(No Model.) 2 Sheets—Sheet 1.

E. J. POND.

DRYING APPARATUS.

No. 376,546. Patented Jan. 17, 1888.

Fig. 1.

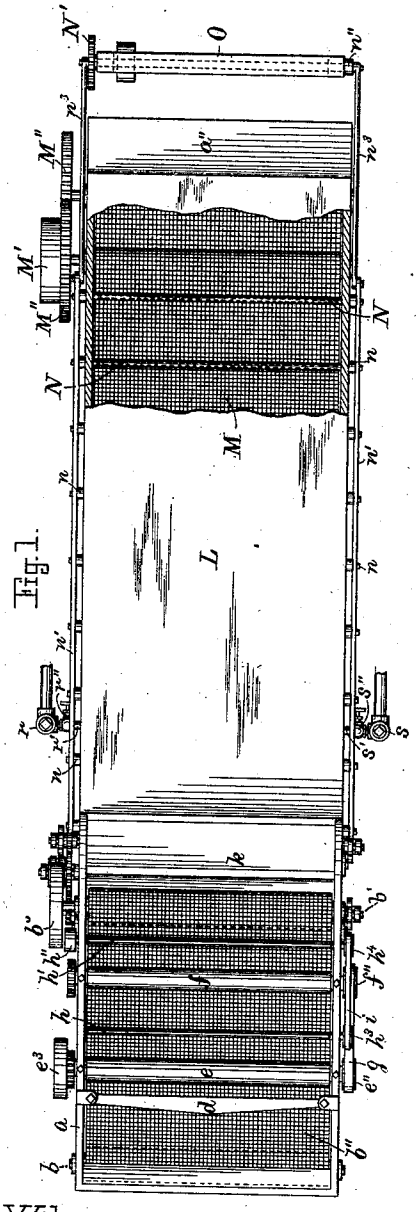
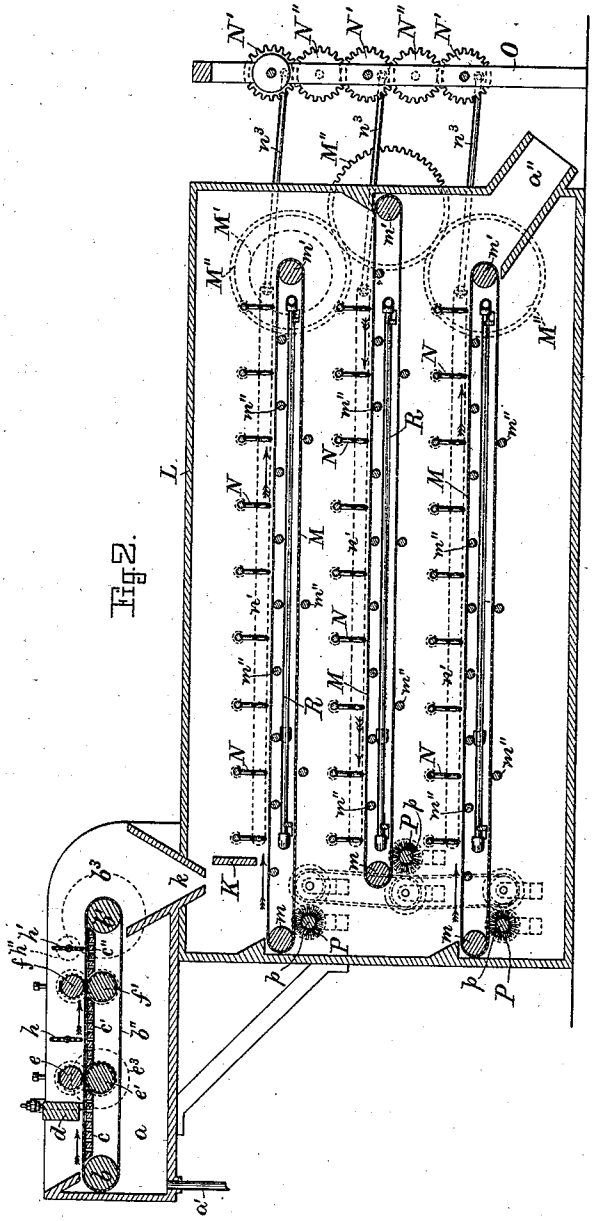


Fig. 2.



