

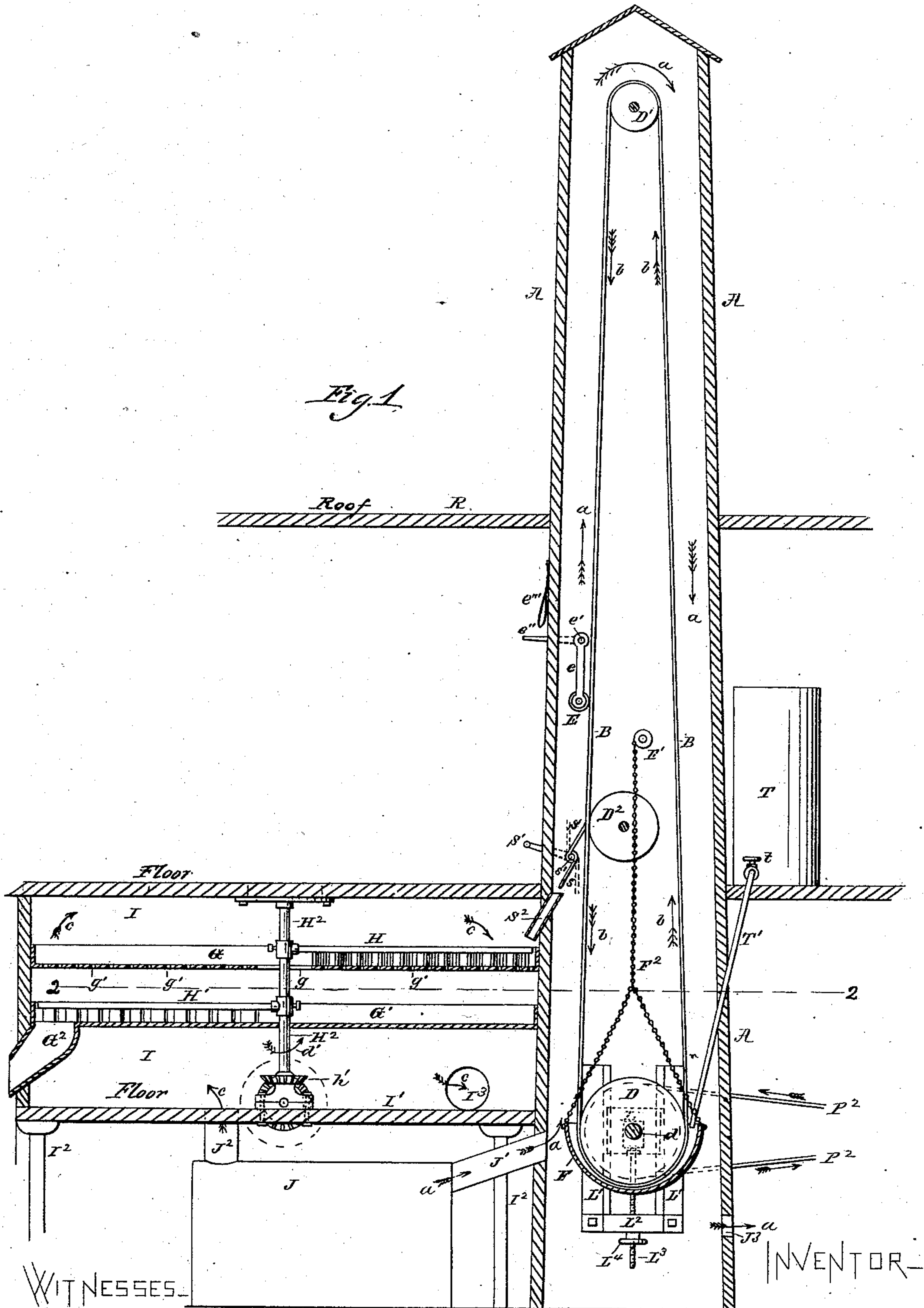
(No Model.)

3 Sheets—Sheet 1.

L. J. CADWELL.

Process of and Apparatus for Desiccating Substances.
No. 239,722.

