(No Model.) 2 Sheets—Sheet 1.

W. H. BUTLER.

APPARATUS FOR DRYING BREWERS' GRAINS, &c.

No. 496,852. Patented May 9, 1893.

Fig. 2.

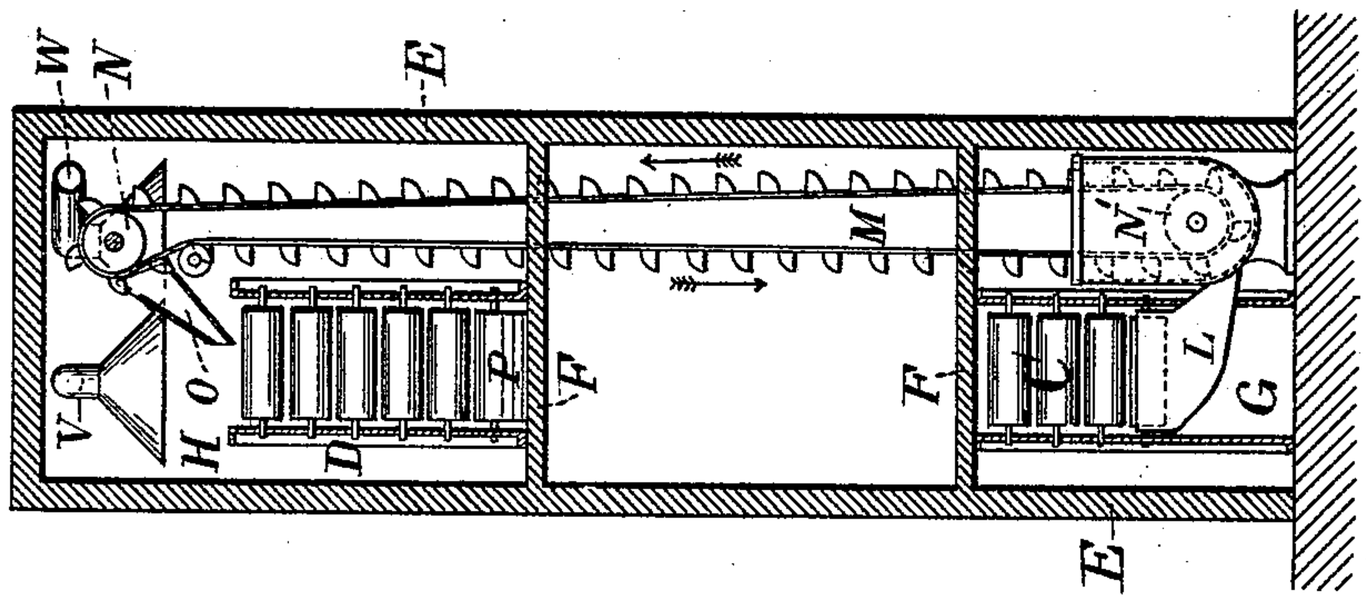
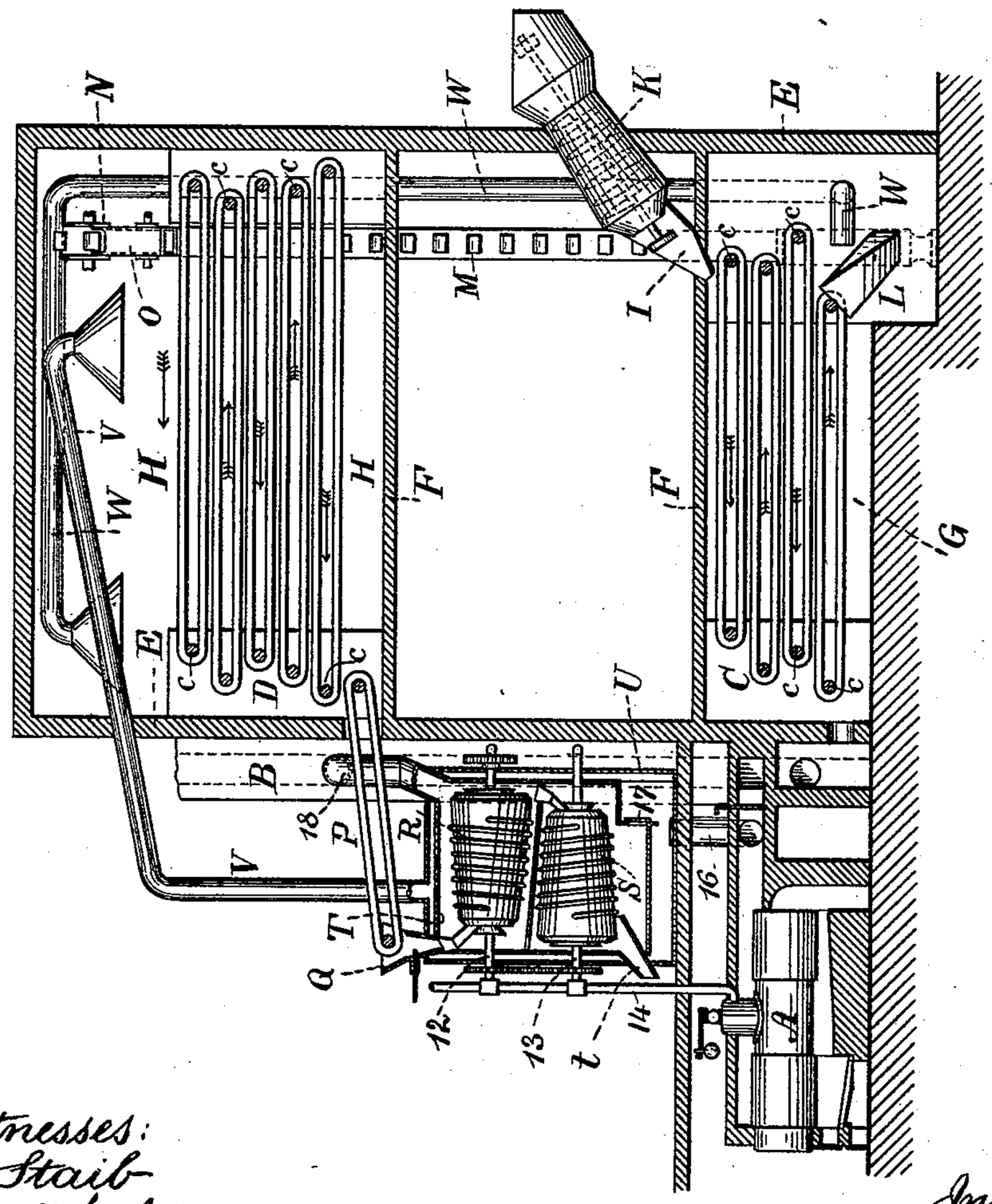


