

No. 770,823.

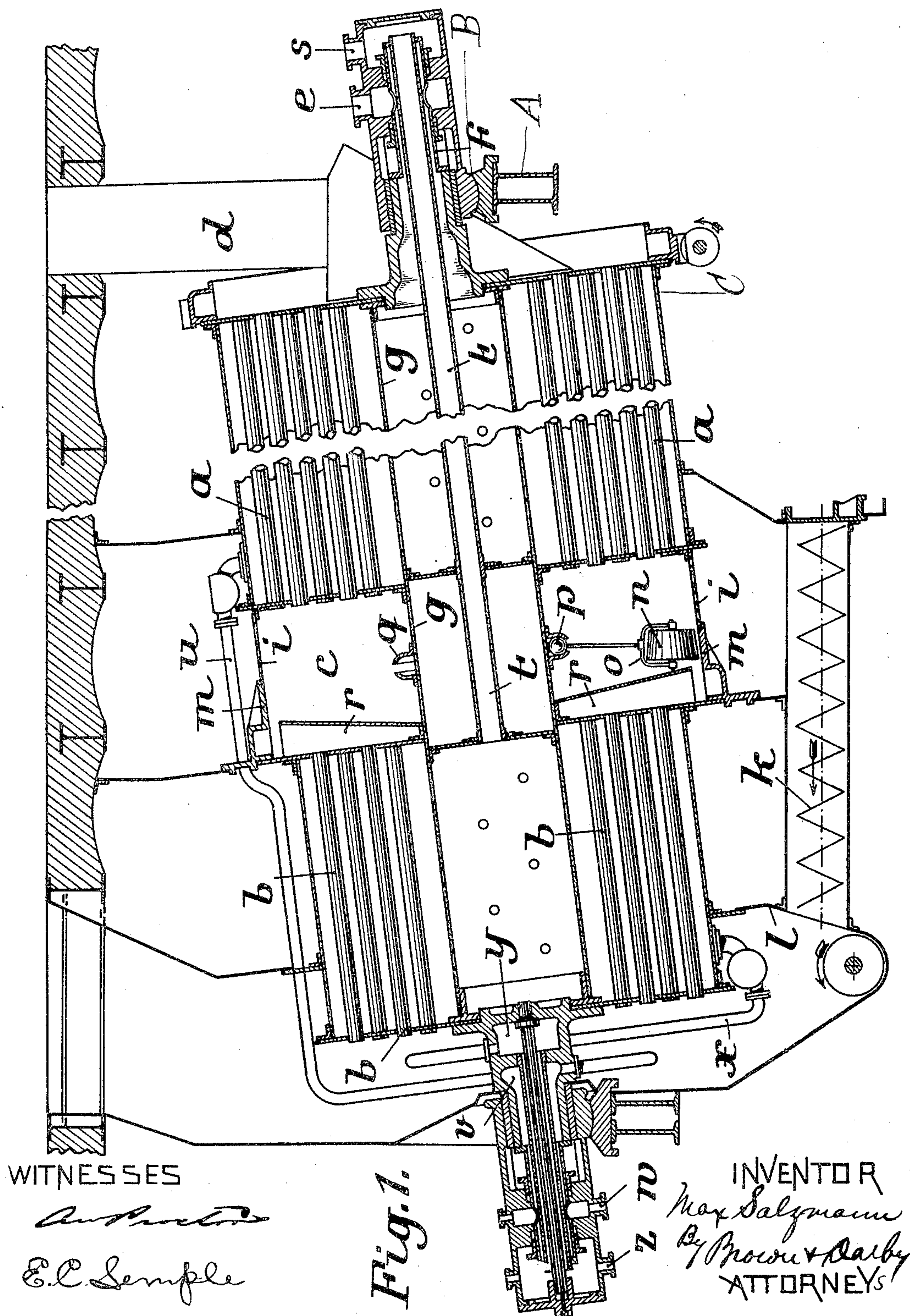
PATENTED SEPT. 27, 1904.

