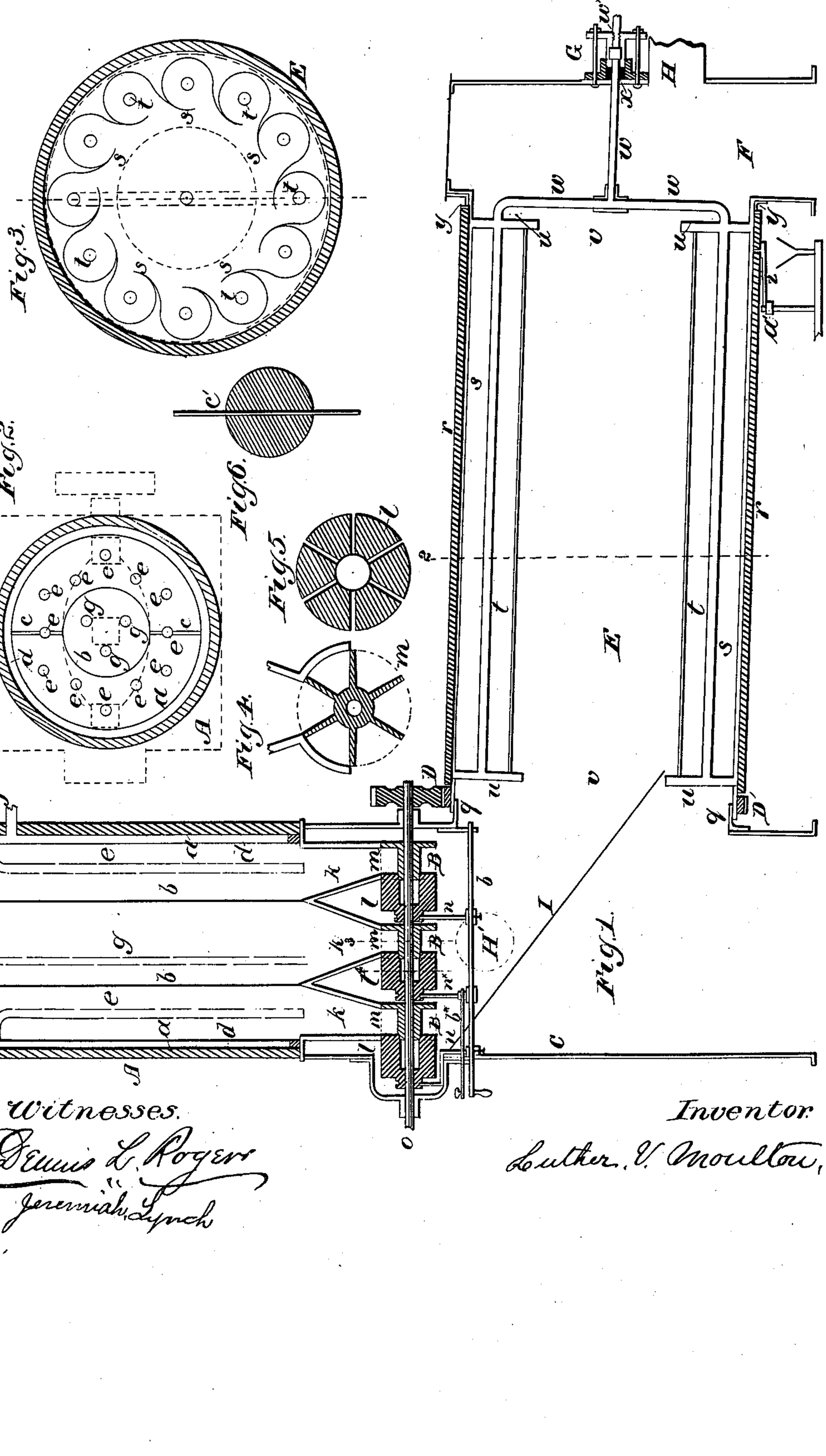
(No Model.)

L. V. MOULTON.

MACHINE FOR STEAMING AND DRYING GRAIN.

No. 286,217. Patented Oct. 9, 1883.



UNITED STATES PATENT OFFICE.

LUTHER V. MOULTON, OF GRAND RAPIDS, MICHIGAN.

MACHINE FOR STEAMING AND DRYING GRAIN.

SPECIFICATION forming part of Letters Patent No. 286,217, dated October 9, 1883.

Application filed May 17, 1881. Renewed September 1, 1882. Again renewed March 24, 1883. (No model.)

To all whom it may concern:

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

My invention relates to improvements in that class of machines for steaming, mixing, and drying grain in which the grain is first subjected to the action of steam in a closed vessel, thereby partially or wholly cooking it, and afterward in another vessel subjected to a mixing or stirring process, and also to the action of heat and a current of air, whereby it becomes mixed and dried.

