W. E. ELLIS.

GRAIN DRIER.

APPLICATION FILED JULY 24, 1908.

921,097.

Patented May 11, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

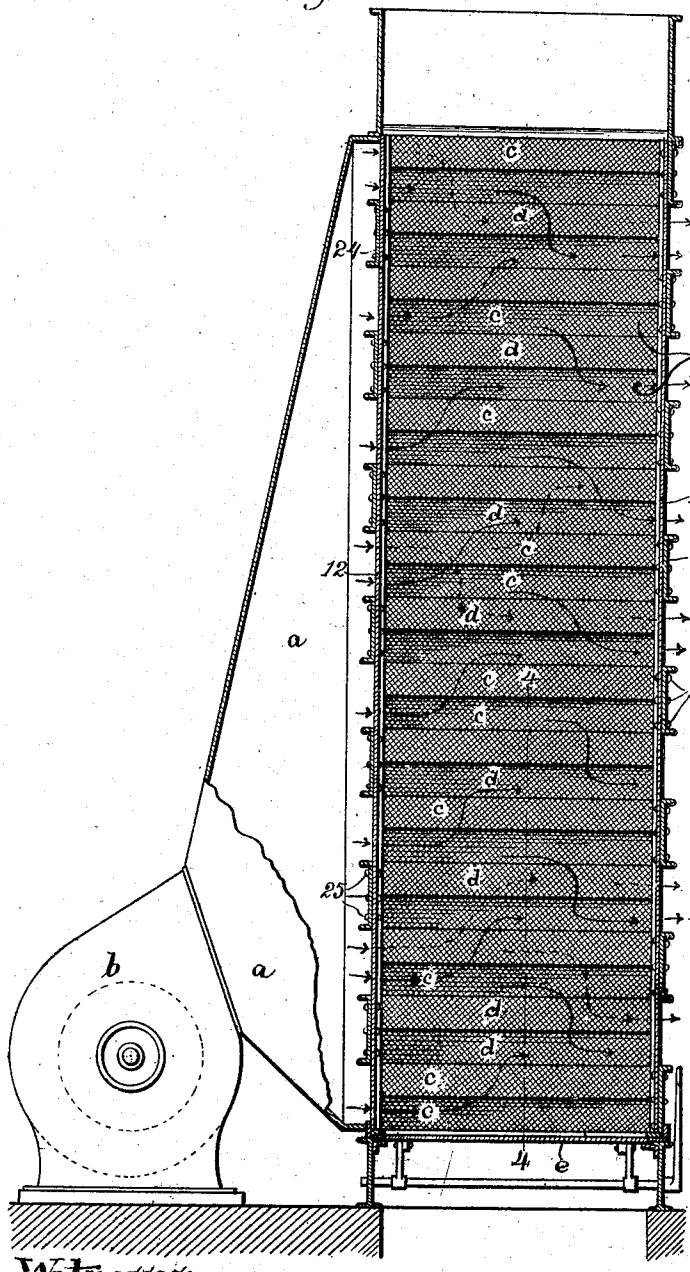
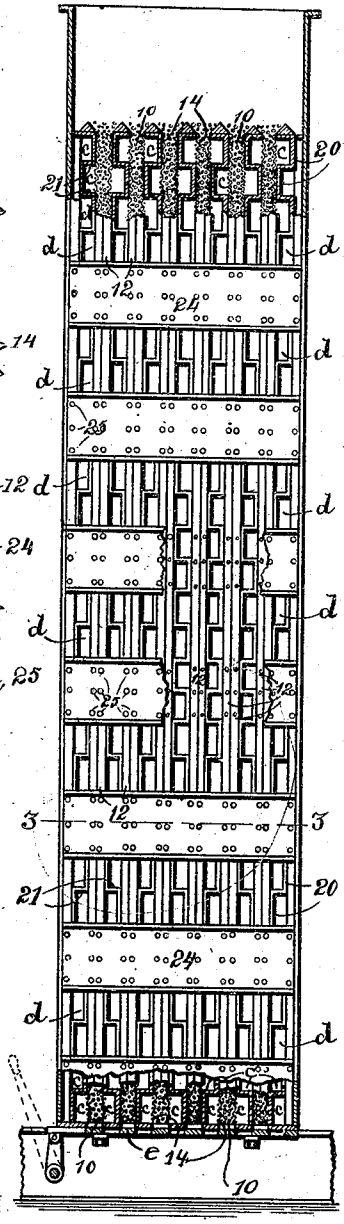


