(No Model.) 2 Sheets—Sheet 1.

L. V. MOULTON.

MACHINE FOR DRYING GRAIN.

No. 288,357. Patented Nov. 13, 1883.

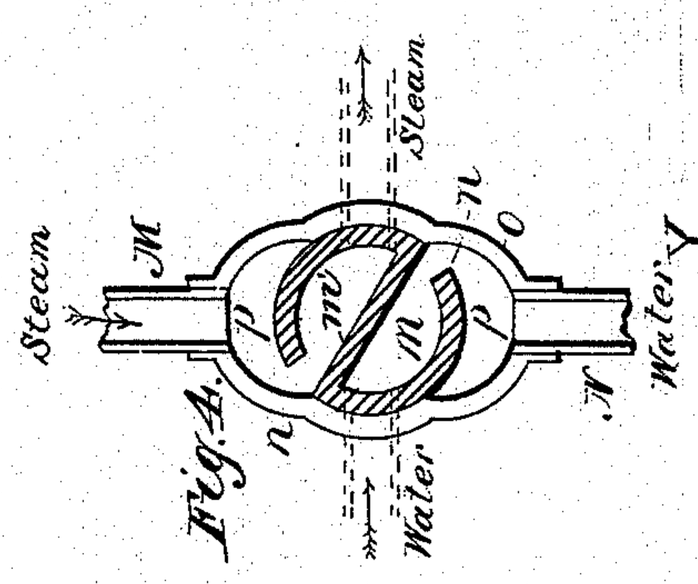

Fig. 4.

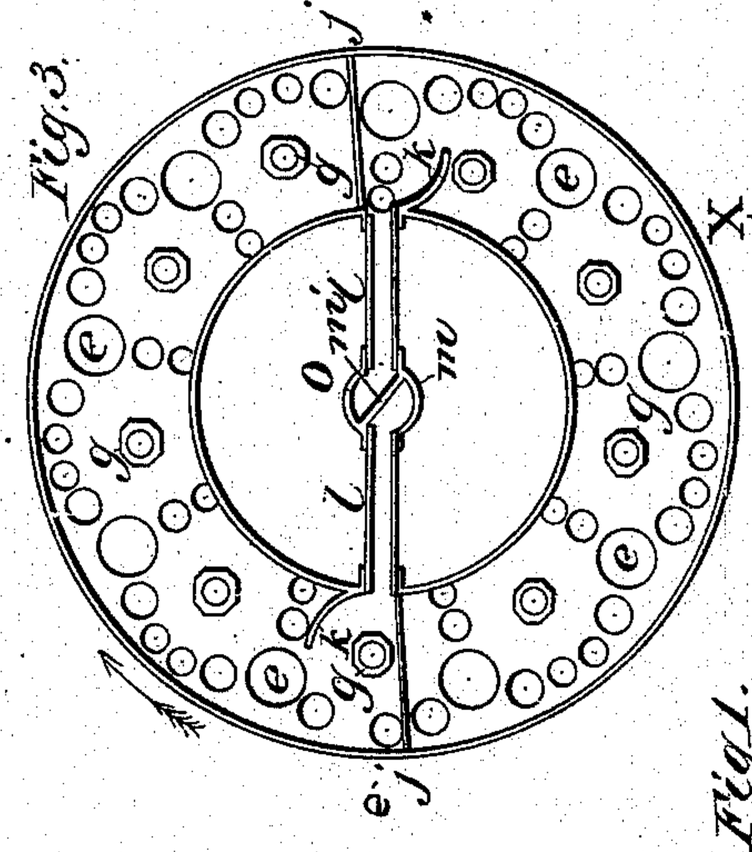

Fig. 3.