The objects of my improvements are, first, to steam or cook the grain with the least possible loss of heat by radiation; second, to provide means whereby more than one kind of grain may be steamed at the same time in the same vessel and the amount of treatment each may receive can be regulated independently; third, to provide means whereby said grain will be caused to pass into and be discharged from said vessel continuously and at a uniform rate, and to regulate the quantity of each kind of grain thus passing through said vessel; fourth, to provide means whereby two or more kinds of grain may be mixed in definite and exact proportions, and such proportions regulated and changed at pleasure; fifth, to provide means of drying the grain by exposing it to the simultaneous action of heat and a current of air; sixth, to provide the drying-cylinder with a greater amount of heating-surface, thereby increasing its capacity; seventh, to utilize a current of hot air to accelerate the removal of moisture from the grain; eighth, to provide means of removing the water condensed in the steam-space of the drying-cylinder, and provide against exploding said cylinder by excess of steam-pressure. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of the entire device; Fig. 2, a plan of the steaming-vessel, with the hoppers and casing shown in dotted lines; Fig. 3, a cross-section of the drying-cylinder on the line 2; Fig. 4, a cross-section of the feed-cylinders; Fig. 5, another cross-section of the same, and Fig. 6 a plan of the diaphragm and disk for dividing the steaming-vessel into two equal parts. Figs. 4 and 5 are on a larger scale than the other figures of the drawings.

Similar letters refer to similar parts throughout.

A is the steaming-vessel, which consists of an outer cylinder, *a*, provided with a steam-chamber, *d*, and covered with asbestus or other non-conductor of heat. It is also provided with a cover, *h*, in which are openings *i i i* to admit the various kinds of grain. Said vessel A is also provided with an inner cylinder, *b*, diaphragms *c c*, and diaphragm and disk *c'*. By means of the cylinder *b* it may be divided into two unequal parts. By adding the diaphragms *c c* the space between *a* and *b* will be divided into two equal parts. By removing *b* and *c c* and inserting *c'* the entire vessel will be divided into two equal parts, and by removing *c'* the interior of *a* forms a single vessel. In each instance the entire vessel or each subdivision, as the case may be, is properly connected with the hoppers *k k k* and feed-cylinders B B B. I am thus enabled to operate upon from one to three kinds of grain at the same time. The pipes *e* are closed at the bottom and perforated along their sides and connected with the steam-chamber *d*. Steam, being admitted through the pipe *f*, will fill the space *d* and pipes *e*, and, flowing from the perforations in the said pipes, will rapidly heat and cook the contents of the vessel A. The pipes *g* are similar to the pipes *e*, but are connected directly to *f*, thereby enabling me to independently regulate the supply of steam admitted to the inner cylinder, *d*.

k are conical hoppers under the vessel A, which serve to conduct the contents of either the entire vessel A, or of its various subdivisions, as the case may be, to the cylinders B. Said hoppers *k* terminate in suitable square openings, and are provided with concave extensions, as shown at *l'* in Fig. 5. These extensions serve to prevent the escape of the contents of the hoppers *k*, except as carried out in the chambers of the cylinders B as they revolve.

B are feed-cylinders, which revolve with the shaft *o*. Each consists of two parts, *l'* and *m*. *m* is fixed securely upon the shaft *o*, and is chambered, as shown in Figs. 1 and 4. *l'* is

loose on said shaft, and is chambered, as shown in Figs. 1 and 5, the result being that when *l'* is slipped over *m* the two combined constitute a solid cylinder, and as *l'* is removed the chambers in *m* are opened to receive the contents of the hopper *k*, which, by the revolution of said cylinder B, will be discharged into the trough I with regularity and precision. I am thus enabled with certainty to determine the exact amount of grain passing through the vessel A or each of its compartments, as occasion may require. As the grain enters at the top and is discharged at the bottom of the vessel A, it must necessarily receive uniform treatment. As the cylinders B revolve with the same relative speed, I can by their relative adjustment determine the quantity discharged by each. I am thus enabled to mix the grain in any desired proportions.

n n× *n* are guide-rods, which are forked at their upper ends in such form as to engage with the grooves in the hubs of *l' l' l'*. Said guide-rods are held in position by the rods *p p*×. *n*× slides freely on *p*, and is actuated by *p*×, thus providing for the independent adjustment of the central cylinder, B. Either of the other guide-rods *n* may be arranged in like manner, thus providing for the independent adjustment of all the cylinders B.

I is a trough to conduct the grain discharged by the cylinders B to the drying-cylinder E. Said trough may be perforated to allow any water to escape that may drip from the vessel A. If desirable, separate troughs may be adjusted under the cylinders B, leading to separate cylinders or vessels.