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

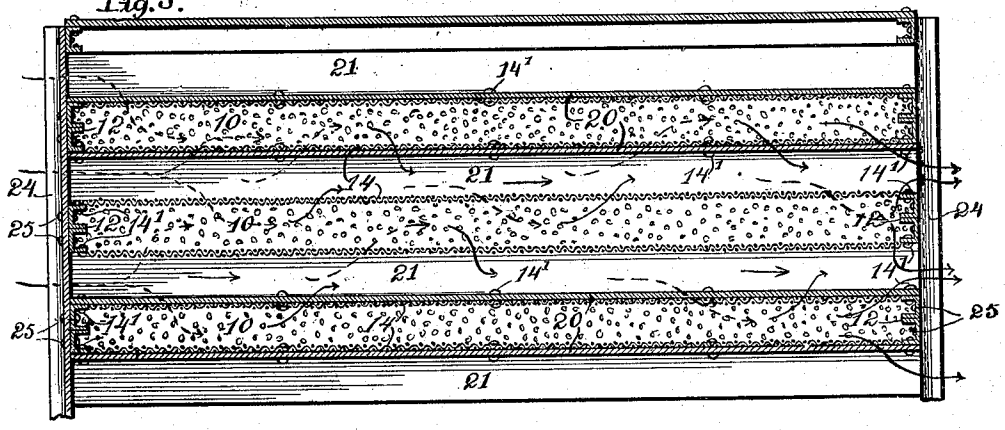


Fig. 4.

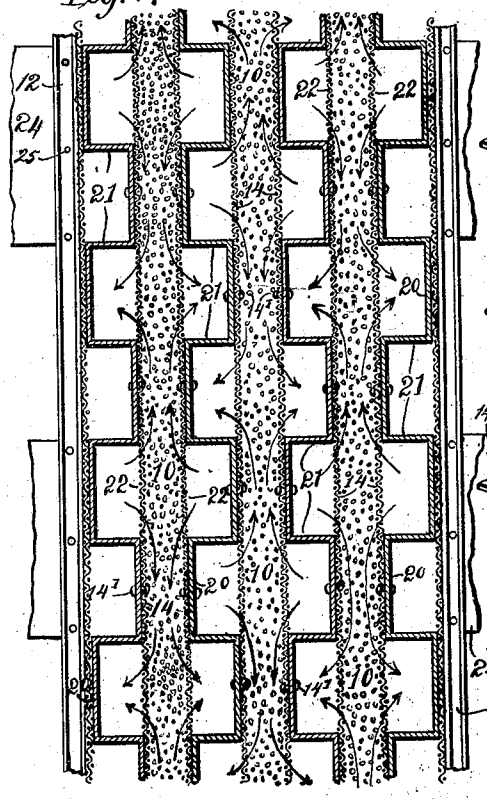
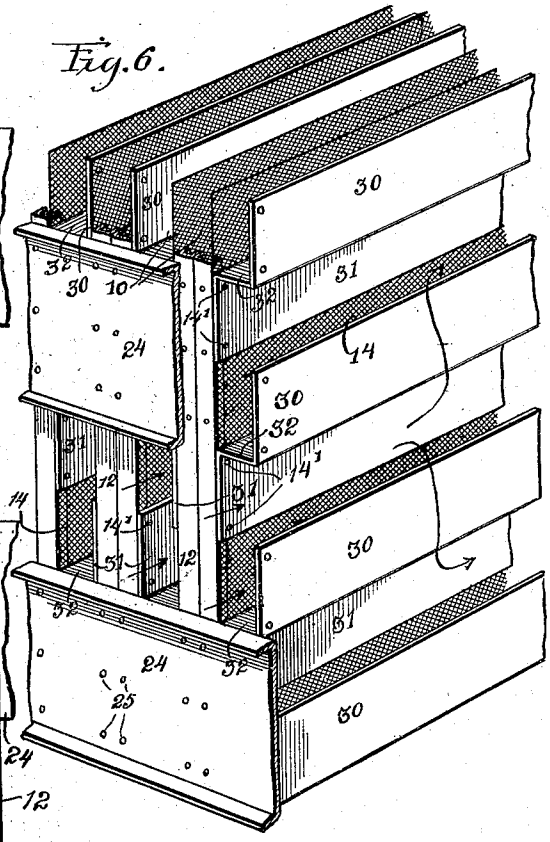