Patented April 5, 1881.



WITNESSES—
S. B. Townsend
M. E. Dayton.

L. J. Cadwell

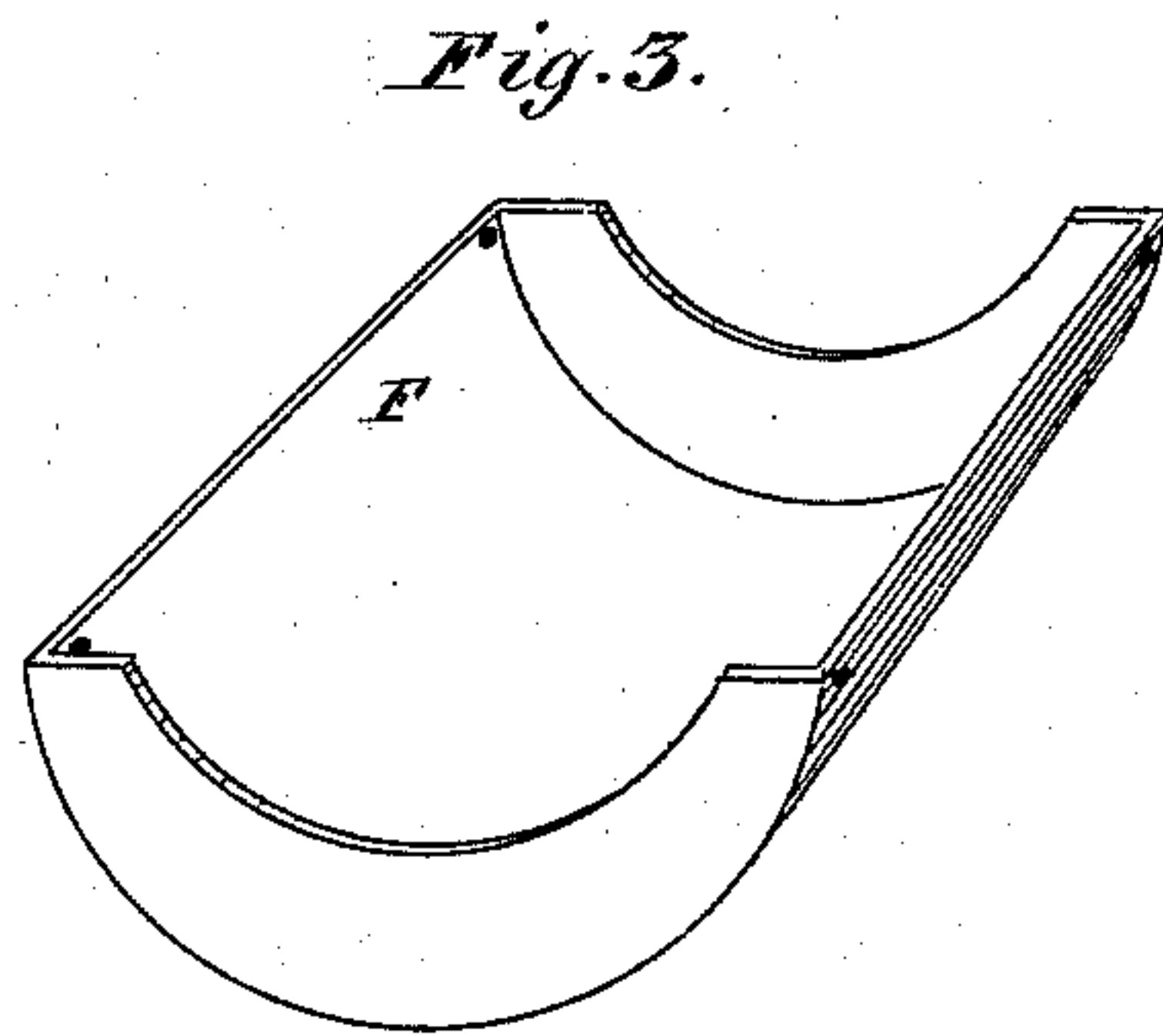
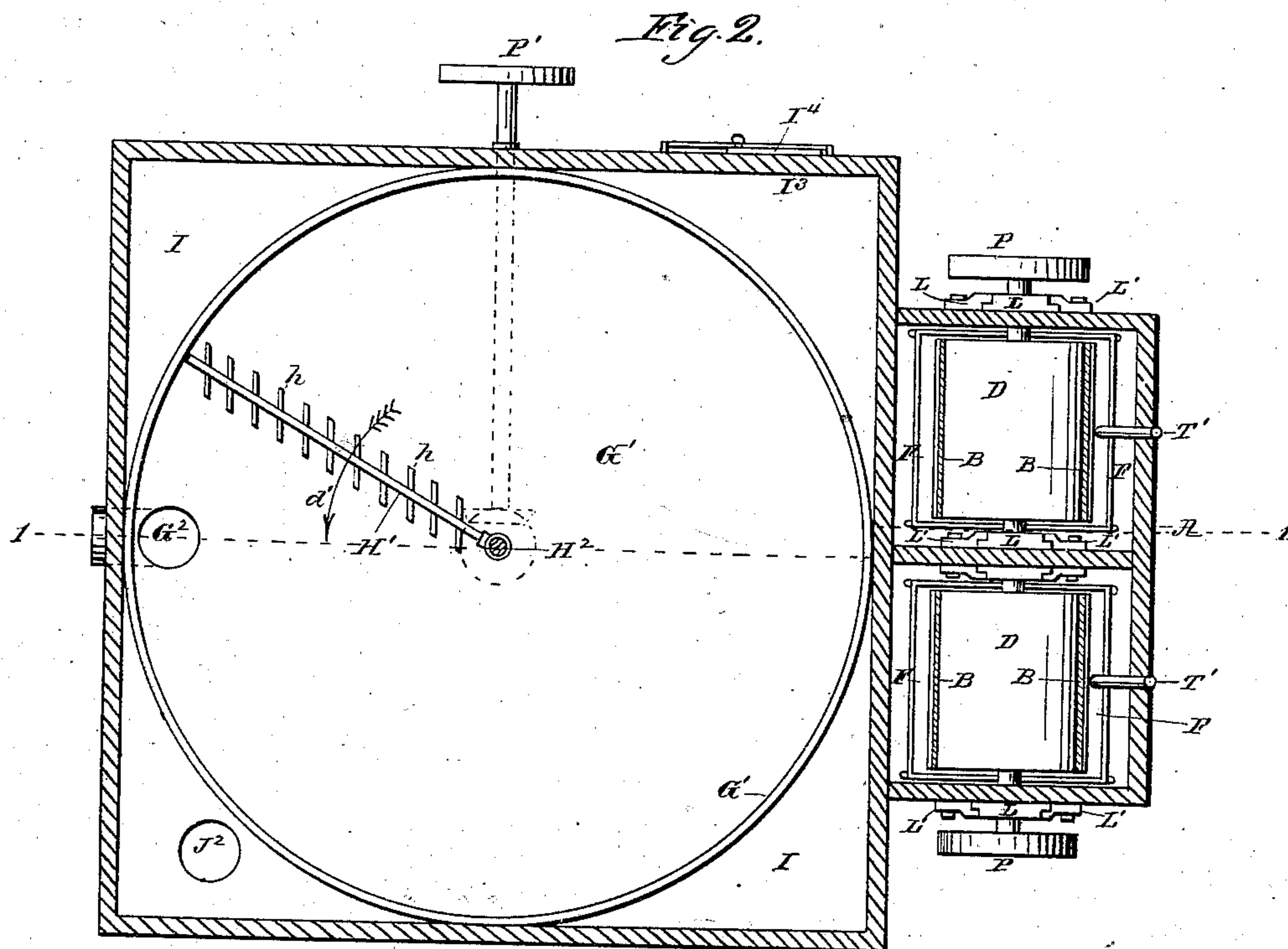
(No Model.)

