No. 814,666. PATENTED MAR. 13, 1906.

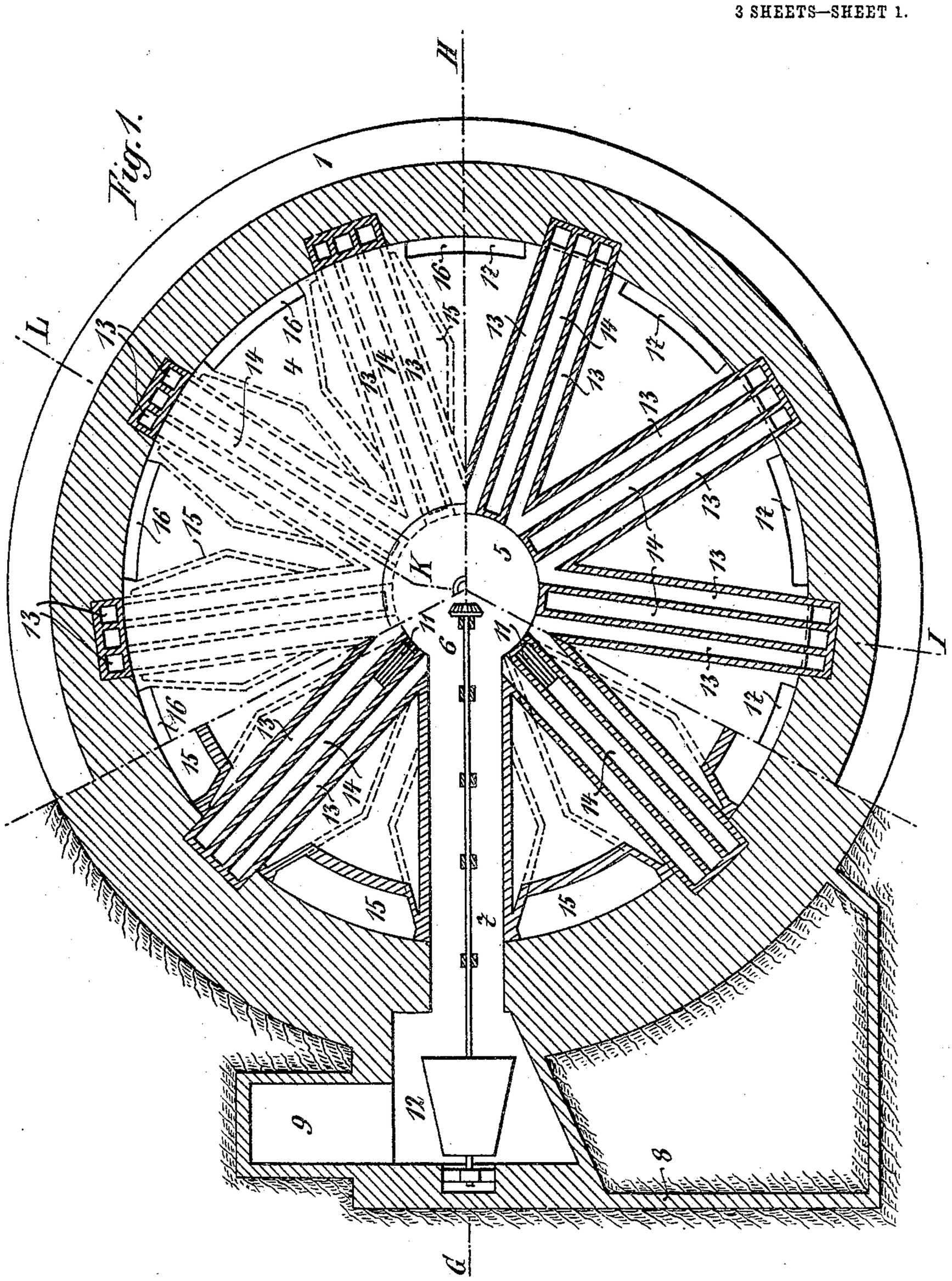
W. BELL.

