No. 765,795. PATENTED JULY 26, 1904.

F. M. SMITH.

GRAIN DRIER.

APPLICATION FILED SEPT. 19, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 2.

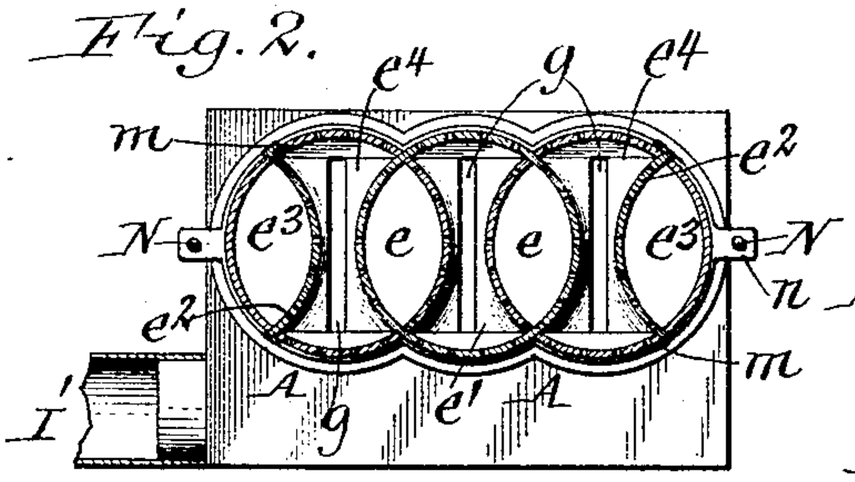

Fig. 3.

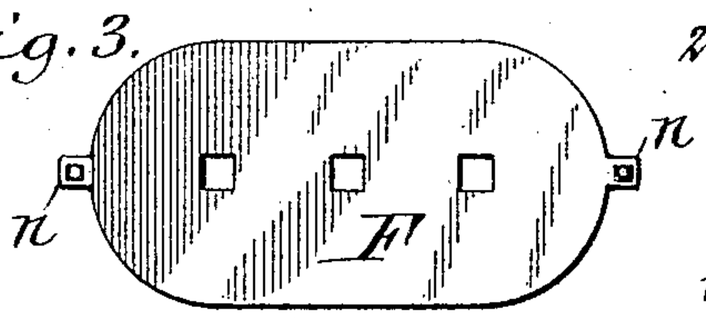

Fig. 1.

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 4.

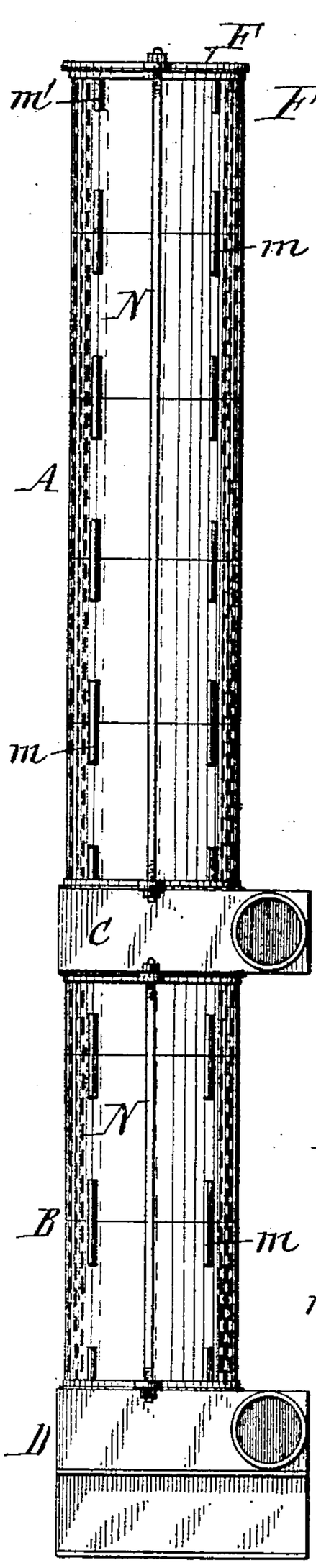


Fig. 8.