M. SALZMANN.
TUBULAR DRYING APPARATUS.

APPLICATION FILED JULY 18, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



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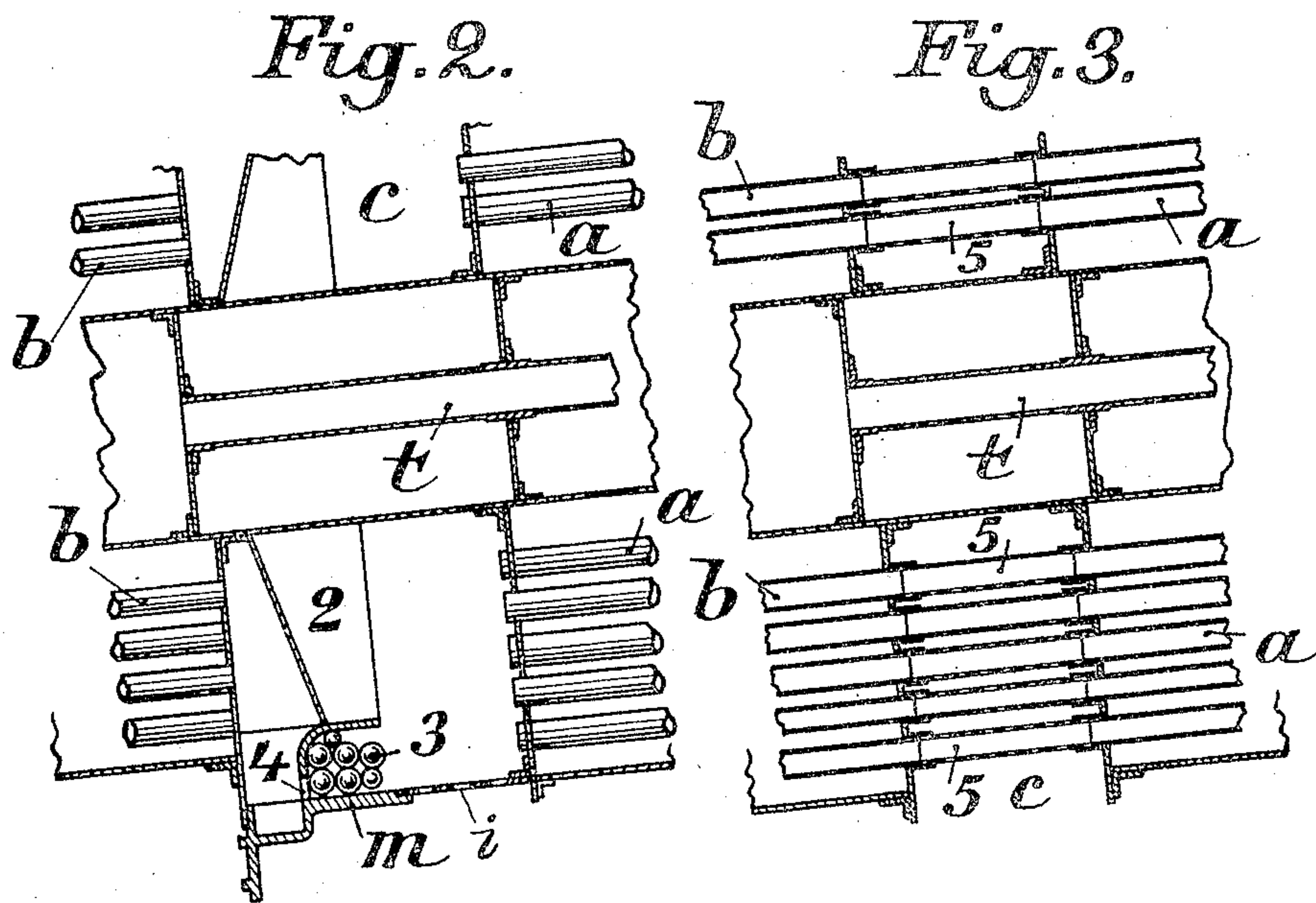
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NO MODEL.

3 SHEETS—SHEET 2.



WITNESSES

Arthur
E. C. Sample

INVENTOR
Max Salzmann
By *Proctor & Darby*
ATTORNEYS

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3 SHEETS—SHEET 3.

Fig. 5.