Fig. 6.



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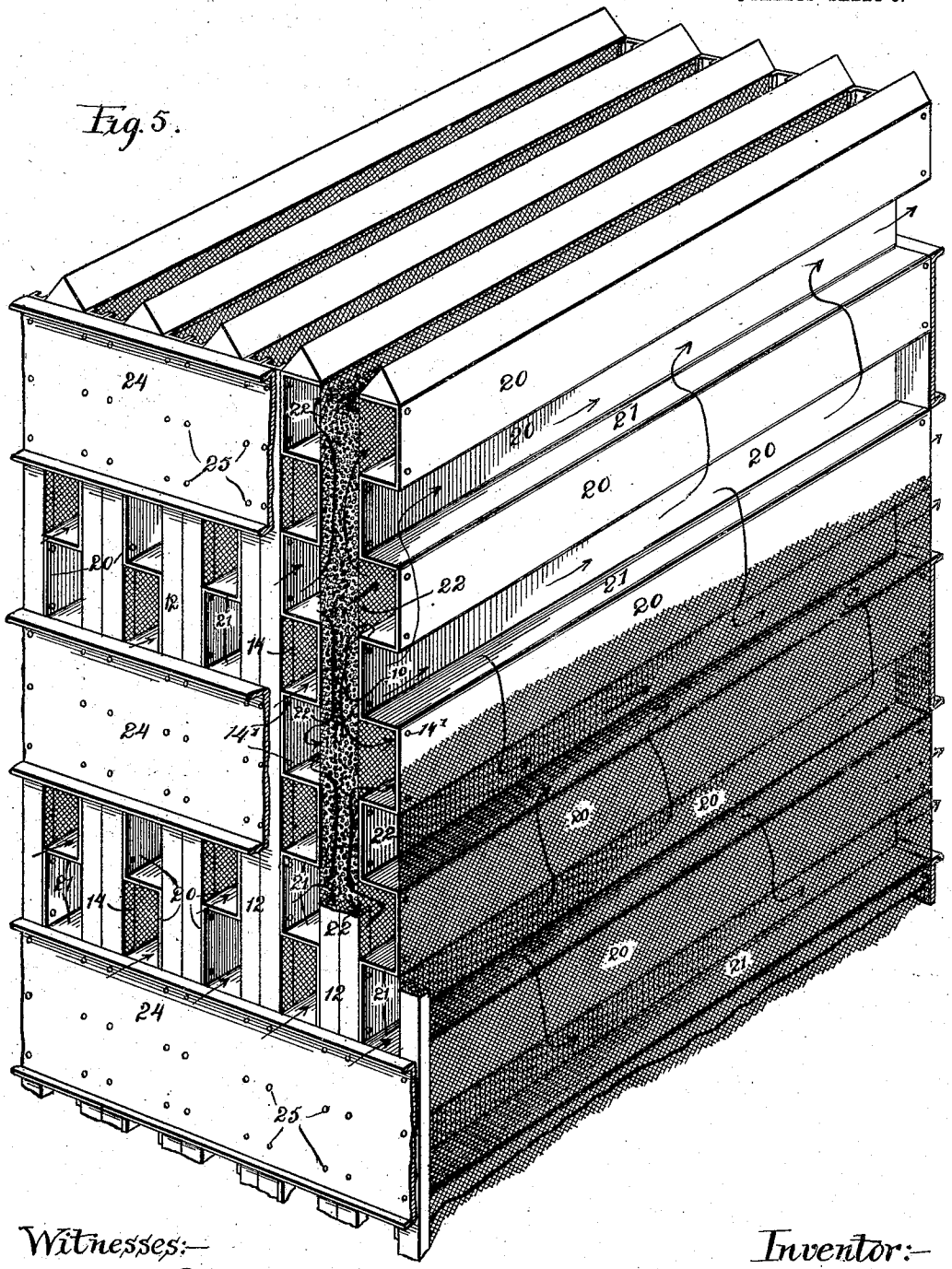
GRAIN DRIER.