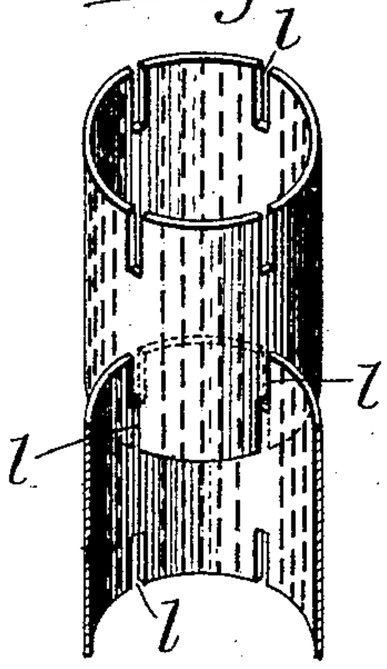


Fig. 6.

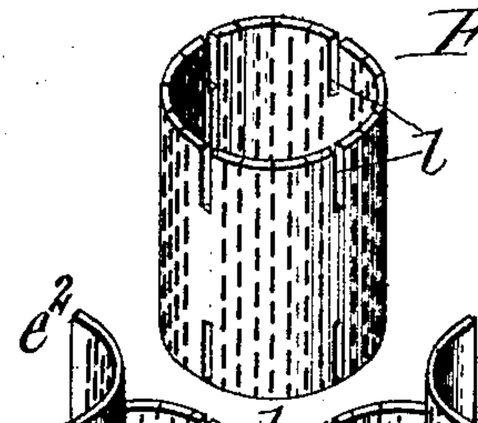


Fig. 7.