L. J. CADWELL.

3 Sheets—Sheet 2.

Process of and Apparatus for Desiccating Substances.
No. 239,722.

Patented April 5, 1881.



WITNESSES—
F. B. Townsend
W. E. Dayton.

INVENTOR—
Lydia J. Cadwell

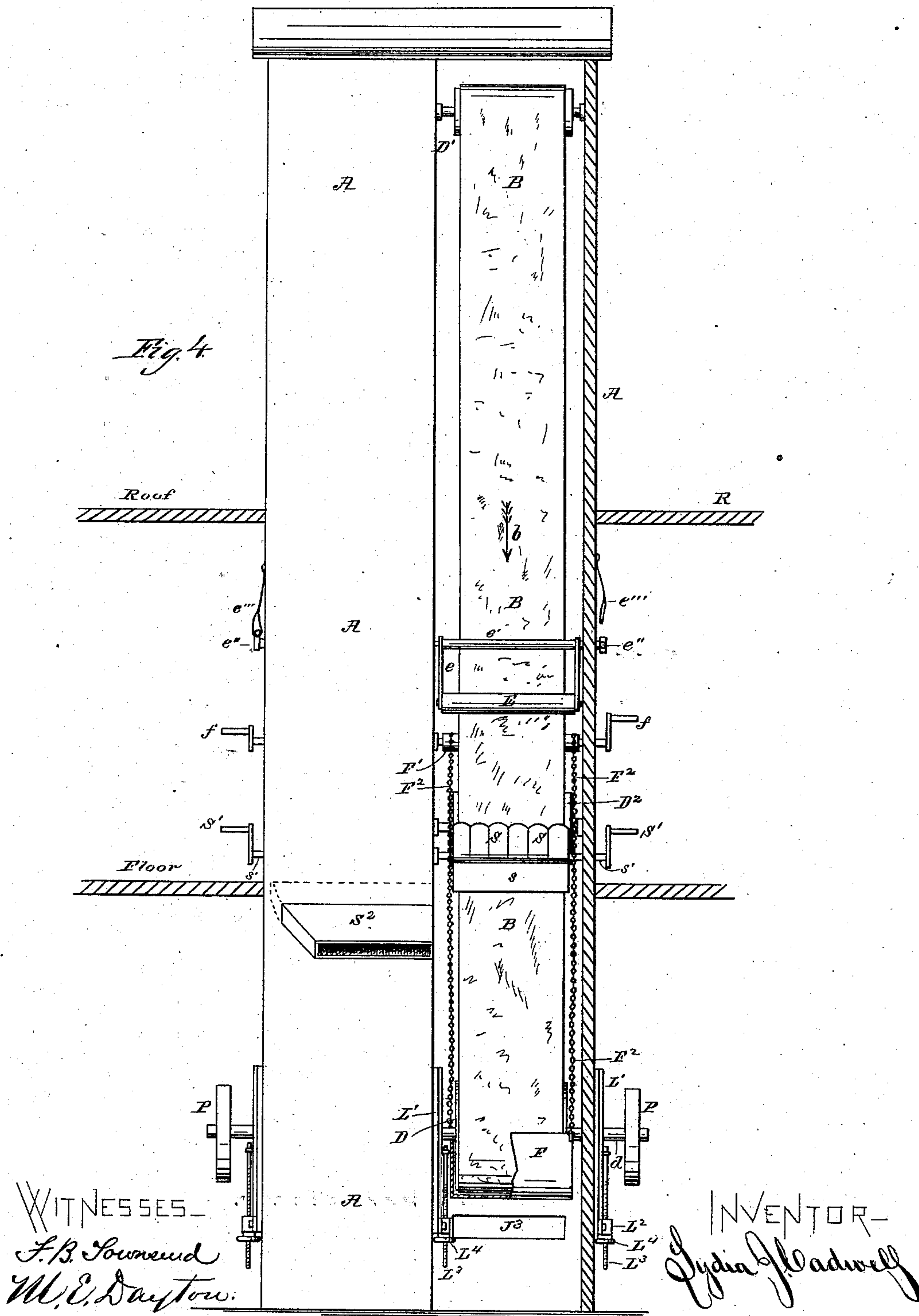
(No Model.)