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3 SHEETS—SHEET 3.

Fig. 5.



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UNITED STATES PATENT OFFICE.

WYNN E. ELLIS, OF CHICAGO, ILLINOIS.

GRAIN-DRIER.

No. 921,097. Specification of Letters Patent. Patented May 11, 1909.

Application filed July 24, 1908. Serial No. 445,112.

To all whom it may concern:

Be it known that I, WYNN E. ELLIS, a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Grain-Driers, of which the following is a full, clear, and exact description.

The invention relates to grain-driers, and more particularly to the type in which the grain is disposed in vertical shafts or comparatively thin layers and submitted to the action of air currents.

In Letters Patent No. 620,432, granted February 28, 1899, there is disclosed an apparatus in which the grain is disposed in vertical shafts or columns and in which there are air-inducts or pressure-flues, and educts or exhaust-flues through which air under pressure is applied to both sides of the grain-columns to cause the air to pass lengthwise of the column and then be discharged at both sides thereof into the exhaust flues. In practice it has been found desirable to provide vertically extending walls between the pressure and exhaust-flues to cause the air-currents to traverse the grain-column vertically some distance greater than the thickness of the horizontal division-walls between the pressure and exhaust-flues to effect a uniform and even drying of the grain throughout the grain-shafts. Mere increase of thickness of the horizontal divisional-walls renders the drier costly in construction and furthermore results in additional height of the apparatus due to the lack of utilization of the space between the flues. Furthermore, at present it is regarded as preferable to avoid the use of wood in the construction of grain-driers.

The invention designs to obviate these structural features of grain-driers by providing a construction which is metallic throughout and further, to provide a drier in which the capacity thereof is not lessened by employment of dead air-spaces or thick solid division-walls and to provide a construction in which the grain may be efficiently and uniformly treated.

A further object of the invention is to provide an improved grain-drier in which the grain will be disposed in comparatively narrow-shafts or columns and in which both sides of the grain-column are subjected to the action of the air-blast which will meet in the grain-columns and pass longitudinally thereof to the exhaust or educt flues.

A still further object of the invention is to provide a grain-drier which is simple in construction and may be formed in sections which may be assembled to form a drier of the desired capacity and which may be produced at a low cost.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claim at the conclusion hereof.

In the drawings: Figure 1 is a vertical section of a grain-drier embodying the preferred form of the invention. Fig. 2 is a view of the drier partly in end elevation and partly in section. Fig. 3 is a horizontal section on line 3—3 of Fig. 2. Fig. 4 is a section on line 4—4 of Fig. 1 on an enlarged scale. Fig. 5 is a perspective parts being shown in section illustrating a portion of the drier. Fig. 6 is a section illustrating a modified form of the invention.

The grain-drier comprises a series of vertical shafts 10 into the top of which grain is usually discharged from a suitable garner, as well understood in the art. The ends of each of the grain-shafts are closed by columns, each consisting of a pair of channel-beams 12, and to the outer flanges of each column, screen-cloths 14 are secured by rivets 14′. Said screen-cloths form foraminous sides of the grain-shafts for holding the grain and permitting the passage of air to and from the grain-columns. Transverse induct and educt-flues for the air-blast are formed between each of the grain-shafts and these flues communicate with the sides of the grain-shaft through the screen-cloths to permit the air to pass into and out of the grain-shafts. These flues are arranged and disposed to cause the air to pass into the shaft through both sides thereof, thence vertically through the grain-column and shaft into correspondingly disposed exhaust-flues.