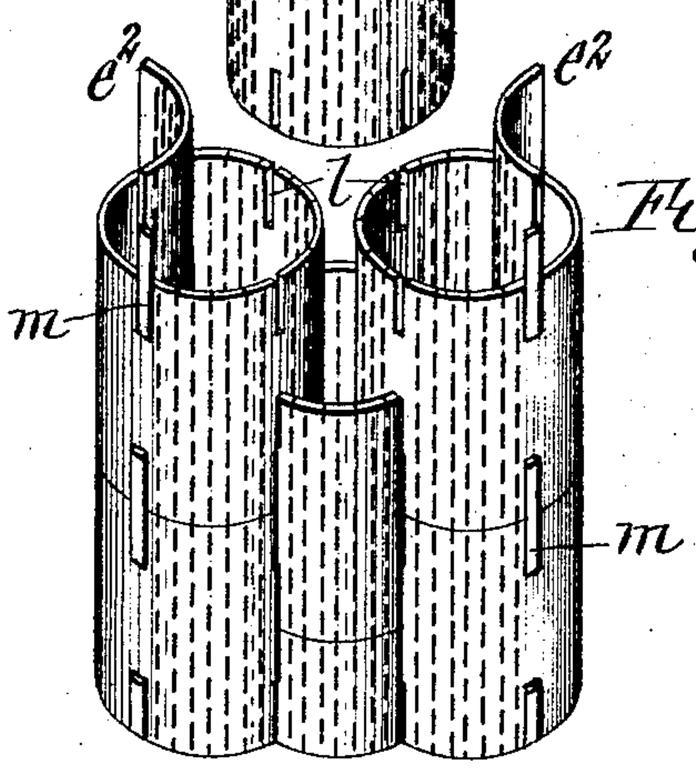
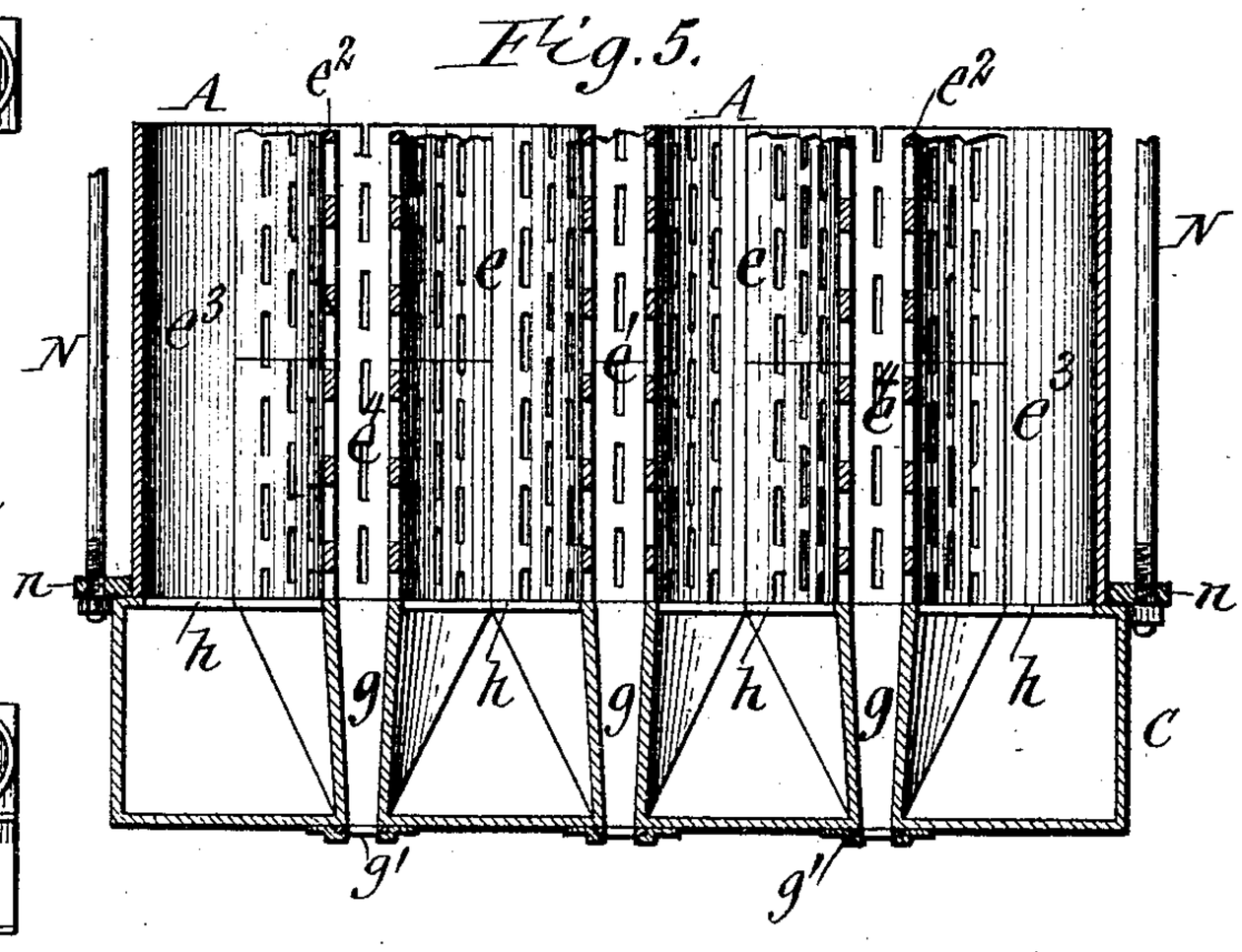


Fig. 5.



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APPLICATION FILED SEPT. 19, 1903.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 12.

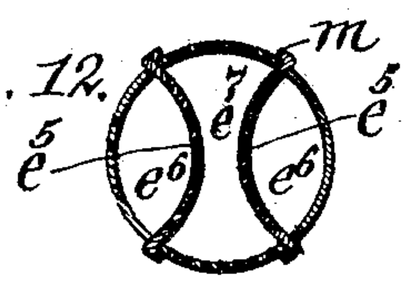


Fig. 9.