3 Sheets—Sheet 3.

L. J. CADWELL.

Process of and Apparatus for Desiccating Substances.
No. 239,722. Patented April 5, 1881.

Patented April 5, 1881.



UNITED STATES PATENT OFFICE.

LYDIA J. CADWELL, OF CHICAGO, ILLINOIS.

PROCESS OF AND APPARATUS FOR DESICCATING SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 239,722, dated April 5, 1881.

Application filed December 3, 1880. (No model.)

To all whom it may concern:

Be it known that I, LYDIA J. CADWELL, of Chicago, State of Illinois, have invented certain new and useful Improvements in Processes of and Apparatus for Drying or Desiccating Fluid or Partially Fluid Substances; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The object of my invention is to rapidly and thoroughly desiccate eggs, glue, and other liquid materials of such nature as are or will become viscid or decrease in tenuity when partially dried, and reduce them to such a hard condition as will enable them to be pulverized or broken; and this I effect by the method of treatment and the new and improved apparatus hereinafter described, and illustrated in the accompanying drawings, in which—

Figure 1 shows an endless belt and its appliances within the vertical drying-well by a vertical section of the latter. It also shows an adjacent supplemental drying apparatus in central vertical section, and the furnace from which heated air is supplied to both the well and the supplemental drying-chamber. Fig. 2 is a horizontal section of a group of two vertical drying-wells and a contiguous supplemental drying-chamber in the line 2 2 of Fig. 1. Fig. 3 is a perspective view of the feeding-pan detached; and Fig. 4 shows a group of two vertical drying-wells, one being in elevation and the other in vertical section. In the latter is presented a front view of the endless belt and other parts related thereto.

A is a tall shaft or well, in appearance resembling a large chimney, but preferably closed at the top, and constructed of wood, (or otherwise,) to retain heat.

B is a belt or band, of canvas or other similar or suitable material, hung within the well A from the loose drum D', situated near the top of the well, and propelled from the larger drum D, located near the bottom of the well, being driven by any suitable power or mechanism. (Not here shown.) For the purpose of tightening the belt B, when required, the shaft *d* of the drum D is mounted in movable bearings L L, arranged to slide up and down between the guides L' L', and provided with

threaded rods L³, which depend therefrom through cross-pieces or brackets L², beneath which wheel-nuts L⁴ serve to draw the drum D forcibly downward, and thus to give the desired tension to the belt. At one end of the drum the shaft *d* protrudes through a vertical slot in the drying-well, and is provided with a driving-pulley, P. The belt is slowly driven in the direction of the arrows *b b*.

F is a pan, preferably semi-cylindric in shape, to conform with the drum D, intended to contain a quantity of the substance to be dried, and adapted to be raised and lowered to feed said substance periodically, if desired, upon the belt B. For the purpose of raising and lowering said pan it is suspended by the chains F² from the windlass F', which is supported by the walls of the drying-well A, and is provided with an external crank, *f*, whereby it may be operated at will. T is a tank, intended to contain a mass of the substance to be dried, and desirably located above the level of the pan F. It is provided with the pipe T', which discharges into said pan, and which has the valve *t*, by which the supply of material from the tank T to the pan F may be controlled.

J is a hot-air furnace, suitably located with reference to the drying-well A, and provided with a flue, J', which discharges heated air into the well, as indicated. I prefer to admit the air at that side of the well at which the belt B descends, and to discharge the moisture-burdened air from the well at the opposite side, near the bottom, as indicated at J³. An important economic advantage is realized from having the drying-well closed at the top and provided with inlet and outlet at the bottom, as shown, in that the drier and hotter air inevitably rises to the top of the well over the descending portion of the belt, and settles and escapes only as it becomes laden with moisture passing over the ascending portion of the belt. There is, therefore, no escape of hot air unutilized, and, on the other hand, the escape of air is insured as fast as it does its work, while the moisture-laden air is not carried over the dry portion of material. The well may, of course, be operated, though less effectively and economically, by allowing the heated air to escape at the top or elsewhere.