The spaces between the grain-shafts are divided into a vertical series of transverse flues by horizontal division-walls 21. Each flue has one open side 22, opening into the grain-shaft at one side of said space and a closed side 20 adjacent the grain-shaft at the other side. These horizontal and vertical division-walls are formed by extending a plate or plates of metal continuously across the space between the shafts, thence vertically at one side to form the side wall for one flue, thence across the space to the other side, thence vertically to form a closed side

adjacent the grain-shaft at the other side and so on. This manner of forming or dividing the spaces between the grain-shafts into flues is important because it provides a construction which may be metallic throughout. As a result of this disposition of the division-walls for the flues, the flues of a vertical series open alternately into the grain-shafts between which the series is disposed and the closed sides for the flues form imperforate vertical walls at the sides of the shafts by which the air blast is caused to pass vertically through the shaft and grain therein between the flues and the vertical wall forms a division-wall between the flues and one of the grain-shafts as well as an imperforate wall for directing the blast vertically in the grain-shaft.

Air under pressure passes into the grain-columns in the shafts through some of the flues which are open at one end for communication with a supply-chamber *a* to which hot air under pressure is supplied by a fan *b* as well understood in the art, and said flues are closed at their opposite ends and constitute pressure-flues *c* through the open sides of which the air blast passes into the grain-shafts. Other flues are closed at that end of the shafts at which the supply-chamber is located and are open at their opposite ends at which the exhaust-chamber is located, and these flues constitute exhaust-flues *d* through the open sides of which the air-blast passes from the grain-shafts and into the exhaust-chamber. The closed ends of the flues are formed by horizontal strips or beams 24 which extend across, and are secured to, the ends of the end-columns of the grain-shafts by bolts 25. These beams 24 are alternately disposed on the opposite ends of the shafts to close the exhaust-flues at that end at which the supply-chamber is disposed and to close the pressure-flues at that end at which the exhaust-chamber is located. Cross-beams 24 being secured to the beams 12 which form the ends of the grain-shafts serve also to secure the columns in connected relation. The screen-cloths 14 are secured to the vertical division walls by rivets 14′ so that the latter will serve to back the screen-cloth and prevent it from bulging so that the shaft-sides will remain straight and smooth to facilitate gravitation of the grain in the column when desired.

The pressure-flues for each of the grain-shafts are oppositely disposed at the sides thereof and the exhaust-flues are correspondingly disposed so that the air blast will pass into the grain column at both sides thereof and will be directed vertically between the imperforate walls 20 of the intermediate flues for the next adjacent grain-shafts. Resultantly the air blast passes into the grain-column at both sides thereof and thence vertically through the column a distance corresponding to the height of the intermediate flues to the exhaust-flues, as indicated by arrows in Figs. 4 and 5. Thus, the closed sides of the flues for one of the shafts serve as division-walls for directing the blast vertically in the adjacent grain-shaft. As a result of this construction, the division-walls 20 and 21 between the flues and the grain-shafts may be formed of sheet metal and may be of continuous formation so that a fire-proof structure will be provided. Further, the use of dead air spaces or thick division walls to cause the air blast to pass vertically through the grain shafts are avoided. As a result of this formation, the vertical series of flues between two shafts open alternately into the shafts respectively and have closed or imperforate walls at one side which form the division wall for directing the blast vertically in the adjacent flue and the pressure and exhaust-flues for one shaft are separated by the intermediate flues for the adjacent shaft. Resultantly, all of the space between the grain-shafts is utilized for flues and the blast is forced through the grain-columns between the flues in such manner that the grain will be uniformly treated.

Pressure-flues for a column are oppositely disposed at the sides of each grain-shaft and the exhaust-flues are correspondingly disposed with flues for the adjacent shafts therebetween. Therefore, the air-blast passes from the pressure-flues into the sides of the grain-shaft thence vertically upwardly and downwardly between the imperforate walls of the flues for the adjacent shafts and into the next series of pressure and exhaust-flues for the same grain-shaft, the current entering the shaft from both sides will meet in the grain-column and be forced upwardly therethrough to an exhaust-chamber. Therefore, the air does not pass directly through the grain-column but passes into it and thence longitudinally thereof to an exhaust-flue. Furthermore, the imperforate walls of the pressure-chambers become heated by the air-blast therein and aid in drying the adjacent grain-column.