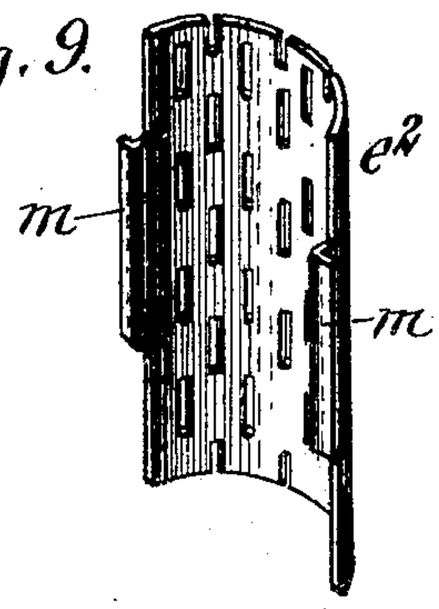
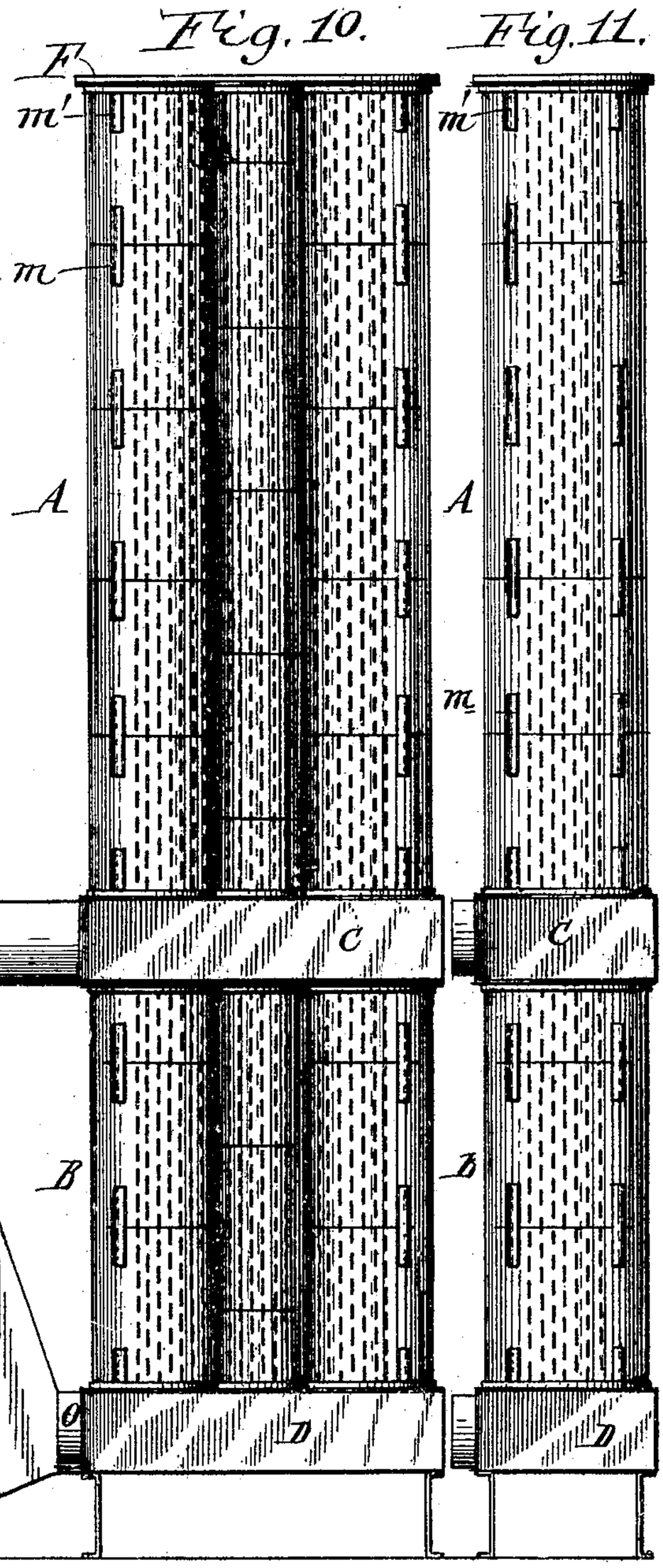


Fig. 10.