DRYING APPARATUS.

APPLICATION FILED AUG. 23, 1904.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

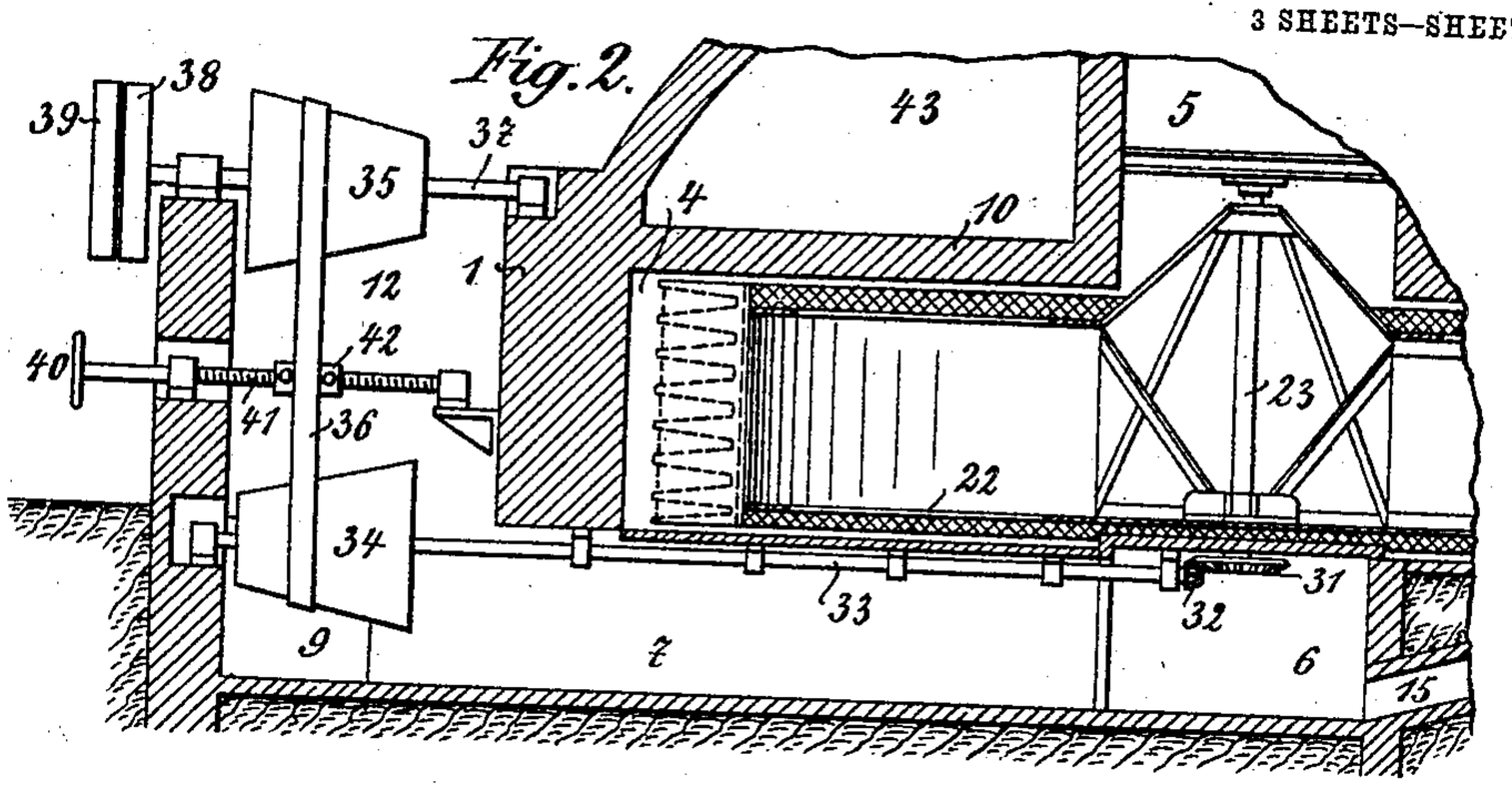
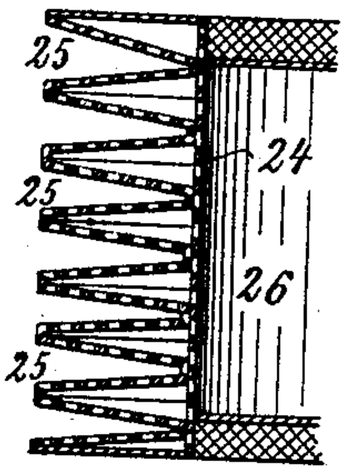


