arranged to slide somewhat loosely therein, a hollow plunger carried by said piston and communicating with the interior of the casing above the piston, a strainer carried by the plunger, means for reciprocating the piston, and a check-valve opening outward from the casing at a point which is passed by the piston near the end of its inward stroke.

14. In an apparatus for compacting finely-divided materials, the combination of a casing, a piston mounted to slide therein, means for reciprocating said piston, a number of hollow plungers carried by said piston and severally communicating with the interior of the casing above the piston, and a strainer carried by each plunger.

In testimony whereof I have hereunto subscribed my name this 17th day of June, 1903.

PIERRE LORILLARD.

Witnesses:

E. D. CHADWICK,

ROLLA W. BARTLETT.