Fig. 11.



Witnesses:
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No. 765,795. Patented July 26, 1904.

UNITED STATES PATENT OFFICE.

F. MARION SMITH, OF CHICAGO, ILLINOIS, ASSIGNOR TO HUNTLEY MANUFACTURING COMPANY, OF SILVERCREEK, NEW YORK.

GRAIN-DRIER.

SPECIFICATION forming part of Letters Patent No. 765,795, dated July 26, 1904.

Application filed September 19, 1903. Serial No. 173,802. (No model.)

To all whom it may concern:

Be it known that I, F. MARION SMITH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Grain-Driers, of which the following is a specification.

This invention relates to an apparatus for drying and cooling cereals of various kinds.

One of the objects of my invention is to provide a simple apparatus of this kind which quickly and effectively drys and cools the grain, so as to place it in condition for milling or for shipment to distant markets without loss from heating or fermentation.

Another object is to construct the drier in sections in such manner that it may be readily erected and dismembered or increased or reduced in capacity.

In the accompanying drawings, consisting of three sheets, Figure 1 is a sectional front elevation of the apparatus. Fig. 2 is a horizontal section thereof in line 2 2, Fig. 1. Fig. 3 is a top plan view of the cap-plate of the drier, the feed-spouts being omitted. Fig. 4 is a side elevation of the apparatus, the fans, heater, and pipe connections being omitted. Fig. 5 is a vertical central section of the hot-air chamber and the tube-sections immediately above the same on an enlarged scale. Fig. 6 is a detached perspective view of one of the tube-sections. Fig. 7 is a similar view of a number of interlocked tube-sections. Fig. 8 is a sectional perspective view of two interlocked tube-sections. Fig. 9 is a similar view of one of the perforated segments or partitions of the outer tubes. Fig. 10 is a front elevation of the drier, showing a modified arrangement of the fan and the heater. Fig. 11 is a front elevation of a drier having a single tube or stand-pipe. Fig. 12 is a horizontal section of the last-named construction.

Similar letters of reference indicate corresponding parts throughout the several views.

The apparatus comprises, essentially, one or more upright drying-tubes A, adapted to receive the moist grain, one or more cooling-tubes B, arranged below and in line with the drying-tubes and adapted to receive the dried grain therefrom, a horizontal hot-air chamber C, arranged between the adjacent ends of the drying and cooling tubes, and a horizontal cold-air chamber D, arranged at the lower ends of the cooling-tubes. In the drier shown in Fig. 1 the upper or drying section and the lower or cooling section are each made up of three circular tubes or stand-pipes arranged side by side. The adjoining tubes of each set intersect each other, as shown in Fig. 2, so as to form two almond-shaped air spaces or passages e and an intermediate grain space or passage e'. As shown in Fig. 2, each of the outer tubes of a set is provided with a perforated segmental partition e^2, which extends throughout its length and forms with the opposing side of the tube an almond-shaped air space or passage e^3 and with the opposing side of the middle tube a grain space or passage e^4. In a drier comprising three of such tubes there are therefore four air-passages and three grain-passages alternating therewith. The middle tube of each set is perforated on all sides and throughout its length, while the side tubes are likewise perforated on all sides except those portions which face the concave outer sides of the partitions e^2, so as to permit the hot and cold air delivered into the air-passages e e^3 to escape outwardly through the perforations of the tubes into the atmosphere after having passed through the grain fed into the grain-passages e' e^4, while preventing the air in the endmost passages e^3 from escaping without first passing through the grain in the passages e^4. The perforations of the tubes and their partitions may consist of slits, as shown, or they may be circular or of any other suitable form.

F is a cap-plate closing the upper ends of the drying-tubes A and provided with feed-spouts f, which register with the grain-passages e' e^4 of said tubes. As shown in Figs. 1 and 5, the portions of the drying-tubes forming these grain-passages are provided at their lower ends with discharge spouts or conduits g, which pass through the hot-air chamber C and conduct the dried grain from said grain-passages to the upper ends of the corresponding grain-passages of the cooling-

tubes B. Slides or cut-offs g' are applied to the lower ends of these spouts for controlling the flow of the grain from the drying to the cooling tubes.