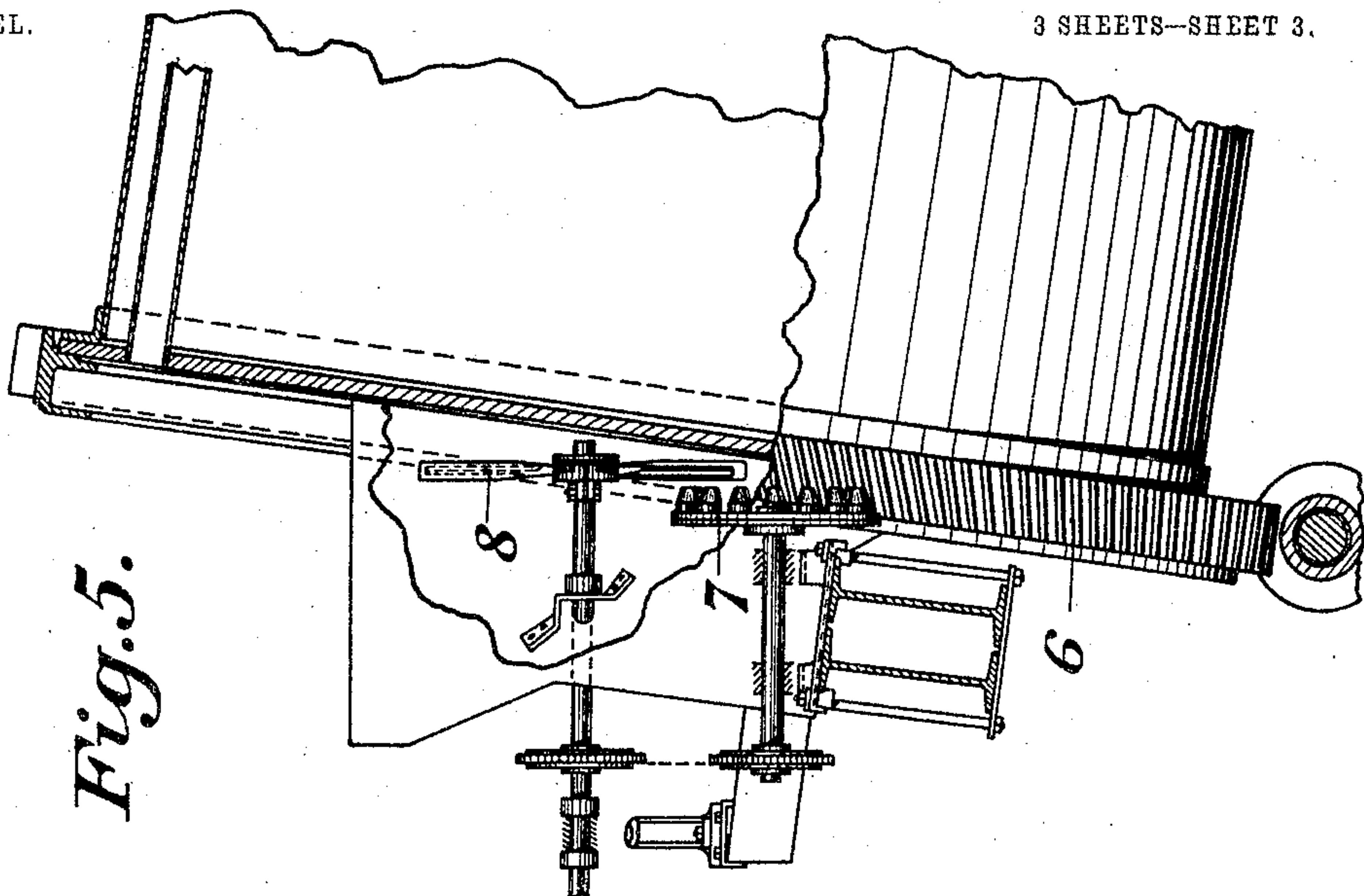
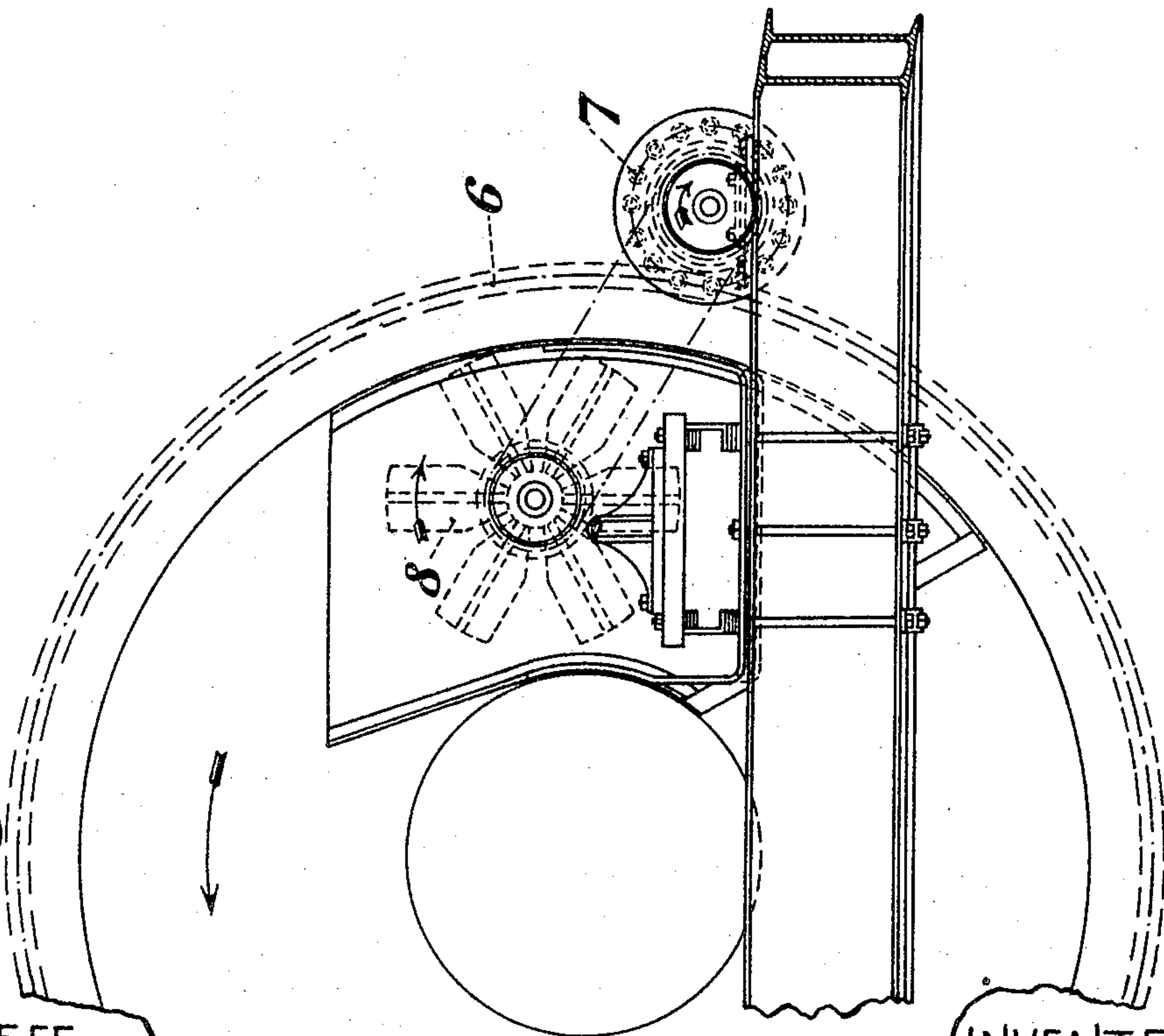