Fig. 4.



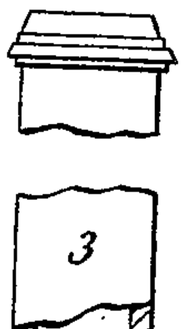
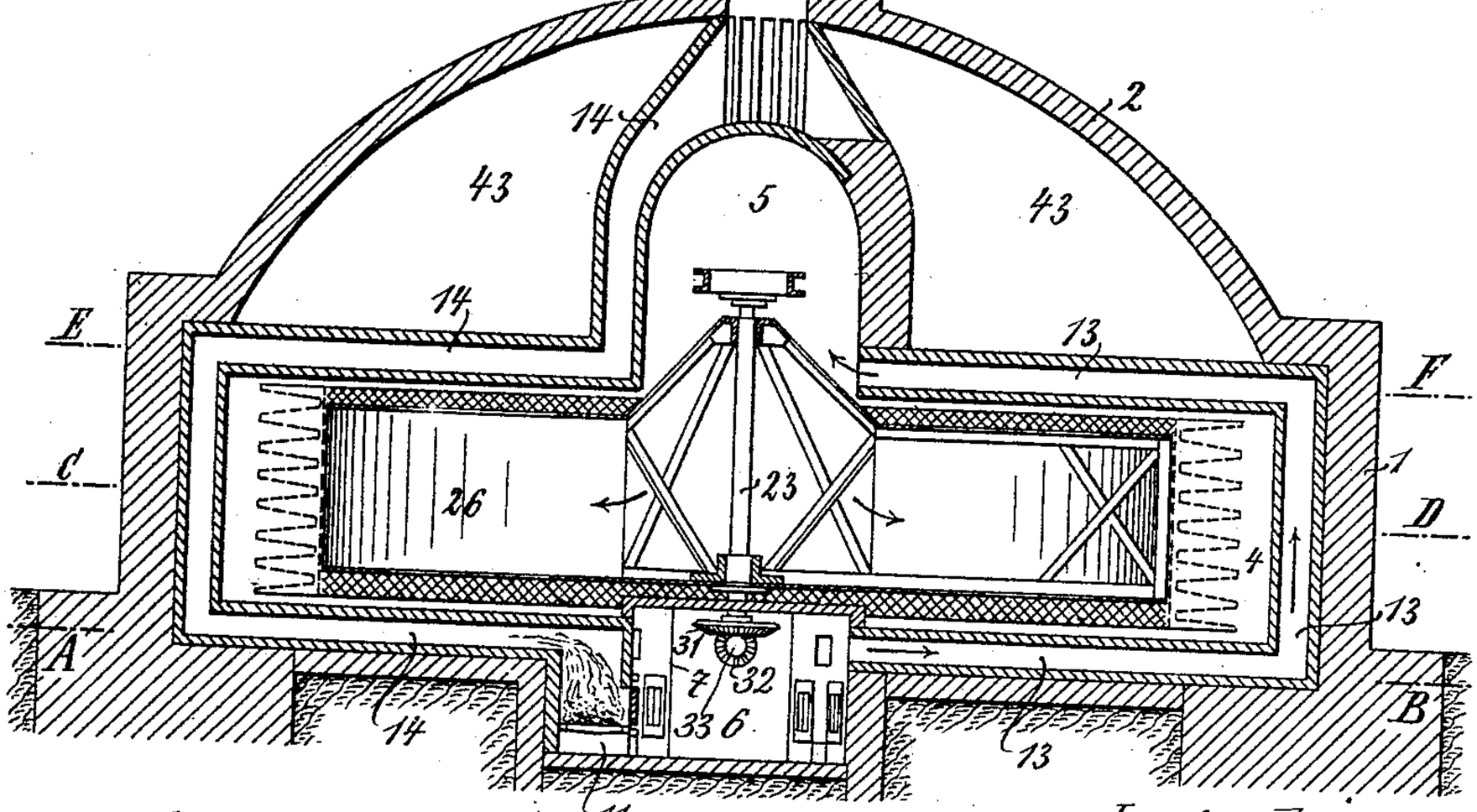