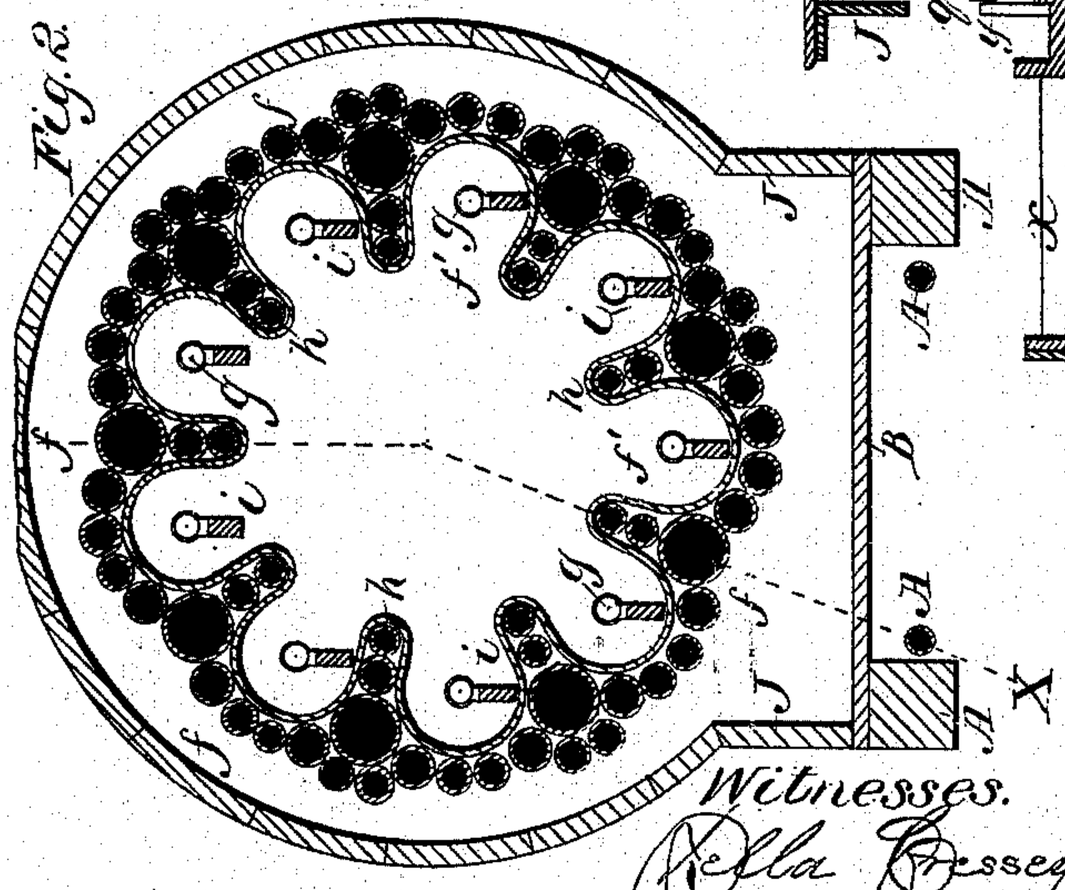

Fig. 2.

