(No Model.) 2 Sheets—Sheet 1.

C. J. HEXAMER.

CONSTRUCTION OF MALT AND GRAIN MILLS.

No. 292,488. Patented Jan. 29, 1884.

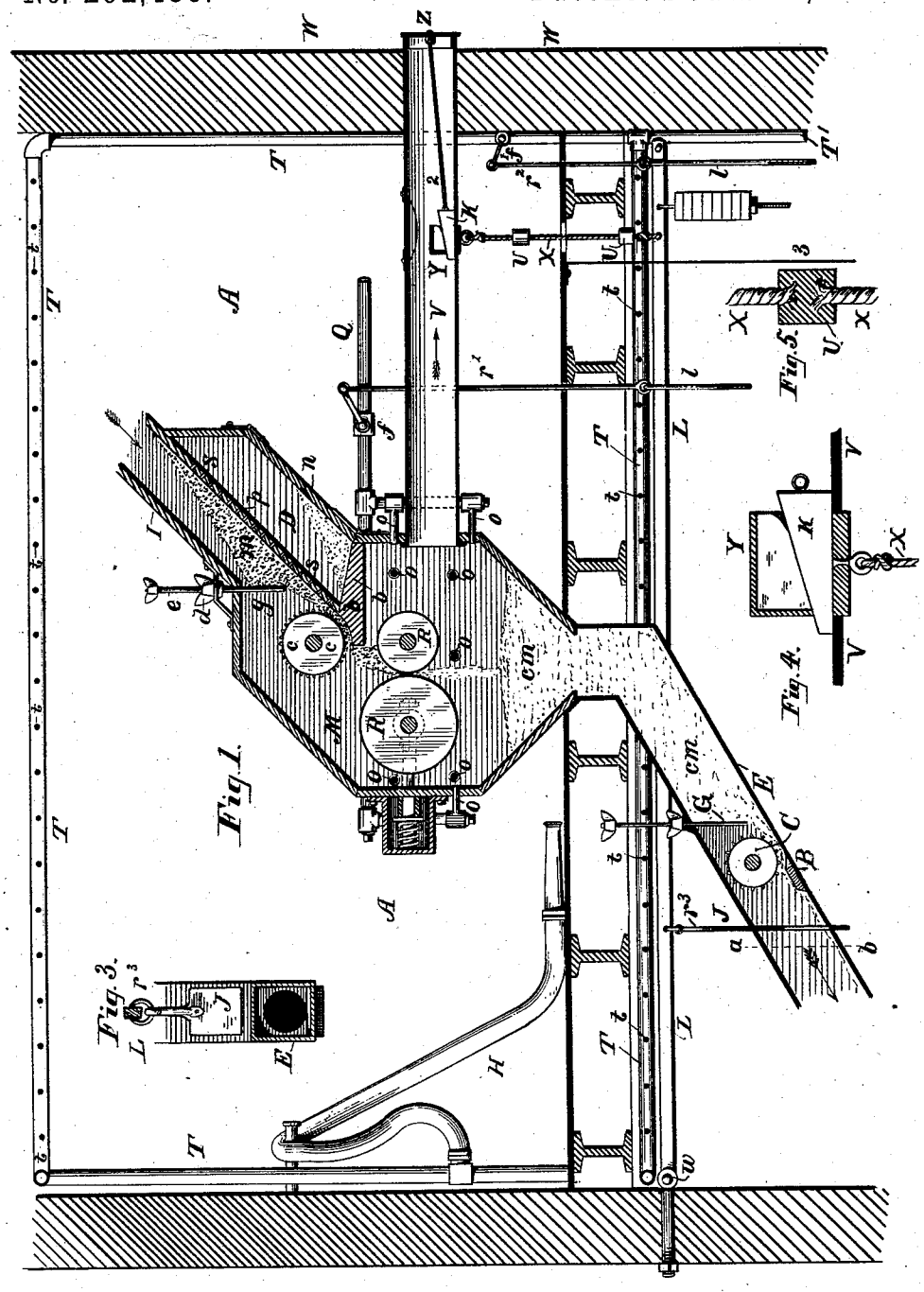


Fig. 1.

Fig. 3.

Fig. 4.

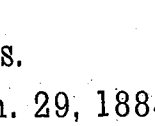


Fig. 5.