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 5.

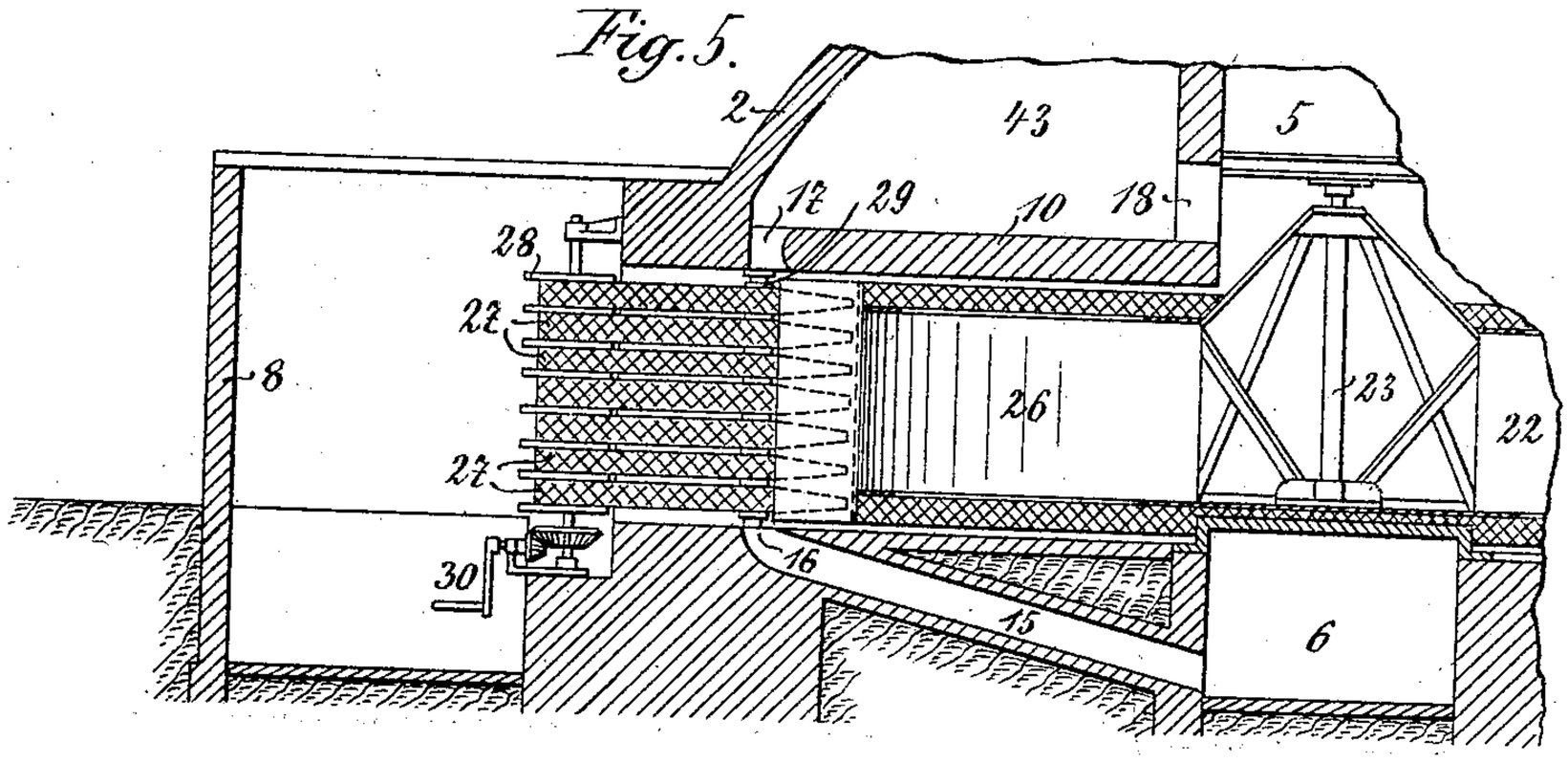
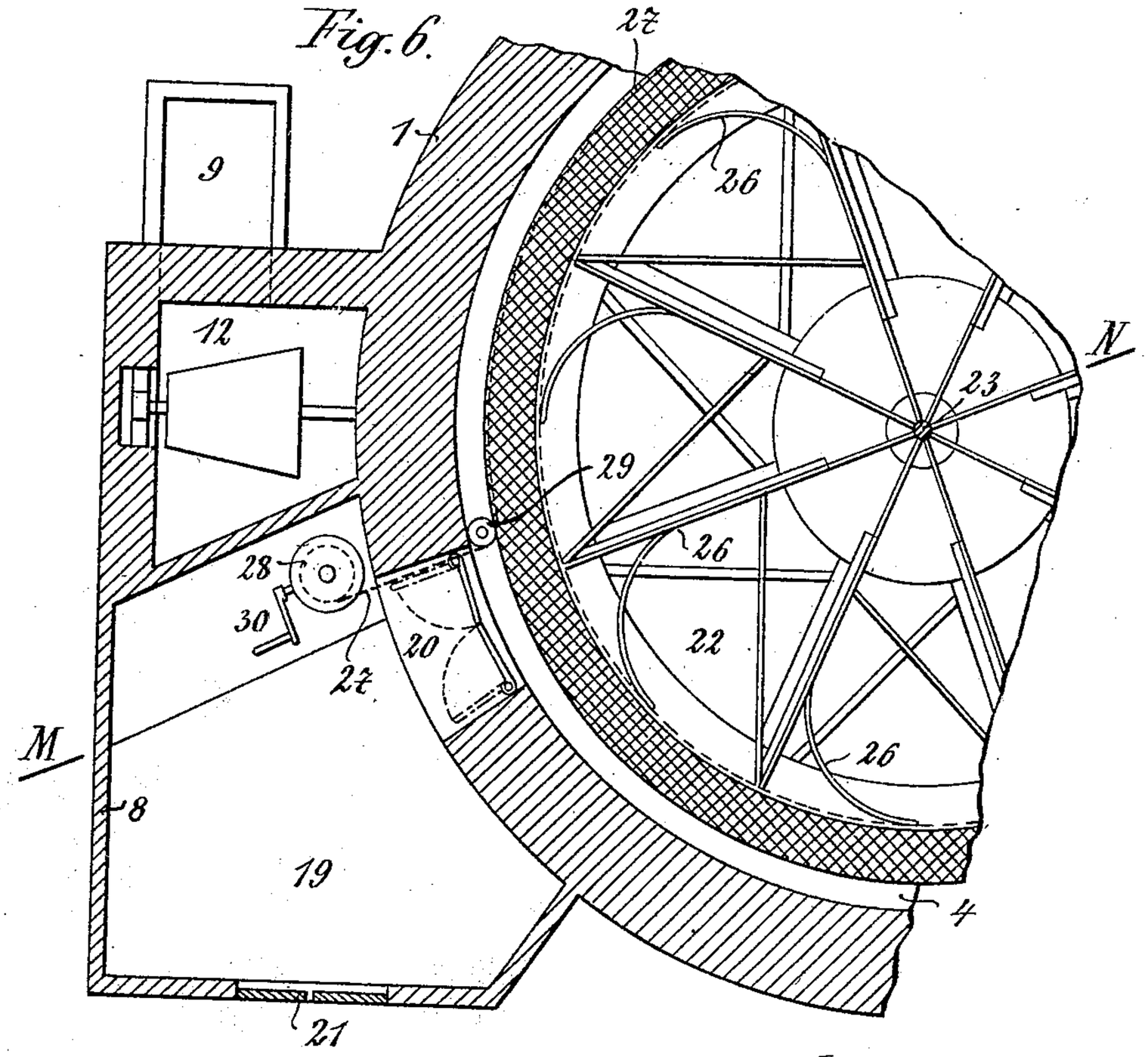