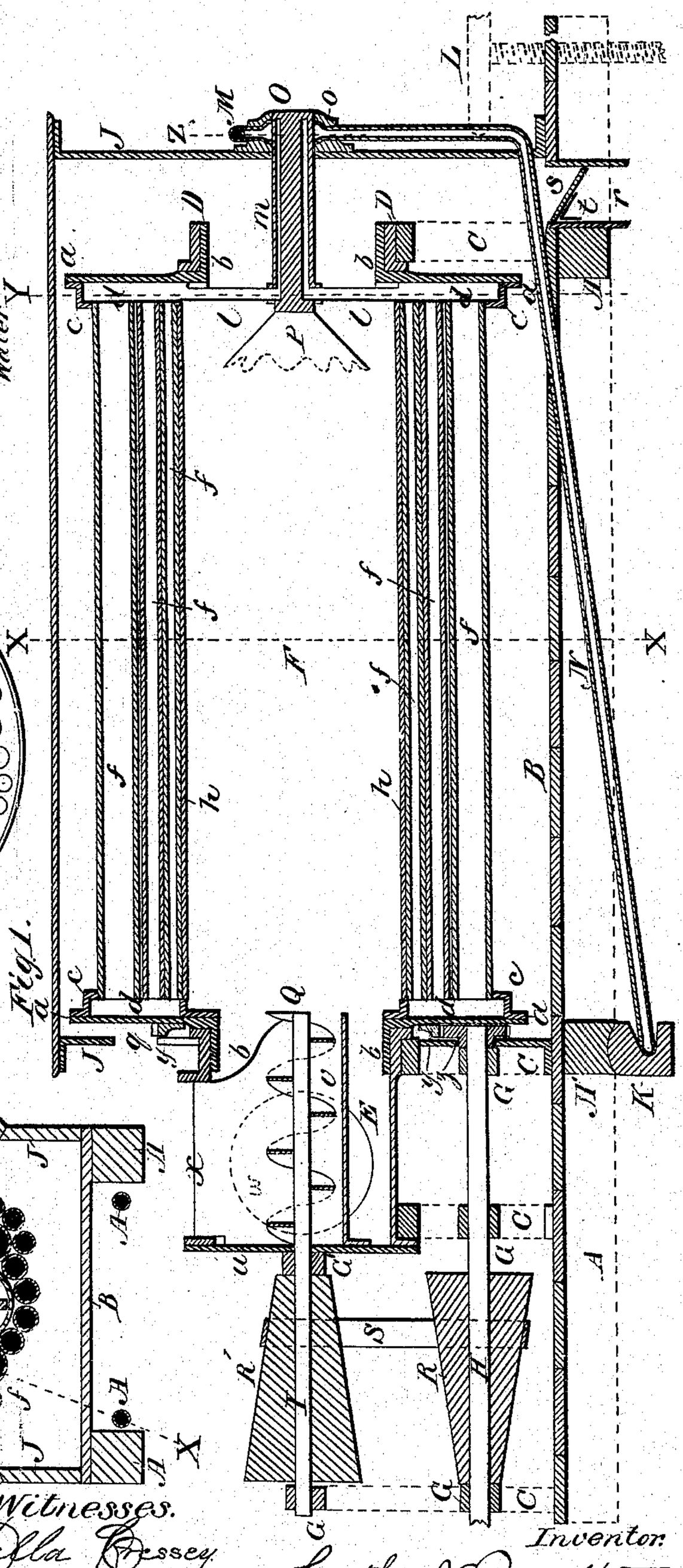

Fig. 1.

Witnesses.
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(No Model.) 2 Sheets—Sheet 2.

L. V. MOULTON.

MACHINE FOR DRYING GRAIN.

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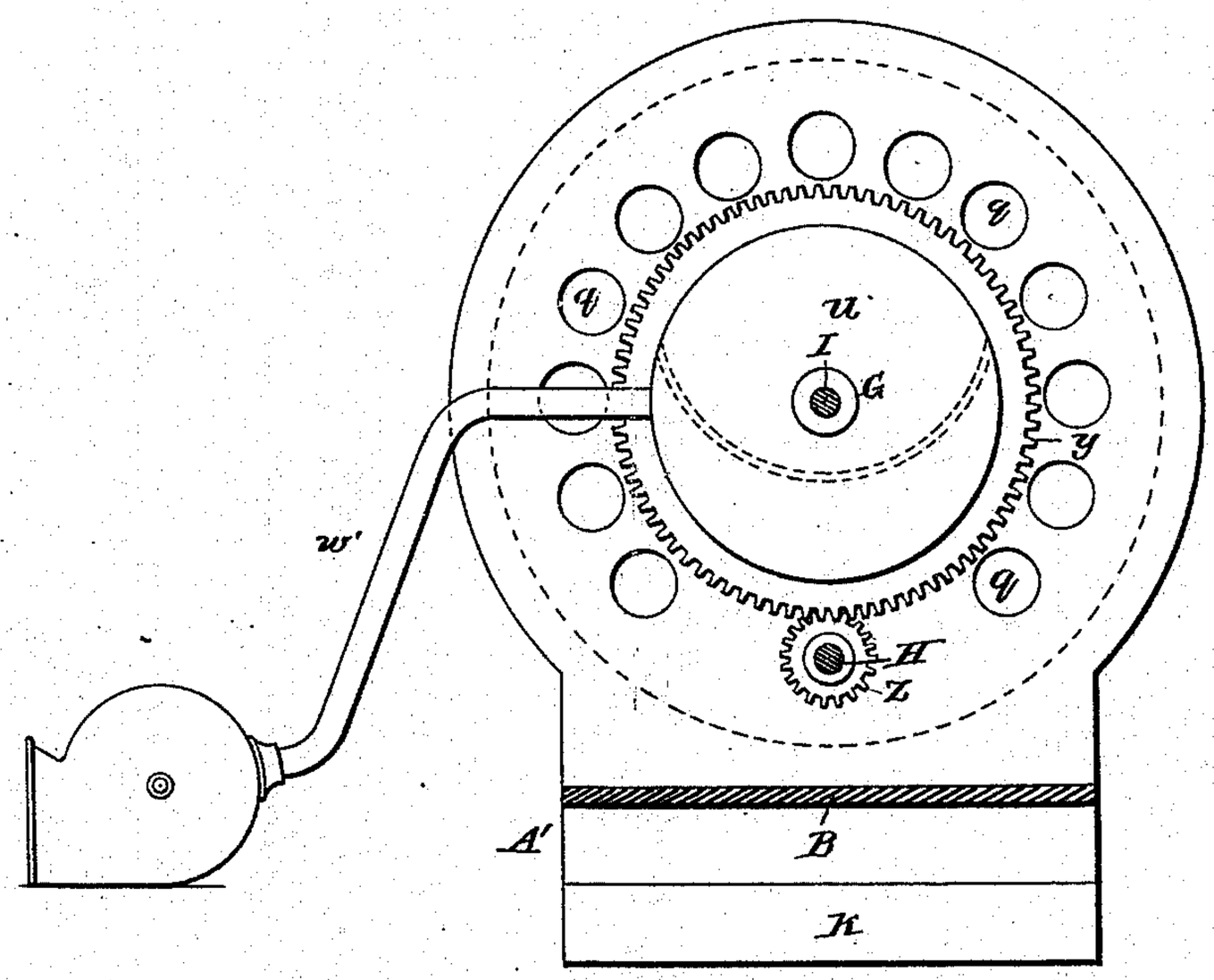
Fig. 5.