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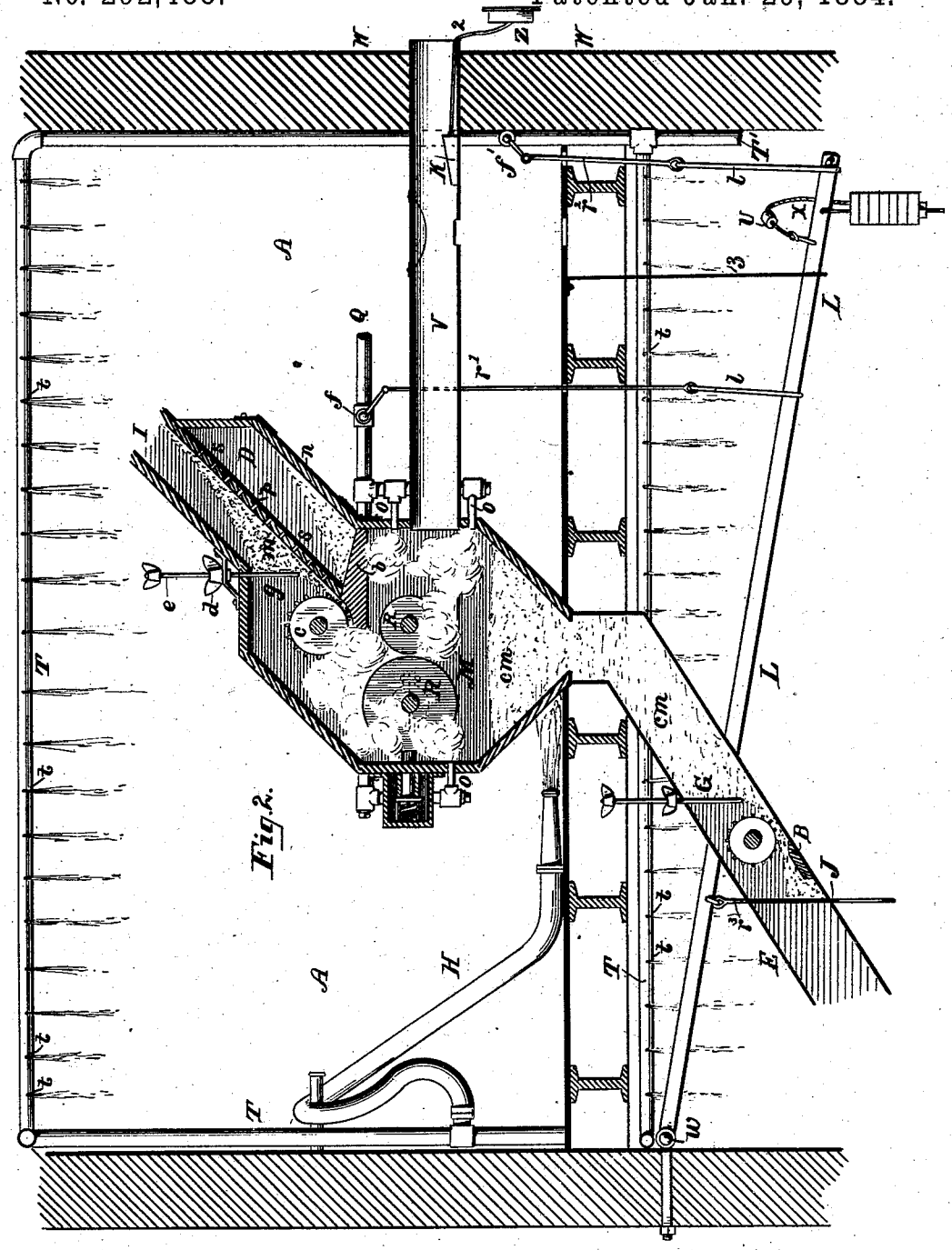


Fig. 2.

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UNITED STATES PATENT OFFICE.

CHARLES JOHN HEXAMER, OF PHILADELPHIA, PENNSYLVANIA.

CONSTRUCTION OF MALT AND GRAIN MILLS.

SPECIFICATION forming part of Letters Patent No. 292,488, dated January 29, 1884.

Application filed February 27, 1883. (No model.)

To all whom it may concern:

Be it known that I, CHARLES JOHN HEXAMER, a citizen of the United States, residing at the city and county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in the Construction of Malt and Grain Mills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

Figure 1, Sheet 1, is a transverse vertical section of a malt-mill or other grain crushing or grinding mill provided with my improvements, as they appear previous to the occurrence of a dust explosion within the mill-box. Fig. 2 is a like sectional view, showing the position of the parts immediately after such an explosion. Fig. 3, Sheet 1, is a section on the line *a b*, Fig. 1, showing the construction and arrangement of the drop-gate. Fig. 4, Sheet 1, is a detail of wedge or key and its connections for holding the rope or rod which sustains the drop-lever. Fig. 5, Sheet 1, is a detail of said rope and fusible couplings.

Like letters of reference, where they occur in the several figures, indicate like parts.