Fig. 4.



WITNESSES

Arthur

E. C. Lemple

INVENTOR

Max Salzmann

By Brown & Darby
ATTORNEYS

UNITED STATES PATENT OFFICE.

MAX SALZMANN, OF MAGDEBURG-BUCKAU, GERMANY.

TUBULAR DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 770,823, dated September 27, 1904.

Application filed July 18, 1903. Serial No. 166,144. (No model.)

To all whom it may concern:

Be it known that I, MAX SALZMANN, manager, a subject of the King of Prussia, Emperor of Germany, residing at 82 and 83 Schönebeckerstrasse, Magdeburg-Buckau, Prussia, Germany, have invented a new and useful Tubular Drying Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In the manufacture of fuel and other briquets it is usual to employ a raw material which is more or less damp and accordingly unfit for use until properly dried. This has been accomplished by the use of drying apparatus; but it is found that the loose dust and the smaller particles dry more rapidly than the larger particles or granules. Accordingly it is customary to separate the dust and loose particles out of the mixture after partly drying the same and then subject the remaining granules and larger particles to a second drying operation.

The present invention relates to a tubular drying apparatus, which is so constructed that the aforesaid method can be carried out continuously in a single apparatus, whereas it was formerly necessary after the material had passed once through the apparatus to separate dust and granules and then to pass the latter again through the same or another apparatus.