Fig. 6.



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UNITED STATES PATENT OFFICE.

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DRYING APPARATUS.

No. 814,666. Specification of Letters Patent. Patented March 13, 1906.

Application filed August 23, 1904. Serial No. 221,838.

To all whom it may concern:

Be it known that I, WILHELM BELL, a citizen of the Empire of Germany, residing at Burgbrohl-on-the-Rhine, in the Empire of Germany, have invented a new and useful Drying Apparatus, of which the following is a specification.

Hitherto it was frequently not possible to at once and safely store upstanding crops, fresh hay, and other agricultural products before rain or wet weather set in, as these products required to be first dried and there were no means for drying them.

My invention relates to a drying apparatus in which the agricultural products—such as crops, hay, and the like—also other things—such as, for instance, industrial products—can be quickly freed from their moisture and dried, so that they may be stored up or otherwise disposed of.

The objects of my invention are, first, to dispose within a circular drying-chamber a perforated large drum mounted to turn around a vertical axis and provided externally with a plurality of grooves adapted for receiving the products to be dried and formed of perforated plates or wire fabric; second, to provide this large drum internally with a plurality of ladles similar to those in a ventilating-fan; third, to provide in the wall of the circular drying-chamber a door for charging and discharging the large drum; fourth, to provide means for applying perforated straps on the products in the grooves of the large drum and for removing them; fifth, to provide means for putting the drum into rotation at a convenient varying speed; sixth, to provide in a central space beneath the circular drying-chamber a plurality of furnaces and to conduct the fire-gases in flues disposed radially in the floor, vertically in the cylindrical wall, and radially in the cover and terminating in a chimney; seventh, to provide a plurality of air-channels on the sides of the flues and communicating with the central space beneath the circular drying-chamber and with a central space in the cover of the drying-chamber; eighth, to provide beneath the circular drying-chamber a plurality of radial channels communicating with the same at the periphery and with the lower central space, and, ninth, to provide means for the circulation of the hot air through the large drum and above the cover of the drying-chamber. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is on the left part a horizontal section through the drying apparatus on the line A B in Fig. 3, on the upper right part a horizontal section through the same on the line C D in Fig. 3, the drum being omitted, and on the lower right part a horizontal section through the same on the line E F in Fig. 3. Fig. 2 is a vertical section through a part of the same on the line G H in Fig. 1. Fig. 3 is a vertical section through the same on the broken line I K L in Fig. 1, part of the chimney being omitted. Fig. 4 shows, on an enlarged scale, a vertical section through the drum-wall and its grooves. Fig. 5 is a vertical section through a part of the drying apparatus on the line M N in Fig. 6, and Fig. 6 is a horizontal section through the same on the line C D in Fig. 3.

Similar characters of reference refer to similar parts throughout the several views.