The grain-shafts are open at the bottom so that the grain therein will gravitate when released. The bottom of each shaft is normally closed by a suitable valve *e* which is adapted to be shifted into position to hold the grain-columns in the shafts while the grain is being treated and which, when open, will permit the grain to pass out of the shaft. Any suitable valve-operating mechanism may be provided as well understood in the art.

The operation of the improved grain-drier will be as follows: Assuming hot air under pressure to be present in the supply-chamber at one side of the drier it will pass into the ends of the pressure-chambers which are in communication with the supply-chamber

and pass into the grain-shafts through the open sides thereof and thence upwardly and downwardly through the grain-column and escape through the sides of the grain-shaft into the exhaust-flues and thence through the open ends of said flues into the exhaust-chamber.

In erecting the drier, a channel-beam 12 is secured to each edge of one of the screen sides 14 of the shaft and then two of such sides with the channel-beams thereon are secured to the sides of the vertical walls 20 of the sheet metal flue-structure, so the division-walls 20 and 21 are formed to constitute a frame, any number of which may be secured in connected relation by the horizontal beams 24. Resultantly, these frames constitute units any number of which may be secured together side by side to provide a drier of the desired capacity. In Fig. 6 is illustrated a modified form of the invention, in which the horizontal division-walls between the pressure and exhaust-flues respectively for the adjacent shafts are omitted. In lieu of dividing the pressure-flues and exhaust-flues for the adjacent shafts respectively and providing a continuously extending wall of sheet metal, the flues are formed by a series of angularly bent strips comprising vertical portion 30, forming a closed side for one of the shafts, and an oppositely disposed vertical wall 31 forming an imperforate side for the next adjacent grain-shaft and an intermediate horizontally connecting wall 32.

The invention possesses several important advantages. It provides a structure whereby the air-blast enters the sides of the grain-shafts and passes vertically through the grain-column or shaft to the exhaust-chambers, thus causing the grain to be uniformly treated and avoiding the necessity of forming vertical passages for the air to the grain-shaft by solid division walls or decreasing the number of flues in a grain-shaft of a given height, and furthermore increasing the capacity of the apparatus.

While the structure has been described in connection with the use of hot-air, it may manifestly be employed with equal advantage in cooling grain.

The invention is not to be understood as restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. In apparatus of the character described, the combination of a series of grain-shafts, laterally extending walls dividing the spaces between the shafts into a vertical series of flues having sides opening into the grain-shafts, and vertically extending walls between the laterally extending walls, some of said flues being open at one end for communication with an air-supply, and others being open at their opposite ends to form exhaust-flues.

2. In apparatus of the character described, the combination of a series of grain-shafts, laterally extending walls dividing the spaces between the shafts into a vertical series of flues having sides opening into the grain-shafts, and vertically extending walls between the laterally extending walls, some of said flues being open at one end for communication with an air-supply, and others being open at their opposite ends to form exhaust-flues, said pressure and exhaust flues being oppositely disposed at both sides of the grain-shafts respectively.

3. In apparatus of the character described, the combination of a series of grain-shafts, laterally extending walls dividing the spaces between the shafts into a vertical series of flues having sides opening into the grain-shafts, and vertically extending walls between the laterally extending walls, some of said flues being open at one end for communication with an air-supply, and others being open at their opposite ends to form exhaust-flues, said pressure and exhaust flues being oppositely disposed at both sides of the grain-shafts respectively, so that the blast will pass vertically between said vertical walls from the pressure flues to the exhaust flues.

4. In apparatus of the character described, the combination of a series of grain-shafts, laterally extending walls dividing the spaces between the shafts into a vertical series of flues having sides opening into the grain-shafts, and vertically extending walls between the laterally extending walls, some of said flues being open at one end for communication with an air-supply, and others being open at their opposite ends to form exhaust-flues, the vertical walls being connected to the laterally extending division walls.