My invention consists, substantially, in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a longitudinal vertical section through a tubular drying apparatus made according to this invention. Figs. 2 and 3 are like sections showing modifications, those parts which are of the same construction as that shown in Fig. 1 having been cut away. Fig. 4 is an end elevation, and Fig. 5 a side elevation, partly in section, of the end of the apparatus, having fitted to it a special feeding device.

Throughout the figures of the drawings the same part is designated by the same reference-sign.

A designates the supporting-frame of the apparatus, and B designates journals or bearings thereon, in which is rotarily mounted the tubular casing or receptacle which constitutes the drying apparatus proper. The frames A A, together with the journal-bearings B B, are arranged to support the casing or receptacle in a somewhat-inclined relation, whereby material placed therein tends to gravitate from one end to the other of the receptacle. I prefer to form this casing or receptacle with a plurality of longitudinally-arranged tubes or passages, and I have shown a convenient form of this arrangement in which the casing C is provided with a plurality of tubes *a* and *b*, which extend inward from the ends of the casing or receptacle.

Reference-sign *c* designates a chamber intermediate the respective series of tubes *a* and *b*, and the material from the tubes *a* is delivered into this chamber previous to its passage into the tubes *b*. The tubes *a* and *b* respectively constitute separate drying devices for the material, and for this purpose I prefer to employ some means for heating these respective series of tubes. I have shown a convenient arrangement for this purpose, to which, however, I do not desire to be limited or restricted, in which the tubes or passages *a* and *b* are arranged in steam-tight drums or heaters at each end of the casing or receptacle, and I provide means by which steam is admitted into the respective drums for the purpose of heating the same, together with tubes *a* and *b*, to any required degree of temperature.

Reference-sign *e* designates the inlet-pipe for the steam supplied to the drum surrounding the tubes or passages *a*, and I have shown an arrangement by which the steam is supplied from the stationary pipe into the rotating casing. For this purpose the inlet-pipe *e* is connected to a sleeve or bushing upon one trunnion of the receptacle or casing. This sleeve or bushing is made steam-tight upon the trunnion by any suitable or convenient packing, and steam is admitted into the cas-

ing through the pipe *f*. An intermediate tubular shell *g* is sometimes provided for the purpose of more convenient construction; but in this case suitable openings should be made
5 therein in order to allow the steam to pass into the outer casing and surround the tubes or passages *a*.

Reference-sign *s* designates an additional steam-pipe, through which steam is admitted into the pipe *t*, which forms a part of
10 and rotates with the main casing or receptacle C. The pipe *s* is mounted on the same sleeve or bushing as the pipe *e* and is connected in steam-tight relation with the said
15 pipe *t* by any suitable stuffing-box or packing. The pipe *t* leads into the chamber surrounding the pipes *b*, so that the pipes *b* are heated from a separate source of steam-supply than the pipe *a*. This allows for the employ-
20 ment of steam of different pressure in the two chambers, so that one may be heated to a greater extent than the other, if desired.

Reference-signs *u* and *x* respectively designate drain-pipes extending from the respec-
25 tive steam-chambers and which lead into separate cavities *v* and *y* in the lower trunnion of the main casing or receptacle C. These cavities respectively communicate with stationary discharge-pipes *w* and *z*, which are
30 mounted in a sleeve or bushing upon the lower trunnion in a manner similar to the pipes *e* and *s*. The pipes *w* and *z* may be connected to any suitable condensers or steam-traps in order to drain off the water in the
35 steam-chambers. It will be observed that the water from the condensed steam is enabled to drain into the pipes *u* and *x* by reason of the rotation of the casing C, acting to remove a certain amount of water at each revolution
40 thereof.

Reference-sign *d* designates a hopper from which the material is led to the upper end of the rotary casing C. From this hopper the material passes into the tubes or passages *a*
45 and gravitates helically therethrough by reason of the rotation of casing C until the material finally drops into the intermediate chamber *c*.

Reference-sign *i* designates a perforated
50 peripheral plate of the chamber *c*, upon which the material from the tubes *a* falls and through which the finer or loose particles and dust drop continuously as the casing C rotates.

Reference-sign *k* designates a trough dis-
55 posed below the perforated plate *i* and from which the material is fed by a worm or other means into the main discharge-trough *l*.

In order to thoroughly disintegrate and comminute the material remaining in the cham-
60 ber *c*, I employ a roller *n*, carried in a frame *o*, suspended from a ball or roller *p* in a raceway *q*. This is a convenient construction, for the reason that it permits the roller to act upon the material in the chamber *c*, the roller

or ball *p* moving around the raceway *q* for 65 this purpose.