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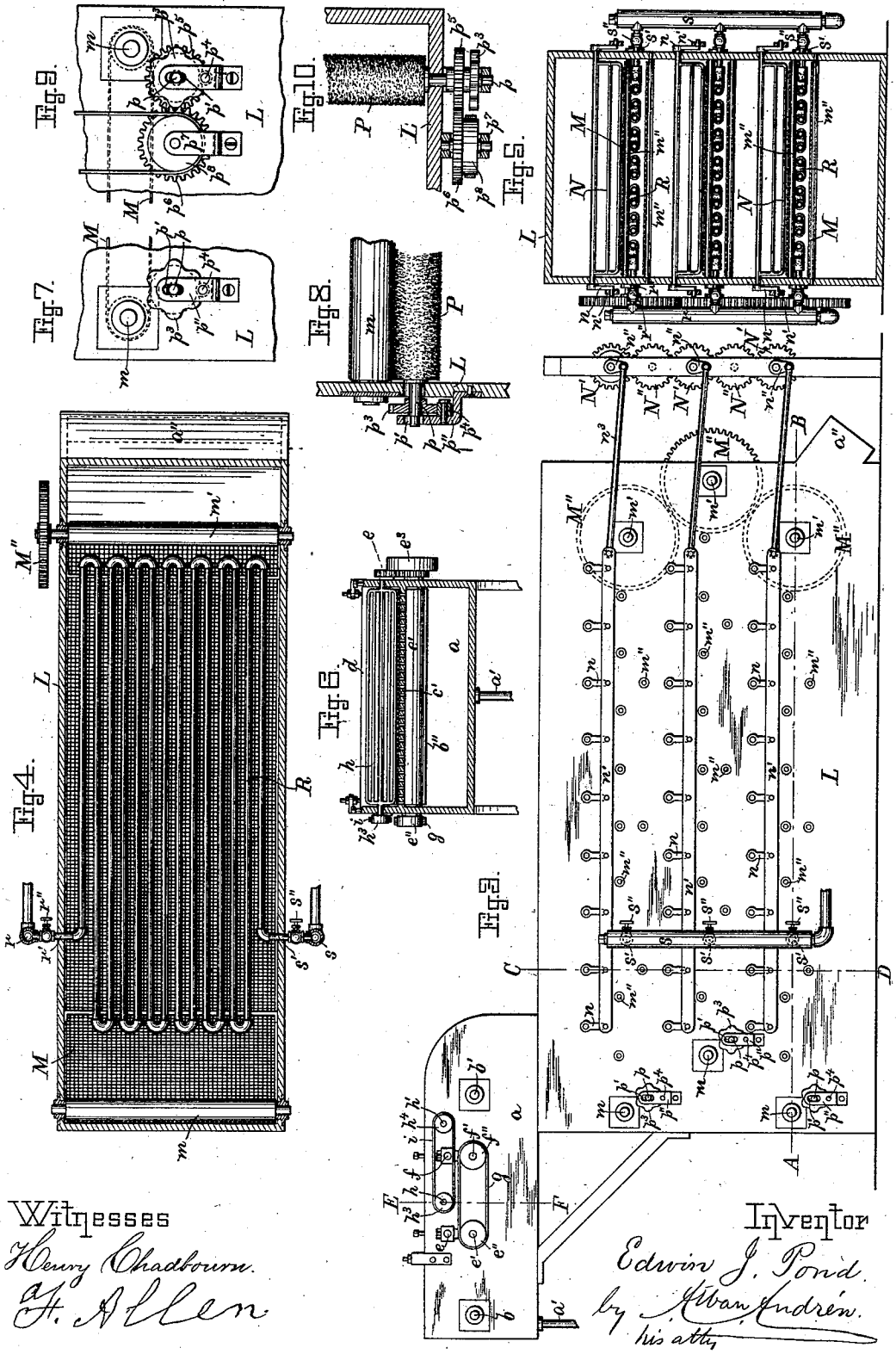
N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

EDWIN J. POND, OF FRANKLIN, MASSACHUSETTS.

DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 376,546, dated January 17, 1888.

Application filed November 7, 1887. Serial No. 254,491. (No model.)

To all whom it may concern:

Be it known that I, EDWIN J. POND, a citizen of the United States, and a resident of Franklin, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Drying Apparatus, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to improvements in drying apparatus, particularly adapted for drying brewers' grain, although it is equally useful for other drying purposes, as will hereinafter be more fully shown and described, reference being had to the accompanying drawings, where—

Figure 1 represents a sectional plan view of the improved apparatus. Fig. 2 represents a central longitudinal section of the same. Fig. 3 represents a side elevation of the said apparatus. Fig. 4 represents a horizontal section on the line A B in Fig. 3. Fig. 5 represents a cross-section on the line C D in Fig. 3. Fig. 6 represents a cross-section on the line E F in Fig. 3; and Figs. 7, 8, 9, and 10 represent detail views of the mechanism for operating the rotary cleaning-brushes.