E is a roller, hung by the arms *e* from the

cross-bar e' in position to bear transversely against the belt B, as clearly seen in Fig. 1. The object of this device is to spread or break up and disintegrate the substance on the belt while being dried, in order that new surfaces of such substance may be successively exposed to the drying air, and also in order to facilitate or induce a granulation or crystallization of the substance, if it be such as is capable of this effect. Several rollers E may be employed, if desired, and located to bear at different points on the belt, by which the effect sought will be practically continuous. By means of the external arm or lever, e'' , the roller E may be lifted away from the belt, and it may be held away by the looped cord e''' . Any other suitable carrier may be used for the purpose.

S represents a scraper, of the full width of the belt B, secured to the rocking shaft s' , and adapted to be borne by the lever-arm S' against the descending surface of the belt, as shown in full lines in Fig. 1. This scraper is for the purpose of removing the dried or partially-dried substance from the belt. While said scraper may be made of a single piece of metal, it preferably consists of a number of blades arranged side by side to extend across the belt, as indicated in Fig. 4. In this case each section may be given an oblique or curved form at its sharpened end to obtain a shearing action, and thus to operate more easily. The scraper is sharpened by being beveled on its under face, that it may not cut the belt while in operation. Said scraper, when borne in an inclined position against the belt B, also serves as a chute to conduct the detached substance away from the belt, and in this character is prolonged by the broad apron or chute s , also secured to the shaft s' , so as to direct the substance detached into the spout S^2 leading out of the well. If it is not desired to use the scraper continuously it may by these devices be swung, together with the apron s , into the vertical position shown in dotted lines of Fig. 1, so as to afford no appreciable obstruction to the upward passage of air in front of the belt. Said scraper may obviously be hinged to the well-wall at the mouth of the spout and turn up against the well when not in use; or, if intended for constant use, it may be fixed in the inclined position shown. Any suitable appliance may be used for adjusting the scraper. Opposite the point at which the scraper bears against the belt is located a large loose drum, D^2 , which supports the belt in opposition to the pressure of the scraper. Any other suitable form of support may be employed instead of the drum D^2 , and, less desirably, such drum or support may be movable and adapted to deflect the belt outward against the scraper set a short distance from the belt when the latter hangs free.

As the apparatus so far generally described is complete in itself for certain important purposes of my invention, and as it embraces the more distinctively novel mechanical features of

said invention, I next describe its operation more in detail, illustrating my improved process in connection with one use to which it may be applied—namely, the desiccation of eggs. For this purpose I will suppose the ultimate desiccated egg product to be that set forth and patented in Letters Patent of the United States No. 184,479, consisting of granular powder composed of both the whites and yolks of the egg and a suitable quantity of sugar for their preservation. To make this product the yolks and whites of eggs are thoroughly broken up together and intimately mixed with a due quantity of sugar, forming what is called "egg-batter." This batter is held in a mass in the tank T. From this tank the pan F is supplied through the pipe T' , and the batter is fed from the pan to the outer surface of the moving belt B. If the feeding is desired to be intermittent, it will be accomplished by raising the pan through the agency of the windlass F' , as described, and holding it in the elevated position until a sufficient quantity adheres to the belt-surface, when the pan will be lowered until a new or further supply is wanted on the belt. Such new or further supply of batter to the belt-surface may be required and applied after that first applied has become partially dried and set, so as to assist in retaining an additional quantity, or after that first applied has been dried and removed. If, as may be the case in the use of a belt of sufficient length and of an adequate heat, the drying is completed in a single revolution of the belt, the application of the batter may be made continuous, and this will be done by holding the pan in the raised position and continuing the supply thereto from the tank T. Ordinarily, after one application of batter to the belt, covering its entire surface, the supply will be discontinued and the belt will be revolved several times before the substance thereon will be dry enough to be removed. While the belt is thus revolved hot air is admitted from the furnace-flue J' , and discharged as it becomes laden with moisture at the outlet J^3 . With the outlet located as shown the air-current will generally be in the direction of the arrows a ; but as the belt is narrower than the well said belt is obviously exposed on all sides to the heated air.