The object of this invention is to prevent those hitherto disastrous fires occasioned by explosions of the fine dust arising from grinding or crushing malt or grain, induced by the mill-rolls striking some foreign hard body—such as a stone or piece of iron—and thereby producing sparks which ignite the impalpable dust. As malt-mills in breweries (for which my invention has especially been designed) are usually constructed and arranged, such explosive fires are not confined to the mill-box or mill-room, but frequently extend through the pipes leading to the elevator-boot, which, being filled with inflammable dust, takes fire, and the fire is carried on to the upper stories of the building, (being aided by the upward draft caused by the motion of the elevator-cups,) and the entire structure frequently becomes a prey to the flames. It is believed that in a mill provided with my improvements such fires cannot become extensive, as, so to say, they will be curbed or smothered at birth.

I shall now proceed to describe in detail the construction, *modus operandi*, and the results of my invention, first, however, briefly explaining the usual general construction of one type of malt-mill, all others known to me being, so far as my present improvements have relation thereto, substantially the same.

In the drawings, A marks the mill-room, and M the mill-box therein; R R, the crushing-rolls, geared to rotate at different speeds; I, the influx-pipe from which the malt *m* descends between said rolls, and E is the efflux-pipe leading to the elevator-boot. (Not shown.)

In the particular style of mill which I have selected for illustration, and which is much in vogue abroad, the inflow of the malt to the crushing-rolls is regulated by means of a gate or gage, *g*, across the delivery-pipe I, and which is vertically adjustable by means of a thumb-nut, *d*, on the rod *e*, extending above the pipe. The comparatively small stream of malt which has passed beneath the gage falls upon a curved faced block, *b*, termed the "receiving-block," whence it is fed down in a thin-spread stream to the rolls R by a rotating feed-roller, *c*.

I may also state, although forming no part of my invention, that on its way down the influx-pipe the malt passes over a plate-magnet, *p*, which arrests particles of iron which may have gotten into the malt, and also that the latter slides over a screen, *s*, which extracts a large part of the dust not taken out by previous screening, which dust falls into a dust-chamber, D, that may be emptied from time to time by removing the door or bottom *n*. The crushed malt, falling from between the rolls R, is conducted by the inclined pipe E to the elevator. Now, the mill-box, as is well known, is continually filled during the crushing or grinding process with the flying very inflammable and dangerously explosive malt-dust, liable to take fire and explode at slight provocation, which is given the instant a spark is thrown off by the rapidly-revolving rolls striking a foreign hard body, such as a nail, stone, or a piece of self-binder wire, &c. The consequences of such an explosion are obvious and well known. It must find vent in some direction, and the readiest is by way of the exit-pipe E and the elevator, with the final results I have above mentioned. I prevent these by providing means, first, for keep-

ing a continuous effective barrier between the mill-box and the elevator-boot; second, for insuring a sufficient vent for the force of the explosion from the mill-box to the open air; and, third, for closing by devices put into operation by and at the instant of the explosion within the mill-box.

The barrier which I make use of to cut off the escape of the explosive gases and fire by way of the efflux-pipe E is composed of and built up by the crushed malt itself.

It will be observed that the bottom part of the mill-box is contracted or hopper-shaped, and that there is a plenum of the malt *m* in this hopper and in the efflux-pipe adjacent thereto. This condition is maintained at all times by means of the devices hereinafter described. Should an explosion now occur within the mill-box, the gaseous pressure upon the top of the tapering body of malt tends to instantaneously pack the expanse of the latter into the contracted hopper and pipe, and thus compel the volume of gases to find an easier vent. I preserve this perpetual plenum by means of a device which I term a "discharger," consisting of an adjustable gate or gage, G, and a feed-roller, C, placed in the pipe E a short distance below the mill-box, as shown. This gage and roller are duplicates in construction, arrangement, and operation of those, *g* and *c*, in the influx-pipe I, as before described. I do not, however, limit myself to a discharger made precisely as shown, as any contrivance for accomplishing the identical purpose will be within the scope of my invention.

When the mill is first started up, the discharger is temporarily adjusted, either by pushing down the gate G, so as to entirely close up the pipe, or by checking the rotation of the roller C, so as to cause the backing up of the malt until the pipe above and the hopper become filled, whereupon the discharger is regulated to allow the outflow of the malt-meal to equal the inflow of the malt, thereby preserving the established level of meal in the hopper.

I purpose applying a device for retarding or accelerating the action of the discharger, (or the feeder,) made to operate automatically by the relative quantity or height of the malt-meal within the pipe E and the hopper, and, perhaps, making the same the subject of future application for Letters Patent.

The vent which I provide for the great volume of expansive gases suddenly generated in case of the ignition of the malt-dust within the mill-box, and which, as seen, are denied escape by way of pipe E, consists of an ample pipe, V, communicating with the interior of the mill-box and with the free air outside the wall W of the building.