Similar letters refer to similar parts wherever they occur on the different parts of the drawings.

a in Figs. 1, 2, 3, and 6 is the extractor into which the moist grain is first introduced preparatory to entering the drying-machine proper, and in said extractor the surplus moisture is removed from the grain as follows:

b and *b'* are rollers, the axles of which are loosely journaled in the sides of the said extractor *a*. The said rollers support and carry the endless apron *b''*, which is preferably made of perforated wire-gauze, netting, or other suitable perforated material.

b^3 is a pulley secured to the shaft or spindle on the roller *b'*, which pulley is rotated by means of a belt from a suitable driving-pulley above or below the machine, as may be most convenient. The perforated apron *b''* is supported on stationary gratings *c c' c''*, as shown in Figs. 2 and 6, which serve to support the weight of the moist grain as it is carried onward toward the drying apparatus.

d is a vertically-adjustable spreader-bar, arranged above the endless apron *b''*, which bar is made adjustable up and down relative to the said apron *b''* by means of screws or other well-known devices, the object of said bar being to distribute the moist grain evenly on the apron *b''*. After the grain has thus been properly spread out on the endless apron, it is squeezed between the rollers *e* and *e'*, the lower one, *e'*, of which is journaled in the sides of the extractor *a* in such a manner that the upper part of the apron *b''* runs over and in contact with said roller, as shown. The upper roller, *e*, is journaled in bearings that are adjustable up or down by means of set-screws or equivalent or well-known devices, so that said roller can be adjusted relative to the lower roller, *e'*, for the purpose of squeezing the grain, and thus pressing out a portion of the moisture from the grain. For the purpose of still further removing moisture from the grain, I employ a second set of squeezing-rollers, *f* and *f'*, constructed, arranged, and made to operate like the rollers *e* and *e'*.

e'' and *f''* are pulleys secured to the shafts or spindles of the lower rollers, *e' f'*, as shown in Fig. 3, which pulleys are provided with an endless belt, *g*, to carry a rotary motion from one to the other. The rollers *e* and *e'* are geared together, as shown in Fig. 6, and the rollers *f* and *f'* are also geared together. To the spindle of the roller *e'* is secured the pulley e^3, to which a rotary motion is imparted by means of a driving-belt, in the usual manner of conveying motion.

h and *h'* are rotary stirrers arranged in bearings in the sides of the extractor *a*, one in front of the roller *f* and the other behind it, as shown in Figs. 1, 2, and 6, which stirrers are rotated by means of the pulley *h''*, secured to one of the stirrer-shafts, and belt-power, applied to it as usual, and the endless belt *i*, connecting pulleys h^3 and h^4 on the shafts for the respective stirrers *h* and *h'*, as shown in Fig. 3. The said rotary stirrers *h* and *h'* serve to disintegrate the grain after it has been squeezed between the rollers *e e'* and *f f'*. From the endless apron *b''* the grain drops through the hopper or chute *k* into the drying apparatus.

a' is a pipe leading from the bottom of the extractor *a* to the sewer or other place, and serves the purpose of allowing the liquid pressed out of the grain to escape freely.

The drying apparatus consists of the case or box or inclosing-room L, in the sides of which are journaled the rollers *m m' m m' m m'*, arranged in pairs, one pair above the other, as shown in Fig. 2, each such pair of rollers having a perforated endless apron, M, made of wire-gauze, netting, or other suitable perforated material. The aprons M M M are set in motion, in the direction shown by arrows in Fig. 2, by means of a pulley, M', secured to the shaft or spindle of one of the rollers *m'*, to which belt-power is applied as usual.

M'' M'' M'' are gears secured to the shafts of the rollers *m' m' m'*, the teeth of which gears intermesh, as shown in Figs. 2 and 3.

m'' m'' m'' are supporting-rolls for the endless aprons M M M, said supporting-rolls having their ends loosely journaled in the sides of the box or chamber L.