C is a casing, which supports the vessel A, shaft *o*, and one end of the cylinder E, and also serves to retain the current of air from said cylinder and conduct it away by means of a pipe attached at H'. In one side of C is a circular opening, around which is fixed the rim or flange *q*, which serves as a journal for the cylinder E, which is actuated by the shaft *o* and gears D D'.

E is the drying-cylinder, and consists of a cylinder, *r*, mounted so as to revolve freely on the rims or flanges *q* and *y*, and also with the discharging end lower than the receiving end. Said cylinder *r* is also provided with buckets *s*. Each bucket is nearly a complete cylinder. A portion of its circumference is left open, as shown, and the sheet of which said bucket is composed is turned back upon the outside of and extended to the opening of the adjoining bucket, where the edges of both are secured to each other, so as to be steam-tight. The curves of the buckets *s* are such that the steam is allowed to penetrate between them and heat their entire surface. I am thus enabled to obtain a large amount of heating-surface within a given cylinder.

t are steam-pipes placed within the buckets *s*, to aid in heating the contents of said buckets. Said buckets and pipes may be made of corrugated metal, thus still further increasing their heating-surface.

u are hollow diaphragms or heads with circular openings *v* in their centers. Said diaphragms serve to distribute the steam to the pipes *t*, and also to the inclosed spaces between the buckets *s* and the cylinder *r*. They also serve to prevent the escape of the contents of the buckets *s* at their ends.

w w× are steam-pipes for supplying steam to the cylinder E.

F is a casing which serves to support the lower end of E, and also to receive the grain discharged from E. It also serves to conduct the current of air from the pipe H to the cylinder E. Said casing also supports a gland, G, to the outer part of which the pipe *w*× is firmly secured, and within the inner part of which the pipe *w* revolves. The packing *x* serves to prevent the escape of steam. The valve *z* serves to remove the water from the steam-space of the cylinder E. Said valve is closed by a spring, and is opened at each revolution of the cylinder E by coming in contact with the adjustable bar *a*. Said valve *z* also operates as a safety-valve for the cylinder E. As the pressure of steam exceeds the resistance of the spring, the valve opens and allows the steam to escape.

H is a pipe, which may be supplied with either hot or cold air by means of any convenient device.

The operation of the cylinder E is as follows: As the grain is discharged from the trough I, it falls into one of the buckets *s*. As the said cylinder revolves, the grain is carried to its upper part, where it is discharged from the bucket *s* and falls across the axis of said cylinder, thus becoming separated and exposed to the current of air, and also becoming mixed. The grain falls into a bucket at the lower side of the cylinder, and the operation is repeated. In consequence of the inclination of the axis of the cylinder E, the grain falls a little nearer the lower end of said cylinder each time, until eventually it is discharged into the casing F, from which it can be conveyed away in any convenient manner. The mechanical action of the cylinder E, the heat imparted to the buckets *s* and pipes *t*, together with the current of air passing through said cylinder, result in rapidly drying the grain.

By excluding steam from A, wet grain may be dried, or grain in ordinary condition kiln-dried without cooking. By a strong blast of air through the pipe H, smut, dust, or other light impurities may be removed. By slightly steaming wheat or other grain in A and drying it in E, the flouring qualities of such grain may be improved.

I do not limit the use of my machine to the treatment of grain exclusively, but claim its use for steaming, mixing, drying, or cleaning any suitable materials.

What I claim and wish to secure is as follows:

1. A machine for mixing, steaming, and drying grain, consisting of upright cooking-vessel

A, constructed and arranged as above described, hoppers *k k k*, feed-buckets *m m m*, trough I, and longitudinal drying-cylinder E, arranged substantially as described, and for the purposes set forth.

2. In combination with cylinder A, the steam-chamber *d* and pipes *e*.

3. In combination with cylinder A, chamber *d*, and pipes *e*, the cylinder *b*, and the pipes *g*.

4. The cylinder A and the hoppers *k k k*, in combination with the cylinder *b*.

5. In combination with the shaft *o*, the feed-cylinders B B B, consisting of the parts *l'* and *m*, and the rods *p p*× and *n n*× *n*, arranged substantially as described, and for the purposes above set forth.

6. The combination of steaming or cooking vessel A, hoppers *k*, shaft *o*, cylinders B, gears D D', and cylinder E.

7. Cylindrically-shaped buckets *s*, constructed of a continuous sheet of metal formed, folded, turned back, and secured as specified, in combination with cylinder E.

8. In combination with cylinder *r*, the pipes *t*.

9. In combination with the buckets *s*, the pipes *t*.

10. The combination of buckets *s*, pipes *t*, and diaphragms *u*.

11. The combination of cylinder *r*, buckets *s*, pipes *t*, diaphragms *u*, and pipes *w*.

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Witnesses:
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