Fig. 1.



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per Leonard W. Serrell
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(No Model.) 2 Sheets—Sheet 2.

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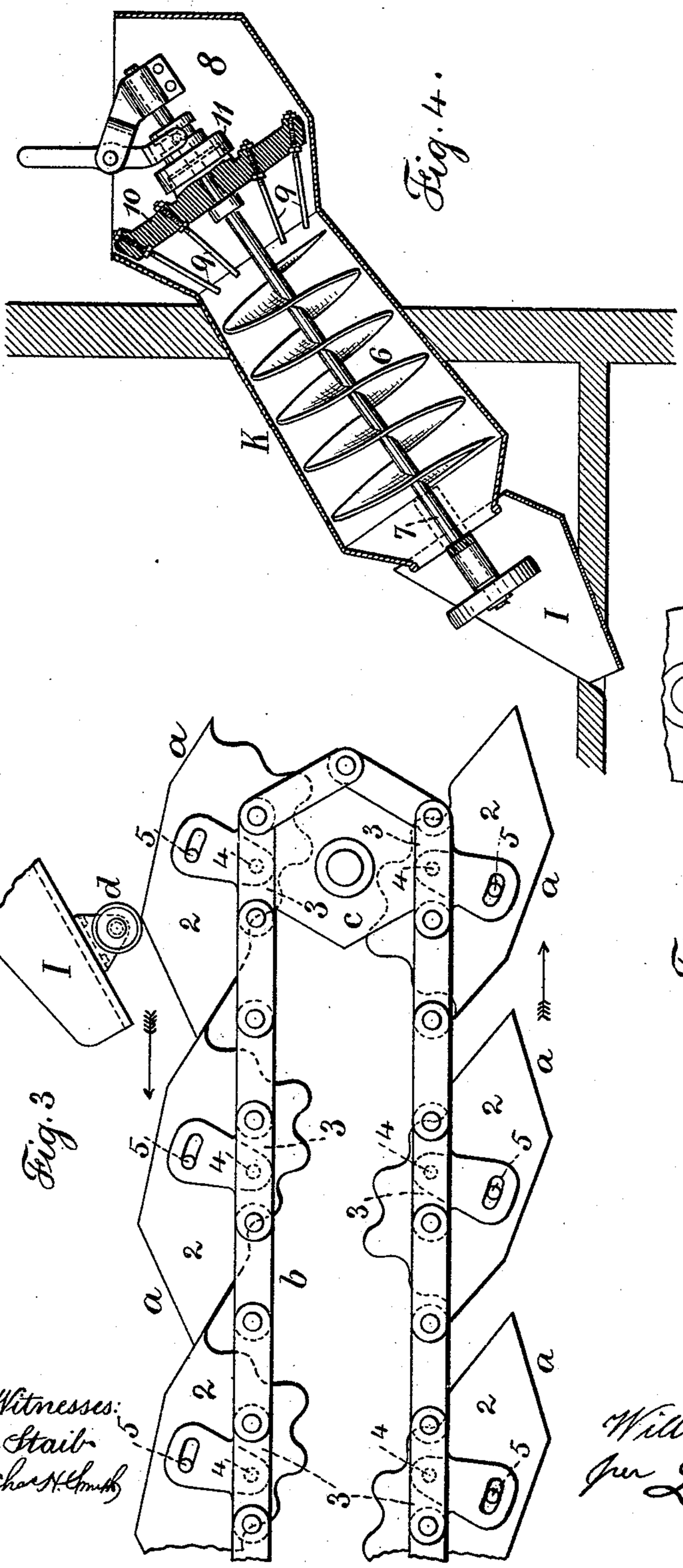