In connection with the endless carrying-aprons M M M, I use a series of oscillating stirrers, N N N, the ends of which are journaled in the sides of the case L a short distance above the respective aprons M M M, as shown in Figs. 2 and 5, which stirrers serve the purpose of agitating the grain as it is being carried onward on the aprons, and thereby preventing the grain from getting caked or lumpy. To the ends of said stirrers are secured, outside of the case L, cranks *n n n*, the ends of which are pivoted to the links *n' n' n'*. A reciprocating motion is imparted to the links *n' n' n'* from the gear-wheels N' N' N', the shafts of which are journaled in the bearing O and intermediate gears, N'' N'', the teeth of which intermesh in the teeth of the gears N' N' N', as shown in Fig. 3. To the ends of the shafts for the gears N' N' N' are secured cranks *n'' n'' n''*, having pivoted to them the respective rods *n³ n³ n³*, the other ends of which are pivoted, respectively, to the stirrer-links *n' n' n'*, as shown in Fig. 3.

In connection with each of the perforated endless aprons M, I use a cleaning device for the purpose of keeping the aprons free and clear of accumulations, and said cleaning device is carried out and operated as follows: Below each of the aprons M, and in contact with the same, is located a cylindrical brush, P, as shown in Figs. 2, 8, and 9, the spindle *p* of which projects through slotted perforations in the sides of the case, as shown, said spindle ends being guided in vertical slots *p' p'* in the bearings *p'' p''*, that are secured in a suitable manner to the case L, as shown in Figs. 3, 7, 8, 9, and 10. To the spindle ends *p p* are secured the corrugated disks *p³ p³*, which as the brush P is rotated come in contact with pins or pins and rolls *p⁴ p⁴* on the bearings *p'' p''*, thus causing the brush to rise and fall intermittently during its rotation, by which the bristles are intermittently pushed into the perforations in the endless belts or aprons M M M, and thus causing the latter to be thoroughly cleaned. The brushes P P P are set in a rotary motion as follows: To the spindle *p* of each brush is secured a gear-wheel, *p⁵*, the teeth of which mesh in the teeth of a pinion or gear, *p⁶*, the shaft or spindle of which is located in bearings *p⁷*, secured to the case L, as shown in Figs. 9 and 10.

p⁸ is a pulley attached to the gear *p⁶*, which pulley is rotated by means of belt-power, as usual. It is, however, immaterial by what means the said brushes are rotated as long as a rotary and intermittent rising and falling motion is imparted to each of said brushes for the purpose stated.

For the purpose of heating the grain and the air within the chamber *a*, so as to dry the grain quickly, I arrange between the upper and lower parts of each apron M a steam-heater, R, to which steam is supplied through the medium of the stand-pipe *r* from any suitable source of steam-pressure. The stand-pipe *r* has lateral branches *r' r' r'*, leading independently to the respective heat-radiators R R R, as shown in Figs. 3, 4, and 5, said branches having valves or cut-offs *r'' r'' r''*, so that the steam can be supplied to any one of the respective radiators and cut off from one or more of the others, as may be required. During the operation of the machine the grain is carried onward on the uppermost apron, from which it drops to the next one, and so on in the series, and as it leaves the end of the lowermost apron it is conducted out through the chute or opening *a''*, to be collected in a bin, room or otherwise, as may be desired.

K is a stationary spreader located above the first apron, as shown in Fig. 2, at a proper distance above such apron, for the purpose of properly spreading the grain on the apron as it is being received from the chute or funnel *k*.

s is the steam-exhaust pipe having branches *s' s' s'* connected to the respective heat-radiators R R R, as shown, each of said branches *s'* being provided with a valve or cut-off, *s''*, as shown in Figs. 1, 3, 4, and 5, by which the exhaust-steam can be so regulated and controlled as to allow it to escape freely from any one of the radiators R without going through any other of the radiators in the series.

What I wish to secure by Letters Patent, and claim, is—

1. In a drying apparatus, the extractor consisting of the shell or case *a*, the rotary rollers *b b'*, and the perforated endless apron *b''*, the stationary gratings *c c' c''*, the spreader *d*, squeezing-rollers *e e'* and *f f'*, and the rotary stirrers *h h'*, combined and arranged to operate in a manner and for the purpose substantially as described.

2. In a drying apparatus, the case or chamber L, containing a series of perforated endless aprons, M M M, and rollers *m m'*, each of said aprons having an independent heat-radiator, R, a set of reciprocating stirrers, N N, and cleaning-brush P, as and for the purpose set forth.

3. The drying apparatus, as described, con-

sisting of the extractor composed of an endless perforated movable apron, *b''*, perforated gratings *c c' c''*, the spreader *d*, one or more pairs of squeezing-rollers, and rotary stirrers, combined with the chamber L, containing one or more perforated endless aprons M, stirrers N N, independent heat-radiators R, and cleaning-brushes P, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 3d day of November, A. D. 1887.

EDWIN J. POND.

Witnesses:
ALBAN ANDRÉN,
HENRY CHADBOURN.