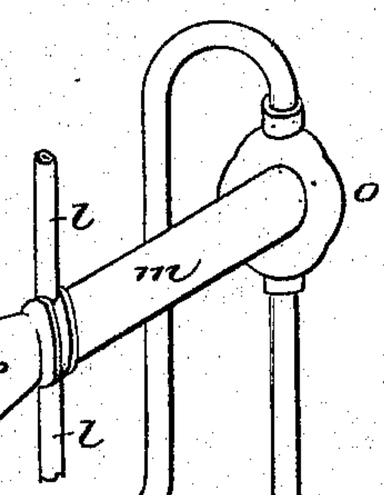
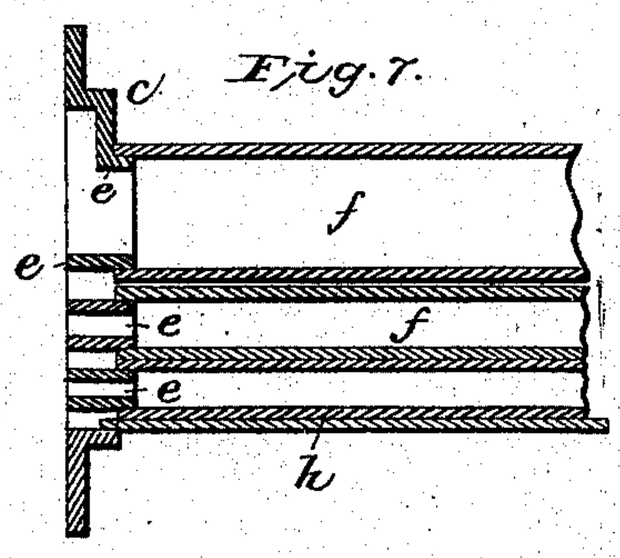


Fig. 6.

Fig. 7.



Witnesses:
A. M. Long.
E. F. Walker

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UNITED STATES PATENT OFFICE.

LUTHER V. MOULTON, OF GRAND RAPIDS, MICHIGAN.

MACHINE FOR DRYING GRAIN.

SPECIFICATION forming part of Letters Patent No. 288,357, dated November 13, 1883.

Application filed February 4, 1882. Renewed March 24, 1883. (No model.)

To all whom it may concern:

Be it known that I, L. V. MOULTON, a citizen of the United States, residing at Grand Rapids, county of Kent, and State of Michigan, have invented a new and useful Improvement in Machines for Drying Grain and other Substances, of which the following is a specification.

My invention relates to improvements in machines for drying grain and other substances by means of steam and hot air.

The objects and nature of my invention will more fully appear from the following description and claims, reference being had to the accompanying drawings, in which—

Figure 1 represents an irregular section on line *x*, Fig. 2; Fig. 2, a cross-section on line *x*, Fig. 1; Fig. 3, a section on line *y*, Fig. 1; Fig. 4, a cross-section of the rotary valve O on the line *z*, Fig. 1. Fig. 5 represents a front elevation with pulleys R R′ removed and shafts H and I in section; Fig. 6, a perspective of pipes M N and valve O; Fig. 7, a detail view.

A represents the frame of the base, having a front cross-piece, A′, with a concave lower face, which rests upon the convex face of block K, and a screw or screws, L, which are used to elevate or depress the rear end of the machine; B, the flooring, resting upon frame A and supporting the case J, which covers the cylinder F.