5. In apparatus of the character described, the combination of a series of grain-shafts, laterally extending walls dividing the spaces between the shafts into a vertical series of flues having sides opening into the grain-shafts, and vertically extending walls between the laterally extending walls, some of said flues being open at one end for communication with an air-supply, and others being open at their opposite ends to form exhaust flues, the pressure and exhaust-flues for each shaft being alternately disposed in each vertical series, said vertical walls extending between the pressure-flues to the exhaust-flues.

6. In apparatus of the character described, the combination of a series of grain-shafts, walls dividing the spaces between the shafts into a vertical series of transverse flues, some

of said flues being open at one end for communication with an air-supply and closed at their opposite ends to form pressure-chambers, others being open and closed at their opposite ends to form exhaust-chambers the flues having one of their sides opening into one of the adjacent grain-shafts, and side-walls for the flues dividing them from the other adjacent grain-shaft.

7. In apparatus of the character described, the combination of a series of grain-shafts, walls dividing the spaces between the shafts into vertical series of transverse flues at each side of each grain-shaft, some of said flues being open at one end for communication with an air-supply and closed at their opposite ends to form pressure-chambers, others being open and closed at their opposite ends to form exhaust-chambers, the flues having one of their sides opening into one of the adjacent grain-shafts, and side-walls for the flues dividing them from the other adjacent grain-shaft.

8. In apparatus of the character described, the combination of a series of grain-shafts, walls dividing the spaces between the shafts into vertical series of transverse flues, some of said flues being open at one end for communication with an air-supply and closed at their opposite ends to form pressure-chambers, others being open and closed at their opposite ends to form exhaust-chambers, the flues having one of their sides opening into one of the adjacent grain-shafts, and side-walls for the flues dividing them from the other adjacent grain-shaft, the pressure and exhaust-flues for each shaft being oppositely disposed at the sides thereof.

9. In apparatus of the character described, the combination of a series of grain-shafts, walls dividing the spaces between the shafts into vertical series of transverse flues, some of said flues being open at one end for communication with an air-supply and closed at their opposite ends to form pressure-chambers, others being open and closed at their opposite ends to form exhaust-chambers, the flues having one of their sides opening into one of the adjacent grain-shafts, and side-walls for the flues dividing them from the other adjacent grain-shaft, the pressure and exhaust-flues for each shaft being oppositely disposed at the sides thereof, said side-walls being oppositely disposed at the sides of the shaft to direct the blast vertically between the pressure and exhaust-flues.

10. In apparatus of the character described, the combination of a series of grain-shafts, walls dividing the spaces between the shafts into vertical series of transverse flues, some of said flues being open at one end for communication with an air-supply and closed at their opposite end to form pressure-chambers, others being open and closed at their opposite ends to form exhaust-chambers, each flue having an open side, the open sides of the flues of a vertical series opening alternately into the sides of the grain-shafts between which they are disposed.

11. In apparatus of the character described, the combination of a series of grain-shafts, walls dividing the spaces between the shafts into vertical series of transverse flues, some of said flues being open at one end for communication with an air-supply and closed at their opposite ends to form pressure-chambers, others being open and closed at their opposite ends to form exhaust-chambers, each flue having an open and a closed side, the open sides of the flues of a vertical series opening alternately into the sides of the grain-shafts between which they are disposed, the closed sides dividing the flues from one of the adjacent grain-shafts.

12. In apparatus of the character described the combination of a series of grain-shafts, walls dividing the spaces between the shafts into vertical series of transverse flues, some of said flues being open at one end for communication with an air-supply and closed at their opposite ends to form pressure-chambers, others being open and closed at their opposite ends to form exhaust-chambers, each flue having an open and a closed side, the open sides of the flues of a vertical series opening alternately into the sides of the grain-shafts between which they are disposed, the closed sides dividing the flues from one of the adjacent grain-shafts, said side-walls being disposed in horizontal series at both sides of the shafts to direct the blast vertically from the pressure-flues to the exhaust-flues.