Reference-sign *m* designates an annular trough into which the comminuted material passes and from which it presently drops into
70 troughs *r*, arranged on the face of the lower steam drum or casing. The material gravitates through the tubes or passages *b* in a manner similar to the action of the tubes *a* and finally drops into the discharge-trough *l*, from
75 which it passes out of the machine, together with the material from the trough *k*, of which I have already spoken.

The operation of the above-described apparatus will be understood from the preceding
80 description. The damp and mixed material is first fed in at the hopper *d*, from which it passes into the drying-tubes *a*. Here it is subjected to the drying action of the steam in the surrounding chamber, so that when the material finally drops into the chamber *c* the
85 loose or finer particles are sufficiently and properly dried. At this point the sieve or perforated plate *i* comes into action and separates out such loose or finer particles, which at once drop into the trough *k* and thence into
90 the discharge-trough *l* and pass out of the machine. The remaining material—that is to say, the coarser particles or granules—is first disintegrated or comminuted by the roller *n* and then passing into the tubes *b* is subjected
95 to the action of the second heating-chamber and additionally dried until it also drops into the discharge-trough *l* and out of the machine. It will be seen that the operation is entirely
100 automatic and that each particle of the raw material, whether coarse or fine, is dried to the proper degree and only to such degree at the time of its discharge from the machine. While I have referred to the chambers sur-
105 rounding the tubes *a* and *b* as “steam-chambers,” it is obvious that they may be heated by air-currents or waste gases or products of combustion or heated currents of water or other liquid or by any circulating medium.

In Fig. 2 I have illustrated a slight modifi-
110 cation, in which a number of balls 3 are employed for the purpose of comminuting or disintegrating the coarser material or granules in the chamber *c*, and these balls are arranged to roll around the casing in a raceway
115 formed by the casting *m*. In order to permit the escape of the material acted upon by the balls 3, I provide a series of openings or passages 4 in the frame or casting *m* and through which the comminuted material
120 passes in order to enter the tubes *b*. In Fig. 3 I have illustrated a still further modification, in which the tubes *b* practically form a continuation of the tubes *a*. For this purpose a series of perforated tubes 5 are pro-
125 vided in the chamber *c* and which connect the ends of the tubes *a* and *b*. This construction is adapted to the treatment of material in

which it is not necessary to provide comminuting or disintegrating means to act after the preliminary drying operation. In this case the fine, loose, or dried particles pass through the openings in the tubes 5 and thence drop into the trough 4 in the same manner as above described.

In some cases it is desirable to provide means by which the raw material is positively fed into the apparatus. I have shown a convenient arrangement for this purpose in Figs. 4 and 5, in which 8 designates a rotary feed wheel or disk having a series of inclined blades which act upon the material to force, crowd, or push the same into the tubes *a* of the revoluble casing or receptacle. The feed-disk 8 may be driven by any suitable or convenient means, and I have shown an arrangement by which it is connected to the main drive-shaft of the apparatus. Numeral 6 designates a large worm-wheel upon the casing or receptacle C, which may be employed in connection with any suitable worm-wheel to drive the device. Numeral 7 designates a pinion formed to mesh with the teeth of the worm 6, and any suitable sprocket-chain connection may be employed to drive the feed-disk 8 from the pinion 7.

It is obvious that many variations and changes in the details of construction would readily occur to any one skilled in the art and still fall within the spirit and scope of my invention. I do not, therefore, desire to be limited or restricted to the exact details shown and described; but,

Having now set forth the object and nature of my invention, and a construction embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. In a drying apparatus, a revoluble casing or receptacle, a plurality of passages therein, means for heating the passages, and a plurality of openings arranged to constitute a sieve at an intermediate point of the said passages, as and for the purpose set forth.

2. In a drying apparatus, a revoluble casing or receptacle, a series of inlet-passages therein, a series of outlet-passages in the said casing, and means for heating said inlet and outlet passages, and means intermediate said inlet and outlet passages arranged to constitute a sieve, and into contact with which the material is led, as and for the purpose set forth.

3. In a drying apparatus, a revoluble casing or receptacle, a series of longitudinal passages therein, means for delivering material into said passages, a second series of passages, means for heating said series, and an intermediate chamber having means therein to constitute a sieve, as and for the purpose set forth.