C C are frames which support the journal-boxes D E, in which the hollow bearings of cylinder F revolve, and the journal-boxes G, in which the conveyer-shaft I and driving-shaft H revolve.

The cylinder F consists of two outer heads, *a*, two inner heads, *c*, and a number of pipes, *f g*. The heads *a* are provided with hollow journals *b*, which rest upon journal-boxes D and E, and suspend the cylinder within the casing J. The heads *c* are provided with flanges, which are attached to heads *a* to form chambers *d d′*, and with nipples *e*, to which pipes *f* are attached. Pipes *f* are of different sizes, and are placed parallel to and in contact with each other, as may be seen in Fig. 2, to form the walls of the shell or cylinder, which are provided with inner chambers or buckets, *f′*, for lifting the contents of the cylinder when the latter is revolved. The interior of these buckets is provided with a lining, *h*, consisting of plates joined together at their edges, so that one or more can be removed when desired. The object of these plates is to prevent corn-meal, waste from starch or glucose, or similar substances adhering to the pipe and being scorched, and to prevent fine particles from sifting between the pipes.

Located in every chamber or bucket *f′* is a pipe, *g*, which passes through heads *c*. These are provided with lock-nuts and serve as rods to bind or clamp the heads *c* and pipes *f* together, and also to heat any substance contained within the buckets. To each of these pipes *g* is attached by means of loose straps a pendent scraper, *i*, which removes any particles that may adhere to the walls of the buckets. If desired, the scrapers may be removed when any substance which will not adhere to the walls is being dried.

Chamber *d* is divided into two compartments by means of a diaphragm or partition, *j*, and has curved plates *k*, arranged upon opposite sides of the diaphragm and cylinder. From the inner end of the diaphragm and guide-plates extend pipes *l*, which connect chamber *d* with valve O. This valve is provided with an inner part or plug, *m*, which revolves with the cylinder, and an outer part or case, *o*, which is attached to the rear side of the back end of case J. The inner part or plug is provided with perforations at its front end, into which pipes *l* are screwed and communicate with the interior, which is divided into two compartments by a longitudinal partition, *m′*, placed obliquely to the inner ends of pipes *l*, as shown in Fig. 3. The rear end of part *m* revolves in case *o*, and is provided with ports *n*, through which steam enters and water escapes.

Case *o* is provided with chambers *p p′* and semicircular depressions, in which plug *m* revolves. Steam-inlet pipe M opens into the upper chamber, *p*, and exit-pipe N into the lower one, *p′*. The plug *m*, as it revolves in part *o*, presents the ports *n* to the steam inlet and exit pipes alternately, so that steam can enter one of the compartments made by diaphragm *m′*, and pass through pipe *l* to chamber *d*, and the water of condensation pass from chamber *d* through the second pipe *l* to the exit-pipe.

The pipes M and N are respectively attached to the upper and lower side of case *o*, and are

bent downwardly and under the case J to the groove in block K, from which they extend outwardly in opposite directions to steam-generator pipe M′ and feed-water-heater pipe N′. The pipes are seated loosely in the groove, so that when the rear end of the drier is elevated by means of the screw they will adjust themselves to the changed angle. To facilitate this movement, couplings m^2 n^2 are used to connect pipes M and N to pipes M′ N′.

Journal-box E is made in the form of a cylinder, closed at one end by means of a head, *u*, to which are attached a conveyer-trough, *v*, and journal-box G′ for shaft I. The upper side of box E is cut away at *x*, to permit grain being supplied to the conveyer. On the side of the box is an opening, *w*, (shown in dotted lines, Fig. 1,) in which the air-exhaust pipe *w′*, Fig. 5, is inserted.

Attached to the front head, *a*, is a gear, *y*, (shown in section, Fig. 1,) meshing with pinion *z*, which revolves the cylinder when motion is imparted to its shaft H. This shaft is provided with a pulley, R, which communicates motion to a similar pulley, R′, on conveyer-shaft I by means of a belt, S. Upon the inner end of shaft I is a worm, Q, which feeds the substance to be dried from the trough to the cylinder.

Case J is provided at its front end with openings *q*, which may have registers placed therein for regulating the admission of air between the casing and cylinder. In the bottom B and to the rear of the cylinder is an opening, *r*, for the dried grain to escape to a suitable vessel. To prevent the heated air from passing through this opening, a valve, O, supported by a spring, *t*, which will allow the valve to fall when a certain quantity of grain rests upon the latter, is placed in the opening *r*. To guide the grain to this opening a cone, P, is attached to part *m* and projects into the cylinder. The surface of the cone may be corrugated from the apex to the base at points to correspond with the buckets, so that the grain falling from the latter will have a groove to guide it out of the cylinder.