The several air-passages e e^3 of the drying-tubes communicate with the hot-air chamber C by openings h in the top of the latter. Hot air is supplied to this chamber by a blast-fan I, having its spout connected with one end of the chamber by a pipe I′, while its eye communicates with a heater I^2 of any suitable construction, that shown in the drawings consisting of a casing containing a steam-coil i. A current of cold air is forced through the cold-air chamber D and the air-passages of the cooling-tubes by a fan J.

The portions of the cooling-tubes B forming the grain-spaces e' e^4 are provided at their lower ends with discharge spouts or hoppers k, similar to the hoppers g. These spouts pass through the cold-air chamber D, and the discharge of the grain from the same is controlled by automatic discharge-valves k', of any suitable construction, which retard the descent of the grain through the drying and cooling tubes, thereby subjecting the grain to the action of the air-currents for a sufficient time to thoroughly dry and cool the same. In the preferred construction shown in the drawings swinging gravity valves or gates are employed, which are provided with adjustable weights k^2 for increasing or reducing their resistance and regulating the discharge of the grain accordingly.

Each of the several drying and cooling tubes A B is preferably composed of short separable sections placed end to end, as shown, to facilitate the erection of the apparatus and enable the tubes to be extended or shortened for increasing or reducing the capacity of the apparatus. The tube-sections of the middle or intermediate tube break joint with the sections of the outer or side tubes, as shown, and each section of the intermediate tube is interlocked with the adjoining sections of the side tubes by longitudinal notches or openings l, formed in the ends of the sections, each section having four equidistant notches at each end thereof, as best seen in Fig. 6. As shown in Figs. 7 and 8, the notches of adjoining sections are in line with each other and those of each section receive the solid walls of the sections of adjoining tubes. The solid portions of the sections between their notches thus mutually overlap each other, whereby the sections of the adjoining tubes are interlocked and firmly held against lateral displacement.

The sections of the outer tubes are further interlocked with each other by their partitions e^2, which latter are constructed of sections which break joint with the sections of said tubes. Each of these partition-sections except the uppermost and lowermost ones of the tubes is provided at its edges midway between its ends with outwardly-turned locking lips or tongues m, which engage in the registering notches l of the adjoining tube-sections and are preferably clenched backwardly against the outer sides of the tubes, as shown. The extreme upper and lower partition-sections of the drying-tubes and the lowermost partition-sections of the cooling-tubes are also provided at their ends with locking-tongues m', which engage in the adjacent notches of the tube-sections. By this construction the tongues of the partitions perform the double function of attaching the partitions to the tubes and connecting the tube-sections. This construction also dispenses with the use of separate fastenings for this purpose.

The hot and cold air chambers and the two sets of tubes forming the upper and lower sections of the apparatus are firmly tied together by any suitable means. In the construction shown in the drawings these parts are secured together by vertical tie-rods N passing through lugs or flanges n, arranged on the cap-plate F, and the hot and cold air chambers.

In the operation of the apparatus the grain to be dried is fed into the grain-passages e' e^4 of the drying-tubes A, where it is subjected to the drying action of the current of hot air which is forced by the fan I from the upper chamber C into the lower ends of the air-passages e e^3 of the drying-tubes and thence into the grain-passages and through the grain, the air finally escaping through the perforations in the front and rear sides of the tubes. In first introducing the grain into the apparatus the slides g' are closed to detain the grain in the drying-tubes for sufficiently heating the same, and the slides are then opened to permit the grain to flow into and through the cooling-tubes B, where the dried grain is subjected to the cold-air current which is forced through the grain by the fan J in the same manner as the hot air is forced through the drying-tubes. After starting the apparatus the flow of the grain through the tubes is continuous, the same being controlled by the automatic gravity-valves k', the weights of which are adjusted to discharge the material at such a speed as to insure the proper drying of the grain.