13. In apparatus of the character described, the combination of a series of grain-shafts, foraminous sides for the shafts, and sheet-metal walls extending transversely and vertically in the spaces between the shafts and dividing such spaces into a vertical series of transverse flues having one of their sides open, some of said flues being open at one end for communication with an air-supply to form pressure-flues, and others being open at the opposite end to form exhaust-flues.

14. In apparatus of the character described, the combination of a series of grain-shafts, foraminous sides for the shafts, and sheet-metal walls extending transversely and vertically in the spaces between the shafts and dividing such spaces into a vertical series of transverse flues having oppositely disposed open sides, opening into the sides of the grain-shafts between which the flues are disposed, some of said flues being open at one end for communication with an air-supply to form pressure-flues, and others being open at the opposite end to form exhaust-flues.

15. In apparatus of the character described, the combination of a series of grain-

shafts, foraminous sides for the shafts and sheet-metal walls continuously extending transversely and vertically in the spaces between the shafts, and dividing such spaces into a vertical series of transverse flues having one of their sides open, some of said flues being open at one end for communication with an air-supply to form pressure-flues, and others being open at the opposite end to form exhaust-flues.

16. In apparatus of the character described, the combination of a series of grain-shafts, foraminous sides for the shafts, and sheet-metal walls continuously extending transversely and vertically in the spaces between the shafts and dividing such spaces into a vertical series of transverse flues having oppositely disposed open sides, opening into the sides of the grain-shafts between which the flues are disposed, some of said flues being open at one end for communication with an air-supply to form pressure-flues, and others being open at the opposite end to form exhaust-flues.

17. In apparatus of the character described, the combination of a series of grain-shafts, foraminous sides for the shafts and sheet-metal walls extending transversely and vertically in the spaces between the shafts and dividing such spaces into a vertical series of transverse-flues having one of their sides open, some of said flues being open at one end for communication with an air-supply to form pressure-flues, and others being open at their opposite end to form exhaust-flues, the open sides of the flues being oppositely disposed on both sides of the shafts.

18. In apparatus of the character described, the combination of a series of grain-shafts, foraminous sides for the shafts, and sheet-metal walls continuously extending transversely and vertically in the spaces between the shafts, and dividing such spaces into a vertical series of transverse flues having one of their sides open, some of said flues being open at one end for communication with an air-supply to form pressure-flues, and others being open at the opposite end to form exhaust-flues, the open sides of the flues being oppositely disposed on both sides of the shafts.

19. In apparatus of the character described, the combination of a series of vertical grain-shafts, columns forming the shaft-ends, walls dividing the spaces between the shaft into transverse flues, and beams extending across the column-ends to close the flues.

20. In apparatus of the character described, the combination of a series of vertical grain-shafts, columns forming the shaft-ends, walls dividing the spaces between the shaft into transverse flues, and spaced beams extending across each of the columns at each end of the shafts respectively and alternately disposed to leave the flues open at one end and closed at the other.

21. In apparatus of the character described, the combination of a series of vertical grain-shafts comprising a pair of columns forming the shaft-ends and foraminous sides, pressure and exhaust-flues between the shafts having sides opening into the shafts, and means for closing one end of each shaft.

22. In apparatus of the character described, the combination of a series of vertical grain-shafts comprising a pair of flanged columns forming the shaft-ends and foraminous sides, pressure and exhaust-flues between the shafts having sides opening into the shafts and means for closing one end of each shaft.

23. In apparatus of the character described, the combination of a series of vertical grain-shafts comprising foraminous sides and a pair of columns forming the end of each shaft, pressure and exhaust flues between the shafts, and spaced beams extending across the columns to form closed ends for said flues.

24. In apparatus of the character described, the combination of a series of vertical grain-shafts comprising foraminous sides and columns forming the shaft-ends, sheet-metal walls in the spaces between the grain-shaft dividing them into flues, means securing the foraminous sides to said walls, and means for closing some of the flues at one end and the others at their opposite ends.

25. In apparatus of the character described, the combination of a series of vertical grain-shafts comprising foraminous sides and columns forming the shaft-ends, sheet-metal walls in the spaces between the grain-shafts dividing them into flues, means securing the foraminous sides to said walls, and beams extending across the columns for closing some of the flues at one end and the others at their opposite ends.

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