An additional barrier between the mill-box and the elevator-boot, which I provide as a further measure of safety when such an explosion occurs, consists of a gate, J, in the efflux-pipe E, which normally is raised or open, as in Figs. 1 and 3, but in case of explosion or fire is caused to descend and obstruct the passage-way of the efflux-pipe, as I shall now proceed to describe. This gate is connected by a rod, r^3, to a drop-lever, L, that is pivoted at one end, *w*, and its free end held up in the following manner: A rod or rope, X, to which the free end of the lever is fastened has a slotted block, Y, at the upper extremity, which block extends up through a slot in the under side of the vent-pipe V, which, it will be remembered, extends from within the mill-box. This block, and by sequence the lever L, is held up by means of a wedge or key, K, passed through a slot in the former, and bearing upon the bottom of the vent-pipe on either side of the slot therein, as clearly shown in Figs. 1 and 4. I prefer to make this key of oiled wood or other material that will not rust or stick, but which can always be relied upon for the purpose in view. It is connected by means of a cord or rod, 2, with the cap Z, which covers the outer end of the vent-pipe. Now, should an explosion take place within the mill-box, this cap will be blown off, thereby causing the withdrawal of the key K from the block, leaving the lever L free to drop by its gravity, and the gate J to be thereby carried down across and effectually close the efflux-pipe. A catch or loop, 3, through which lever L is passed, serves to check its fall, so as to avoid undue strain or breakage of the connections.

The positions of the several parts following an explosion are represented in Fig. 2 of the accompanying drawings, the cap Z being blown off, the lever L fallen, and with it the gate J, across the efflux-pipe. The cap Z, besides serving the purpose hereinbefore mentioned, at the same time keeps the vent-pipe closed at ordinary times, thus preventing the escape of the fine inflammable malt or grain dust in that direction.

I prefer to make the connection, X, between the key K and the drop-lever of cotton, hemp, or other similar readily-inflammable material, which, burning, in case of fire occurring outside the mill-box, soon severs, and thereby allows the said lever to drop. This feature, however, I shall make the subject of future application for Letters Patent. I also prefer to make the rope (or rod) X, instead of integral, in sections and connect them, as seen in Fig. 5, with couplings U, composed of some fusible alloy which melts at a comparatively low degree of heat, and which, becoming melted from the heat in case of fire adjacent to the room, breaks the connection between the said sections, and the lever falls. This will also form the subject of an application for a patent, as will other devices shown and lettered in the drawings, for extinguishing fires within and adjacent to the mill-box, and not herein claimed.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The method of preventing fires resulting from explosions of grain-dust within the mill-boxes of malt or other grain crushing or grind-

ing mills from extending from the mill-box to the elevator-boots and other parts of the building, which consists in maintaining a continual plenum of the ground or crushed grain in the outlet-pipe from the mill-box, in conjunction with a suitable vent leading from the latter into the open air, substantially as set forth.

2. In combination with the mill-box having the grinding or crushing rolls therein and the efflux-pipe leading therefrom, an adjustable discharger for regulating the flow of the ground grain from the efflux-pipe, so as to maintain the plenum in said pipe above the discharger, substantially as and for the purposes set forth.

3. The mill-box having the grinding-rolls therein, and its bottom conical or hopper shaped, the efflux-pipe leading therefrom, and the adjustable discharger, all combined, constructed, arranged, and operating substantially as and for the purposes described.

4. The combination, with the mill-box having the grinding-rolls therein, and the influx and efflux pipes communicating therewith, a feeder in the former pipe and a discharger in the latter, said feeder and discharger being adapted to be relatively adjusted and regulated, so as to preserve a continual plenum of the ground grain within the efflux-pipe, substantially as and for the purposes set forth.

5. The combination, with the mill-box having the grinding-rolls therein, and the influx and efflux pipes, of means for preserving the described plenum within the efflux-pipe, and the vent-pipe V, communicating with the interior of the mill-box, substantially as and for the purpose set forth.

6. In combination with the mill-box, efflux-pipe, and the gate J, means for automatically causing said gate to close said pipe from the result of an explosion within the mill-box, substantially as and for the purpose set forth.

7. In combination with the mill-box, efflux-pipe, gate J, and means for automatically causing the said gate to close the said pipe from the effect of an explosion within the mill-box, the vent-pipe V, substantially as described.

8. The combination of the mill-box, the efflux-pipe, the gate J, and the drop-lever L, connected with said gate, all constructed, combined, and adapted to operate substantially as and for the purpose specified.

In testimony whereof I have hereunto affixed my signature this 24th day of February, A. D. 1883.

CHARLES JOHN HEXAMER.

Witnesses:
RICH. T. BOEHME,
E. H. ECKFELDT.