During the earlier part of the drying process, and while the latter is yet in a more fluid state, said batter is disposed to flow on the belt, wherefore I have made the lower drum, D, larger than the upper one, D' , or have thrown the lower end of the belt out beyond the upper. This feature of construction lessens the tendency of the batter to flow, and in case it does flow causes any portion of the batter that may be detached to drop back on the belt at a lower point. It is most important that the descending side of the band be thus inclined, as the thickness of the nearly dry material is made uniform and the presence of undried lumps avoided.

The roller E, which bears against the belt

B and is thereby rotated, plainly operates to respread the mass on said belt at every revolution thereof, and thus to crush the lumps above referred to, and to maintain an even distribution of the egg substance on the belt, favorable to its uniform drying throughout. In doing this the drying process is itself materially hastened, since the roller necessarily disintegrates, breaks up, and stirs the mass being dried, and thus exposes continually new surfaces of such mass to the action of the heated air. In the later stages of the drying process, as performed on the belt, said roller also contributes to another and very important effect—namely, the granulation or crystallization of the substance being dried, to which end it operates by the stirring action referred to, which has its analogy in the operation or stirring in the manufacture of sugar from sirup. In the case of egg substance, moreover, whether composed of the whites and yolks together, or of either separately, or of either or both combined with saccharine matter, there is a tendency to rapid expansion of the albuminous portion or cells, and thus to their escape and loss in the form of fine dust or flakes. Frequent mixing, “working,” and spreading of the mass by the roller E or equivalent device, as the drying process goes forward, serve to prevent this undue expansion, unequal evaporation, and separation, and thus to retain the albumen as a most desirable element, thoroughly incorporated in the finished product. Not only this, but the albumen thus stirred in while being dried seems, in connection with the sugar, to take a crystalline form, favorable to its ultimate reduction to powder. If several revolutions of the belt are made to complete the drying process the scraper S is held during such process in a vertical position away from the belt, as stated, and as indicated in dotted lines. When the egg substance is sufficiently dried to be removed the scraper is pressed against the belt by means of the lever S', or by means of a spring, or otherwise. The loose drum or roller D² meets the pressure of the scraper and prevents the belt from being unduly deflected and stretched, and also insures a more perfect action of the scraper. Being arranged as shown, the scraper S forms an inclined chute, prolonged by the metal apron s, which serves to direct the detached egg substance into the spout S², by which said substance is conveyed out of the well A. As a result of this process the egg or other material is usually taken from the belt in such a state of dryness as to be broken up into coarse fragments by the action of the scraper in removing it. In this broken or fragmentary condition it is fit to be subjected, if necessary, to further and final drying preparatory to being ground and packed for market.

For the purpose of the final drying I have provided the large inclosed square chamber I, Figs. 1 and 2, upheld over the furnace J by the posts I². In this chamber are placed one or more large circular drying-pans, G G'. Fig.

1 shows two such pans arranged one above the other. The upper may, if preferred, have a bottom of perforated metal, perforations being indicated at $g' g'$. It also has a large central aperture, g , by which the substance being dried passes to the lower pan, G'. The latter has a discharge-opening, G², at its circumference, which is here shown to lead out of the chamber I, and may lead directly to the grinding-mill. (Not shown.) The spout S² discharges into the upper pan, G, at its periphery. Through the center of the pans G and G' rises a shaft, H², adapted to be rotated through the bevel-gear h' , or otherwise, and provided with arms H H', respectively bearing wings $h h$, which sweep about in the drying-pans in the direction of the arrows d' . The wings $h h$ are set obliquely on the arms, to which they are secured, and serve to stir the substance being dried, and also, by their obliquity, to gradually carry the same to the discharging-apertures of the several pans. Thus the wings h on arm H carry the substance received at the periphery of the upper pan, G, inward to the aperture g , and the wings h carry it outward in the lower pan, G', to the discharge G².