4. In a drying apparatus, a revoluble casing or receptacle, a series of passages therein, means delivering into said passages, a second

series of passages, means for heating said passages, and an intermediate chamber having a perforated peripheral portion, into contact with which the material is led, as and for the purpose set forth.

5. In a drying apparatus, a revoluble casing or receptacle, a series of passages therein, a second series of passages, means for heating said passages, an intermediate chamber having a perforated peripheral wall, and means within said chamber for comminuting the material, as and for the purpose set forth.

6. In a drying apparatus, a revoluble casing or receptacle, a series of passages therein, a second series of passages, and means intermediate said series constituting a sieve, and receptacles surrounding said passages and arranged to contain a circulatory medium, as and for the purpose set forth.

7. In a drying apparatus, a revoluble casing or receptacle, a series of passages therein, a second series of passages, an intermediate chamber having a perforated wall, and steam drums or jackets surrounding said passages, as and for the purpose set forth.

8. In a drying apparatus, a revoluble casing or receptacle, a series of passages therein, a second series of passages, an intermediate chamber having a perforated wall, separate steam drums or jackets surrounding said respective series of passages, and separate steam connections communicating with said drums or jackets, as and for the purpose set forth.

9. In a drying apparatus, a revoluble casing or receptacle having a plurality of longitudinally-arranged passages, means interposed between the ends of said passages constituting a sieve, a drum or jacket surrounding said passages, a supply-tube for said drum or jacket, and a swivel or sleeve connection in said supply-tube whereby the casing may be rotated, as and for the purpose set forth.

10. In a drying apparatus, a revoluble casing or receptacle, a series of passages therein, a second series of passages, intermediate means constituting a sieve, a jacket or drum surrounding said passages, and a supply-pipe swiveled or sleeved therein concentric with the axis of rotation of the casing, whereby the latter may be rotated, as and for the purpose set forth.

11. In a drying apparatus, an inclined revoluble casing or receptacle, a plurality of passages therein, means for supplying material to said passages, a steam-jacket surrounding said passages, means for supplying steam to said drum or jacket, and a discharge-pipe leading from said drum or jacket at a point on the periphery thereof, whereby the water of condensation is led away, as and for the purpose set forth.

12. In a drying apparatus, an inclined revoluble casing or receptacle, a series of passages therein, an intermediate chamber constituting a sieve, means for supplying material

to said passages, and a steam drum or jacket having inlet connections coaxial with said casing, and an exhaust-pipe extending from a point on its periphery, as and for the purpose set forth.

13. In a drying apparatus, an inclined revoluble casing or receptacle, a plurality of passages therein, means for supplying material to said passages, an intermediate chamber constituting a sieve, and a pair of steam-drums having separate inlet connections coaxial with said casing, as and for the purpose set forth.

14. In a drying apparatus, an inclined revoluble casing or receptacle, a plurality of passages therein, means for supplying material to said passages, an intermediate chamber having a perforated wall to constitute a sieve, and means in said chamber for comminuting or disintegrating the material, as and for the purpose set forth.

15. In a drying apparatus, an inclined revoluble casing or receptacle, a plurality of passages therein, means for supplying material to said passages, an intermediate chamber having a perforated wall to constitute a sieve, and a roller disposed in said chamber and arranged to comminute or disintegrate the material, as and for the purpose set forth.

16. In a drying apparatus, an inclined revoluble casing or receptacle, a series of passages therein, means for supplying material to said passages, a second series of passages, an inlet-chamber having a sieve, means for directing the material into said second series

of passages, and means for heating said passages, as and for the purpose set forth.

17. In a drying apparatus, an inclined revoluble casing or receptacle, a series of passages therein, means for supplying the material to said passages, an intermediate chamber constituting a sieve, a roller therein for comminuting the material, said roller suspended from a raceway on the casing, and means for heating said passages, as and for the purpose set forth.

18. In a drying apparatus, an inclined revoluble casing or receptacle, a plurality of passages therein, means for supplying material to said passages, an intermediate chamber constituting a sieve, means in said chamber for comminuting or disintegrating the material, a discharge-trough, and means for leading the material from said passages and from said chamber into said discharge-trough, as and for the purpose set forth.

19. In a drying apparatus, an inclined revoluble casing or receptacle, a plurality of passages therein, means for heating said passages, and a revoluble feed-disk for supplying material to said passages, as and for the purpose set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

MAX SALZMANN.

Witnesses:

SARAH C. McKELLIP,
JAMES L. A. BURRELL.