The drying apparatus comprises a circular building 1, of brickwork, with a dome 2, a chimney 3, a circular drying-chamber 4, having a central upper space 5, a lower central space 6, and a tunnel 7, further, an external building 8 and an air-shaft 9. I have not shown more particularly the construction of the cover 10 of the drying-chamber 4, as it is immaterial for the present invention. In the wall of the lower central space 6 several (here eight) furnaces 11 11 are disposed, to which the air is supplied from without through the air-shaft 9, the space 12 in the building 8, and the tunnel 7. Eight flues 14 14 are disposed radially in the floor and vertically in the wall 1 of the drying-chamber 4, further, radially in the cover 10 and vertically in the wall of the upper central space 5 for conducting the fire-gases from the furnaces 11 11 to the common chimney 3. On both sides of each flue 14 two air-channels 13 13 are disposed, which communicate with the upper part of the lower central space 6 and with the lower part of the upper central space 5. Eight inclined air-channels 15 15 are disposed beneath the drying-chamber 4 and communicate with the lower part of the lower central space 6 and with the drying-chamber 4 through openings 16 16 at the periphery. Above these openings 16 16 similar openings 17 17 are disposed in the cover 10 and other openings 18 18, Fig. 5, in the wall of the upper central space 5. A communication be-

tween the drying-chamber 4 and the space 19 within the building 8 can be established through a door 20, and another door 21 is provided for the admittance to the space 19.

Within the drying-chamber 4 a large drum 22 of any convenient construction is arranged to turn with its vertical axle 23 in suitable bearings of any known construction. The cylindrical wall 24 of the drum 22 is perforated and may be made of perforated metal sheets or wire fabric. On the external face of the wall 24 several (here seven) grooves 25 25 of preferably triangular cross-section are formed by means of conical rings made either of perforated metal sheets or of wire fabric. Within the large drum 22 a convenient number of ladles 26 26, similar to those of a ventilating-fan, are disposed. The products to be dried in the grooves 25 25 of the large drum require to be secured against being thrown off by their centrifugal force during the rotation of the drum. For this purpose perforated straps 27 27, of elastic material—say wire fabric strengthened with wire ropes on the edges—are employed, which can be detachably fastened on the walls of the drum-grooves 25 25 and on a vertical operating-drum 28 within the space 19 by any known means, such as hooks, bolts, or the like. They are led over a guiding-roller 29, and the door 20 is so arranged as to permit the straps 27 27 to pass through when open. The vertical drum 28 can be rotated by means of a hand-crank 30 and suitable bevel gear-wheels. The large drum 22 can be put into rotation by means of two bevel gear-wheels 31 32, a horizontal shaft 33 in the tunnel 7, two cones 34 and 35, a belt 36, a shaft 37, and a driving-pulley 38, a loose pulley 39 being provided for stopping the drum 22. By shifting the belt 36 with the aid of a hand-wheel 40, a screw-spindle 41, and a threaded fork 42 the speed of the large drum 22 can be regulated.

The drying apparatus is operated as follows: The drying-chamber 4 is heated by firing the eight furnaces 11 11 while admitting air through the shaft 9 and the tunnel 7 to the lower central space 6. The fire-gases pass upward through the flues 14 14 to the chimney 3 and heat the floor of the drying-chamber 4, the walls 1 of the building, the cover 10, and the wall of the upper central space 5, of course also the walls of the adjacent air-channels 13 13. The air is preliminarily heated in the tunnel 7 before it enters the central space 6, from whence it passes through the several air-channels 13 13 while being further heated. The hot air leaving these channels 13 13 enters the upper central space 5 and the large drum 22 in the direction of the arrows in Fig. 3. Of course it can also enter the space 43 beneath the dome 2 through the openings 18. The goods or products to be dried are transported from without to the space 19 through the opened door 21, after which the latter is closed and that 20 opened. Then the hot air will be prevented from escaping to without and getting lost. The products are successively introduced into the grooves 25 25 of the large drum 22, while the latter is slowly turned by hand, so that it will unwind consecutively all the straps 27 27 from the operating-drum 28. When the drum-grooves 25 25 are full, the ends of the straps 27 27 are detached from the operating-drum 28 and secured on the groove-walls. Then the door 20 is closed and the driving-pulley 38 is started to put the large drum 22 into rotation. During this rotation the ladles 26 26 will exert a pressure upon the air to force it outward through the drum-wall. The hot air will then pass from the upper central space 5 through the large drum 22 and through the perforations of the drum-wall 24 and those of the walls of the grooves 25 25, then through the products to be dried and through the perforations of the securing-straps 27 27 into the space around the drum 22. Both the centrifugal force and the current of the hot air will quickly expel the moisture from the products and throw it off, after which the hot air will soon dry the products. The air saturated with the moisture will sink through the openings 16 16 and go downward through the channels 15 15 to the lower central space 6, while the dry air will go upward through the openings 17 17 into the space 43 and thence through the openings 18 into the central space 5 to repeat its circulation. Sometimes hot air may sink from the space 43 through the openings 17 17 into the space around the drum 22 and pass with the saturated air downward through the channels 15 15 into the lower central space 6. This air will then partly enter the furnaces 11 11 and partly be further heated during the passage through the channels 13 13 upward. When the products are sufficiently dried, the large drum 22 is stopped and the door 20 opened. Then the ends of the straps 27 27 are detached from the large drum 22 and attached to the operating-drum 28, and the hand-crank 30 is turned to unwind the straps 27 27 from the large drum while the dried products are taken off. Afterward the large drum is charged with fresh products and the whole series of occurrences described will repeat. It will be seen that the fire-gases are prevented from mixing with the hot air, which is frequently of special advantage for the products to be dried.