Fig. 4.

Fig. 3

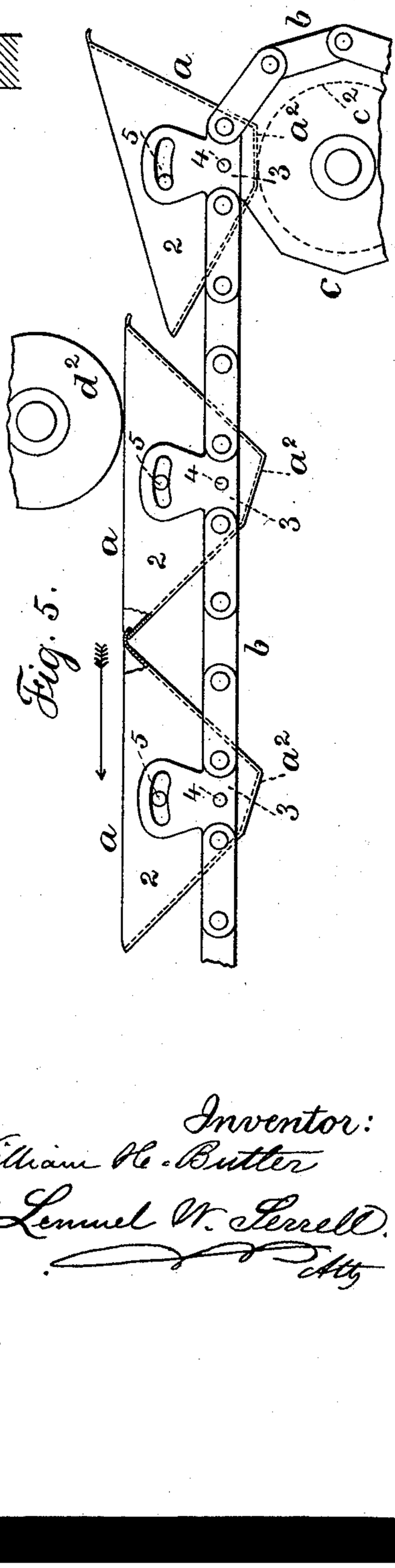

Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM H. BUTLER, OF WALDWICK, ASSIGNOR TO HIMSELF, AND ALBERT PFLUGH AND PHILIP STEWERWALD, OF HOBOKEN, NEW JERSEY.

APPARATUS FOR DRYING BREWERS' GRAINS, &c.

SPECIFICATION forming part of Letters Patent No. 496,852, dated May 9, 1893.

Application filed March 8, 1892. Serial No. 424,124. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. BUTLER, a citizen of the United States, residing at Waldwick, in the county of Bergen and State of New Jersey, have invented an Improvement in Apparatus for Drying Brewers' Grains, &c., of which the following is a specification.