The operation is as follows: The machine is tilted to any desired angle by raising or lowering screw L, which elevates or lowers the rear end of the machine. The front end of the latter adjusts itself to the variant angles by means of the concave surface of cross-piece A′, which moves over the convex face of block K. Power is applied to shaft H, which sets cylinder F and conveyer Q to revolving. The substance to be dried is then placed in trough *v*, from which it is passed by the revolving conveyer Q to the revolving cylinder. It falls into the lower buckets and gradually makes its way toward the rear end of the cylinder. The cylinder, when revolving, elevates the lower buckets, from which the grain falls into the buckets which were formerly the upper buckets. The grain near the rear end of the upper buckets strikes upon cone P and falls into the chamber at the rear of the cylinder and passes through opening *r* when a sufficient quantity has been deposited upon valve *s* to overcome the pressure of spring *t*. The pipes *f* are heated by steam admitted to chambers *d d′* through pipes *l*, valve O, and supply-pipe M. The water of condensation accumulates between partition *j* and curved plates K, and enters one of the pipes *l* when that part of the revolving cylinder to which it is attached has reached the point *e* in its upward movement, and passes into the lower division of part *m* and out into chamber *p′* to exit-pipe N. At the same time that the steam is supplied to the pipe air is drawn through openings *q* over the heated pipes, and through the cylinder to the exhaust-pipe opening *w*. The heated air enters the rear end of the cylinder, so that it will reach the grain which is dried most, and is drawn to the front end, where the grain enters. By giving the air this passage it mingles with the falling grain and conveys the moisture in the opposite direction to that in which the grain is moving, and prevents vapor from accumulating in the cylinder.

I am aware that cylinders have been made of coils of pipes with the coils touching each other and in contact with the casing, but am not aware that an air-space communicating with the outer air and the interior of the cylinder has ever been formed between the cylinder and casing for the purpose of heating the air by means of the steam-pipes forming the shell of the cylinder.

I am aware that the shells of cylinders have been made of straight lengths of pipes laid parallel to and in contact with each other, that cylinders have been provided with means for changing the angle of their inclination, that pipes for supplying steam and removing water from the cylinder have been used, that hot air has been drawn through the cylinder to aid the drying, and that conveyers, cones, and belts have been used to move the grain, and these I do not claim; but

What I do claim is—

1. In a grain-drier, the combination, with a drying-cylinder having hollow walls, heated substantially as described, and open at both ends, of a jacket inclosing said cylinder, an air-chamber between the jacket and the cylinder, and communicating with the outer air and with the interior of the cylinder, and a device for drawing the air from the cylinder, substantially as described.

2. In a grain-drier, a cylinder the shell of which is composed of lengths of pipes in contact with each other, and having buckets formed of pipes in contact with each other and with the pipes which form the shell, substantially as described.

3. In a drier, a cylinder having hollow heads, pipes forming the shell of its cylinder, and also pipes forming its buckets, and connecting the interior of the heads, and pipes *g*, provided with nut-locks for holding the heads and shell together, for the purpose set forth.

4. In a grain-drier, the combination, with a

base having screw L and cross-piece A′, provided with a concave face, of a block, K, having a convex face, upon which the concave face of cross-piece A′ rests, for the purpose set forth.

5. The combination, with a cylinder adapted to be inclined, and having buckets for elevating and spilling the grain, of a cone placed at the rear central part of the cylinder, and having its apex projecting therefrom, for the purpose set forth.

6. The combination, with a base, A, having a casing, J, cross-piece A′, and screw L, of block K, having a groove upon one of its sides, and pipes M N, attached to casing J and resting in the groove in block K, substantially as described.

7. The valve O, consisting of case *o* and plug *m*, in combination with pipes M, N, and *l*, substantially as described.

8. The valve O, in combination with chamber *d*, having diaphragm *j* and pipes *l*, for the purpose set forth.

9. The valve O, in combination with chamber *d*, having diaphragms *j* and curved plates *k*, substantially as described.

10. A cylinder having chambers *d d′*, the former provided with partitions *j*, and a shell composed of pipe laid parallel to each other and connecting the heads, for the purpose set forth.

11. The lining *h*, in combination with pipes *f*, for the purpose set forth.

12. The scrapers *i*, in combination with pipes *g* and buckets *f′*, substantially as described.

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Witnesses:

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