Hot air is admitted to the chamber I from the furnace J through the flue J², and finds escape from said chamber at I³, preferably provided with a sliding door or register, I⁴, to regulate the outflow.

There is nothing essentially new in the construction of the supplemental drying apparatus itself, as described; but it is new in the combination shown, and it moreover illustrates a step in my process which is also new.

In the foregoing description of my improved process as performed by the apparatus herein set forth, I have supposed the substance operated upon to be an egg-batter composed of the whites and yolks of eggs and a quantity of sugar. I wish it to be understood that I am not limited as to my process to the treatment of this particular egg-batter, as said process is equally applicable to the desiccation of the whites and yolks, either together or separately, and to either or both of these with or without saccharine or other substance; nor do I wish to be limited, either as to my process or as to the use of my machine, to the desiccation of eggs, since said apparatus and process are obviously equally applicable to the drying of other than egg substances that may be made to adhere to a belt. I further do not wish to be limited to the vertical arrangement of the belt, except in those claims wherein this arrangement is made an essential feature.

The belt B may obviously be made of thin metal or of any other flexible and otherwise suitable material. I prefer to use cloth for the reason that cloth gives a better hold to the substance being dried, whereby said substance, when partially dried, is less liable to be detached by being repeatedly bent with the belt over the drums and then straightened out again between the drums. Wherefore the drying process may be carried farther in the

well A with a belt of cloth or similar material than with a metal belt, and the substance may therefore be brought to a condition on the belt in which it is adapted to break up or separate in fragments in the act of removal, whereby it is better fitted for the supplemental drying.

While I have referred to a belt or band as being used in connection with the device for disintegrating the film, such device may be used with any other film-carrier—as, for instance, a roller or plate; and although I have referred to and prefer a roller for breaking up the films, other devices may be used with like effect—as, for instance, a series of vibrating plates or blades brought against the film and moved away therefrom as it is moved by the carrier.

While for many purposes it is desirable to use heated air, for other purposes the air may be cold. A strong blast is sometimes desirable. At other times the desiccation may be effected without any artificial heating or moving of the air, and in some instances the products of combustion may be taken directly from the furnace to and through the drying-chamber.

Other means than those described may be used for depositing the liquid material upon the surface of the carrier. For instance, when the belt is horizontal, or nearly so, it may pass beneath a hopper, from which the material falls upon the belt.

I am aware that in treating paper-pulp and other mixtures the same have been dried by simultaneously heating and agitating or stirring. This, however, is not my invention, which requires that before any disintegration the substance be in a semi-hard or viscid state, and then worked or agitated, while drying, until reduced to the form of thin hard particles or powder.

I claim—

1. The within-described improvement in treating eggs and other liquid or semi-liquid

substance, the same consisting in first treating the substance until it is in a viscid, semi-hardened condition, and then mechanically disintegrating the same while drying, substantially as set forth.

2. In the desiccation of eggs and other liquid or semi-liquid substance, first subjecting such substance, while upon a carrying-surface, to the action of air or gas until it is in a viscid or partially-hardened condition, and then completing the hardening and breaking up or reduction to powder by working or disintegrating the same, while drying, by contact with one or more blocks or blades, whereby the film is broken and disintegration is effected.

3. The combination, in a desiccating apparatus, of a band, means for depositing on the same a film of the material to be dried, appliances whereby said film is subjected to the action of drying or hardening gases, and means whereby the film upon the band is stirred and broken after partial hardening, and prior to removal, substantially as set forth.

4. The combination, in a desiccating apparatus, of the shaft or casing, heating or drying appliances, traveling band B, roller E or its equivalent, and roller-carrier, constructed to permit the roller to be thrown into or out of contact with the band, substantially as set forth.

5. The combination, with the casing, heating or drying appliances, and endless belt B, of the scraper S, arranged to bear on the moving surface of the belt, and a support arranged to oppose the pressure of the scraper, substantially as set forth.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

LYDIA J. CADWELL.

Witnesses:

M. E. DAYTON,
HERBERT VANDYKE.