By the use of tubes composed of interlocking sections, as herein described and shown, the drier may be constructed of any desired height and capacity.

If desired, a single fan or air-propelling device may be employed for inducing hot and cold air currents through the drying and cooling tubes, as shown in Fig. 10. In this modification the blast-spout of the fan I^3 leads to the hot-air chamber, and its eye is connected with the casing of the heater I^4, as in the first-described construction; but this casing instead of taking its cold-air supply directly from the atmosphere is connected with the cold-air chamber D by a pipe o. By this arrangement the fan draws the outer cold air into the grain-passages of the lower tubes through the per-

forations in their front and rear walls and through the grain into the air-passages of said tubes and the cold-air chamber. It is next drawn through the heater and forced in its heated state into and through the drying-tubes and the grain in the same, as already described in connection with the apparatus shown in Figs. 1 to 8.

A greater or less number of drying and cooling tubes may obviously be employed, according to the desired capacity of the apparatus. In Figs. 11 and 12 is shown a drier having but one drying-tube and one cooling-tube. In this construction the tube-sections are notched at their ends and interlocked by means of the segmental partitions e^5, as in the construction first described. In this case two of such perforated partitions are arranged in the upper and lower tubes of the apparatus, forming two air-passages e^6 and an intermediate grain-passage e^7, as shown in Fig. 12.

I claim as my invention—

1. A grain-drier, comprising one or more perforated upright drying-tubes, one or more perforated upright cooling-tubes arranged below said drying-tubes and adapted to receive the dried material therefrom, a hot-air chamber connected with said drying-tubes, a cold-air chamber connected with said cooling-tubes, a heater having its casing connected with said cooling-chamber, and a fan having its eye connected with said casing and its blast-spout with said hot-air chamber, substantially as set forth.

2. A grain-drier, comprising a perforated upright drying-tube, a perforated upright cooling-tube arranged below said drying-tube and adapted to receive the dried material therefrom, a hot-air chamber arranged between said drying and cooling tubes, a cold-air chamber arranged at the lower end of said cooling-tube, a heater having one side thereof connected with one of said chambers, and a fan connected with the other of said chambers and the opposite side of said heater, substantially as set forth.

3. A grain-drier, comprising perforated tubes arranged side by side and intersecting each other for forming alternating air and grain passages, and means for inducing an air-current through said passages, substantially as set forth.

4. A grain-drier, comprising a series of perforated tubes arranged side by side and intersecting each other to form alternating air and grain passages, and perforated partitions arranged in the end tubes of the series and dividing the same into adjacent air and grain passages, said end tubes being solid or imperforate in the sides thereof which face said partitions, substantially as set forth.

5. A grain-drier, comprising one or more perforated tubes, each composed of sections arranged end to end and provided in their ends with notches or openings which register with the notches of adjoining sections, and partitions arranged lengthwise in said tube-sections and interlocking with the registering notches of adjoining sections, substantially as set forth.

6. A grain-drier, comprising one or more perforated tubes, each composed of sections arranged end to end and provided in their ends with notches or openings which register with the notches of adjoining sections, and partitions arranged lengthwise in said tube-sections and provided at their lateral edges with lips or tongues which interlock with the registering notches of adjoining sections, substantially as set forth.

7. A grain-drier, comprising a plurality of perforated tubes arranged side by side and intersecting each other, each of said tubes being composed of sections arranged end to end, and provided in their ends with notches or openings which receive and interlock with the walls of the sections of adjoining tubes, substantially as set forth.

8. A grain-drier, comprising a series of perforated tubes arranged side by side and intersecting each other for forming alternating air and grain passages, each of said tubes being composed of sections provided in their ends with notches which receive and interlock with the walls of the sections of adjoining tubes, and perforated partitions arranged in the end tubes of the series and dividing the same into adjacent air and grain passages and provided with lips or tongues which interlock with the registering notches in the adjoining ends of said end tube-sections, substantially as set forth.

Witness my hand this 17th day of September, 1903.

F. MARION SMITH.

Witnesses:
G. A. STIBBENS,
S. J. MCTIERNAN.