In Letters Patent No. 360,971, granted April 12, 1887, to Timothy G. Palmer, a drying apparatus is represented in which steam is made to encircle the drying cylinder. I combine with the said apparatus a preliminary drying device and also a peculiar arrangement of heating flue by which the air is made to take up as much moisture as possible before passing off to the chimney or escape.

In the drawings Figure 1 is a general elevation of the apparatus with the inclosures in section. Fig. 2 is a cross section. Fig. 3 represents the buckets in larger size, and Fig. 4 shows the feeding in hopper and agitators, and Fig. 5 is a modification in the buckets.

The steam boiler at A is of any desired character for supplying steam to the drying apparatus and also for supplying an engine by which the parts are revolved, and the heated products of combustion may pass off to the chimney B, and there are dampers and flue openings as hereinafter described to direct the products of combustion, so that they may be utilized in the drying operation previous to ultimately passing into the chimney.

It is well known that brewers' grains are in a very wet condition and that they require to be dried before they are in a condition for packing or transportation as a cattle feed; it is therefore necessary to subject such grains to a very extended drying operation. With this object in view I supply the wet grains into shallow receptacles or pans united together by chains to form endless conveyers, and these pans are within a heated chamber, and the grains are dumped from one set of pans into another set of pans, so as to be agitated and fresh surfaces exposed to the drying action.

In constructing the conveyers I make use of ranges of pans such as shown in Figs. 3 and 5. Each pan *a* is made with a double inclined bottom and with upwardly projecting sides 2, and the chains *b* are preferably flat plate links of suitable lengths, and the links 3 receive the pivots 4 upon which the buckets are permitted to swing, and the links 3 are extended upwardly at the sides of the pans and provided with slots for the pins 5 upon the buckets, so that the buckets are allowed a swinging motion upon their pivots 4 to the extent of the length of the slots for the pins 5; and the end of one bucket laps upon the end of the next bucket when the buckets are in line, as seen in Fig. 3 or beneath the end of the advance bucket, as seen in Fig. 5, but when the buckets are passing around the end rollers or pulleys *c* the buckets are free to turn and separate and the contents of the buckets are discharged as each bucket comes to the end roller or pulley, as hereinafter described, and such pans or buckets return beneath the full buckets and come up into position for receiving the moist grain, and as a bucket rises, as seen in Fig. 5 and the chain passes around one of the rollers *c*, the weight of the bucket causes it to swing upon its pivot to the extent of the length of the slot receiving the pin 5. Hence when the bucket comes up to the upper or horizontal portion of the chain, the forward end of such bucket is above the rear end of the previous bucket, and there is no risk of the buckets interfering one with the other as they assume the horizontal positions, and I provide rollers or stationary guides *d* beneath which the chain of buckets passes and the roller or guide acts upon the top of the inclined side or sides of the bucket and presses the bucket down, so that the forward edge of such bucket laps over the rear edge of the bucket in front of it. Thereby there is no opening left for the moist or wet grain to fall down between one bucket and the next and the grain, as supplied or fed in as hereinafter described, is received upon the upper part of the chain of pans or buckets and is exposed to the drying action, and such moist grains are delivered from the buckets as they turn downwardly to the return side of the chain of conveyers.

The buckets shown in Fig. 5 act in the same manner as those shown in Fig. 3, except that the inclined bottoms a^2 of the buckets *a* com-

ing into contact with the roller c^2, turn the front ends of the buckets downwardly, and the roller d^2 tips the buckets the other way as they pass successively beneath the same to bring the front of one bucket up and into contact with the under side of the projecting lip of the next bucket in front of the same.

In this drying apparatus any desired number of chain conveyers, constructed as aforesaid, may be employed; I have represented diagrammatically in Fig. 1 two sets of such chain conveyers, the one set at C and the other set at D, and these sets of chain conveyers are composed of any desired number of chains and buckets. I have shown four chain conveyers in the set C and five in the set D, and there is a suitable inclosure with walls E and floors F forming a chamber G for the set of chain conveyers C, and a chamber H for the set of conveyers D.