The drying apparatus may be varied in many respects without deviating from the spirit of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination with a circular drying-chamber, of means for heating said drying-

chamber, a drum perforated on the periphery and mounted to turn around a vertical axis in said circular drying-chamber, a plurality of perforated rings on the periphery of said drum to form a plurality of grooves adapted to receive goods or products to be dried, a plurality of detachable perforated straps for securing the goods or products, and means for driving said drum.

2. In a drying apparatus, the combination with a circular drying-chamber, of means for heating said drying-chamber, a drum perforated on the periphery and mounted to turn around a vertical axis in said circular drying-chamber, a plurality of perforated rings on the periphery of said drum to form a plurality of grooves adapted to receive goods or products to be dried, a plurality of perforated detachable straps for securing the goods or products, a plurality of ventilating-ladles within said drum and adapted to force the hot air through the drum-wall, and means for driving said drum.

3. In a drying apparatus, the combination with a drum mounted to turn around a vertical axis in a circular drying-chamber and having its peripheral wall made of wire fabric, of means for rotating said drum, a plurality of rings of wire fabric arranged on the periphery of said drum to form a plurality of grooves adapted to receive goods or products to be dried, a plurality of detachable straps of wire fabric strengthened with wire ropes for securing the goods or products in the drum-grooves, an operating-drum adapted to wind on said plurality of detachable straps from said drum and to apply same on the latter, a plurality of ventilating-ladles inside said drum and adapted to force the hot air through the drum-wall, and means for heating the circulating air.

4. In a drying apparatus, the combination with a circular drying-chamber having a central dome, of a central space beneath said circular drying-chamber, an air-shaft leading from without to said central space, a plurality of furnaces around said central space, a plurality of flues leading from said plurality of furnaces radially in the floor, vertically in the peripheral wall and radially in the cover of said circular drying-chamber and upward in the wall of said central dome to the chimney, a plurality of air-channels on the sides of said plurality of flues and communicating with the upper part of said central space and with said central dome, a plurality of inclined air-channels communicating with the lower part of said central space and with said circular drying-chamber at the periphery, a drum perforated on the periphery and mounted to turn around a vertical axis in said circular drying-chamber, a plurality of perforated rings on the periphery of said drum to form a plurality of grooves adapted to receive goods or products to be dried, a plurality of perforated detachable straps for securing the goods or products, a plurality of ventilating-ladles inside said drum and adapted to force the hot air through the drum-wall, a charging and discharging door in the wall of said circular drying-chamber, an operating-drum adapted to wind on said plurality of detachable straps from said drum and to apply same on the latter, and means for rotating said drum at a convenient varying speed.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILHELM BELL.

Witnesses:

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JOH. SCHULZ.