The wet brewers' grains are supplied to the top conveyer of the set of chain conveyers C by any suitable hopper or spout. I have shown a chute I as receiving the grain from a separator K, which separator K is provided with an internal worm 6 upon the shaft 7 that is suitably supported and rotated by competent power, and such separator K has a hopper-shaped mouth 8 at the upper end, into which the grain is supplied from a cart or other receptacle, and the stirrers 9 are in the form of bars or rods upon a cross head 10 upon the shaft 7 and connected thereto by a friction clutch 11, so as to revolve with said shaft 7 or at a less speed than the same, and the stirrers 9 serve to open up or separate the lumps of brewers' grains that may adhere together in the mass that is supplied into the hopper end of the separator, and the worm in said separator carries the grain with regularity to the chute I and the supply through the chute can be proportioned to the speed of revolution of the worm in the separator K in order that the chain conveyers may not be overloaded but carry off the brewers' grain into the drying chamber G and upon the set of chain conveyers C. Each endless chain conveyer of the sets of chain conveyers C is similar, and the lower endless chain conveyer extends beyond the delivery end of the upper chain conveyer sufficiently for the materials to be delivered from the upper buckets or pans to those of the conveyer next below, and there may be chutes or side plates to guide the grain as it falls from one set of buckets to the other, and the lowest endless chain conveyer delivers the partially dried grain to the chute L that discharges such material into the bottom case of the elevator M, which elevator is made with buckets of any desired character passing over the pulley N at the top and the pulley N′ at the bottom, and the elevated material is discharged by the spout O upon the top conveyer in the set of conveyers D, and these conveyers act in the manner before described, the material from one conveyer being discharged from the buckets or pans thereof into the buckets or pans of the conveyer next below, and from the lowest conveyer in the chamber H the material is discharged upon the conveyer P which is constructed the same as before described and carries such material out of the chamber D and delivers the same into the hopper Q which corresponds to the hopper l' in the aforesaid patent No. 360,971, and there are two drying cylinders R and S, one above the other with agitators inside such drying cylinders and steam coils around the same supplied by steam through the hollow shafts 12 and 13 and pipe 14 that leads to the boiler A, and there is an inclosure T for the drying cylinders R and S, and as these parts correspond to the aforesaid patent, they do not need further description and the dried material passes away by the chute t as it is discharged from the drying cylinder S. There is an inclosure U outside the inclosure T, so as to form a hot air space outside of the inclosure T, and there is a flue or pipe 16 that leads the products of combustion from the flue of the steam boiler A into the inclosure U and around the outside of the inclosure T. Hence the drying cylinders will become highly heated by the surrounding products of combustion as well as by the action of the steam passing through the pipe 14 and hollow shafts 12 and 13, and there is a register 17 by which the products of combustion can be allowed to pass also into the inclosure T to circulate through the same sufficiently for carrying off the vapors that are discharged from the drying grain, and such vapors go by the flue 18 into the chimney B, and I provide a pipe V leading from the inclosure U to the upper part of the chamber H so that the products of combustion go right into the chamber H and heat the same, and the heat is availed of to vaporize the water from the grain upon the upper set of chain conveyers D, and the air and moisture pass by the pipe W from the upper part of the chamber H down into the chamber G to heat the same, and in this chamber the air will become largely saturated with moisture, and the temperature will be correspondingly reduced, so that when the air passes from the lower chamber G into the chimney B, there will be no loss of heat and the air will have taken up as much moisture as possible from the grain. It will be apparent by this improvement that the dry heat from the products of combustion is expended in perfecting the drying operation and that the vapors are taken up from the moist and wet brewers' grain by the progressive operations performed in the respective chambers, the final drying operation being performed in the cylinder S, and the first drying operation in the chamber G, and the apparatus is compact and easily kept in order.

I claim as my invention—

1. The combination in a drying apparatus of sets of chain conveyers in two chambers, a supply chute for discharging the material to

be dried upon one set of conveyers, an elevator for receiving the partially dried material from one set of conveyers and raising the same, and a chute for delivering the material upon the upper set of conveyers, and pipes for admitting the products of combustion into the upper chamber, and a pipe for conveying the gases and vapors from the upper chamber to the lower chamber, substantially as set forth.

2. The combination with the drying cylinders having steam coils around them and an inclosing case, of sets of chain conveyers for receiving and partially drying the brewers' grains or other materials and for conveying the same to the drying cylinders, an inclosure to the drying cylinders into which the products of combustion are admitted from a furnace, and pipes leading the hot air from the inclosure to the chambers for the respective sets of chain conveyers, substantially as set forth.

Signed by me this 4th day of March, 1892.

WM. H. BUTLER.

Witnesses:
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WILLIAM G. MOTT.