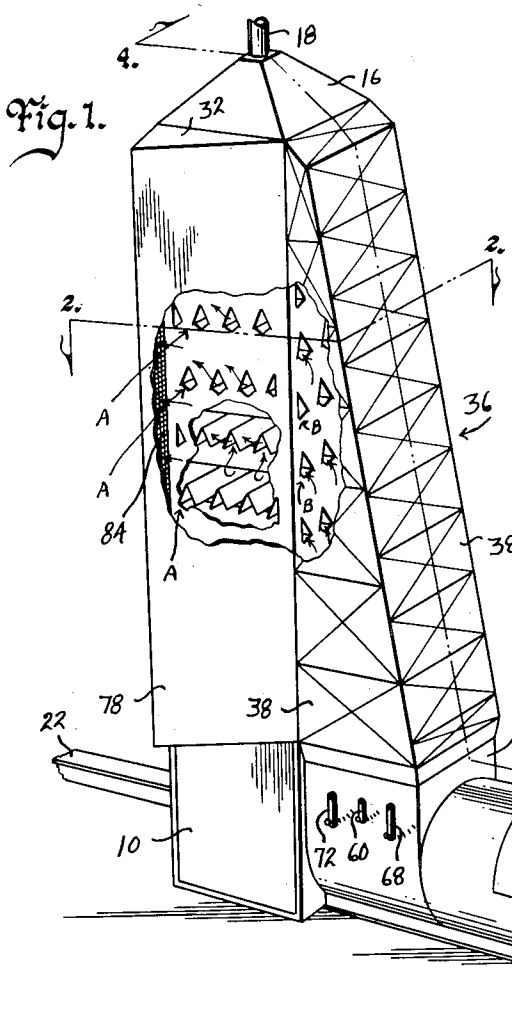
Feb. 15, 1955 B. CAMPBELL 2,701,920

GRAIN DRIER

Filed Aug. 18, 1952 2 Sheets-Sheet 1

Fig. 1.



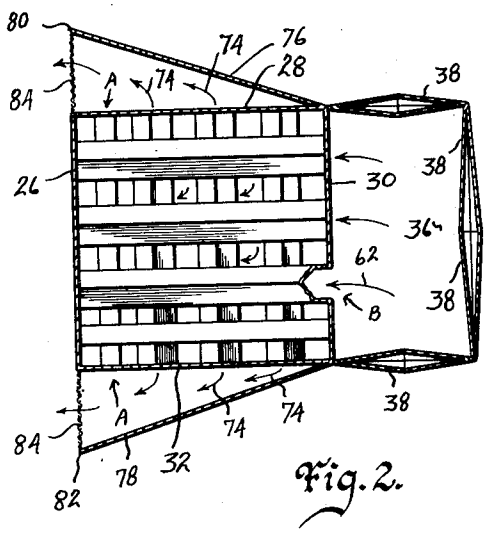


Fig. 2.

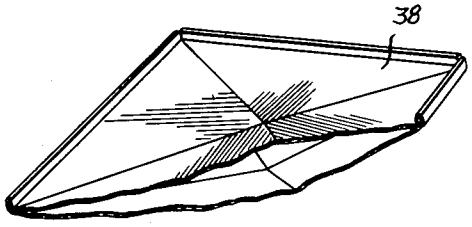


Fig. 3.

Inventor
Bowen Campbell
by Talbert Dick & Adler
Attorneys

Witness
Edward P. Leeby

Feb. 15, 1955 B. CAMPBELL 2,701,920

GRAIN DRIER

Filed Aug. 18, 1952 2 Sheets-Sheet 2

Fig. 4.

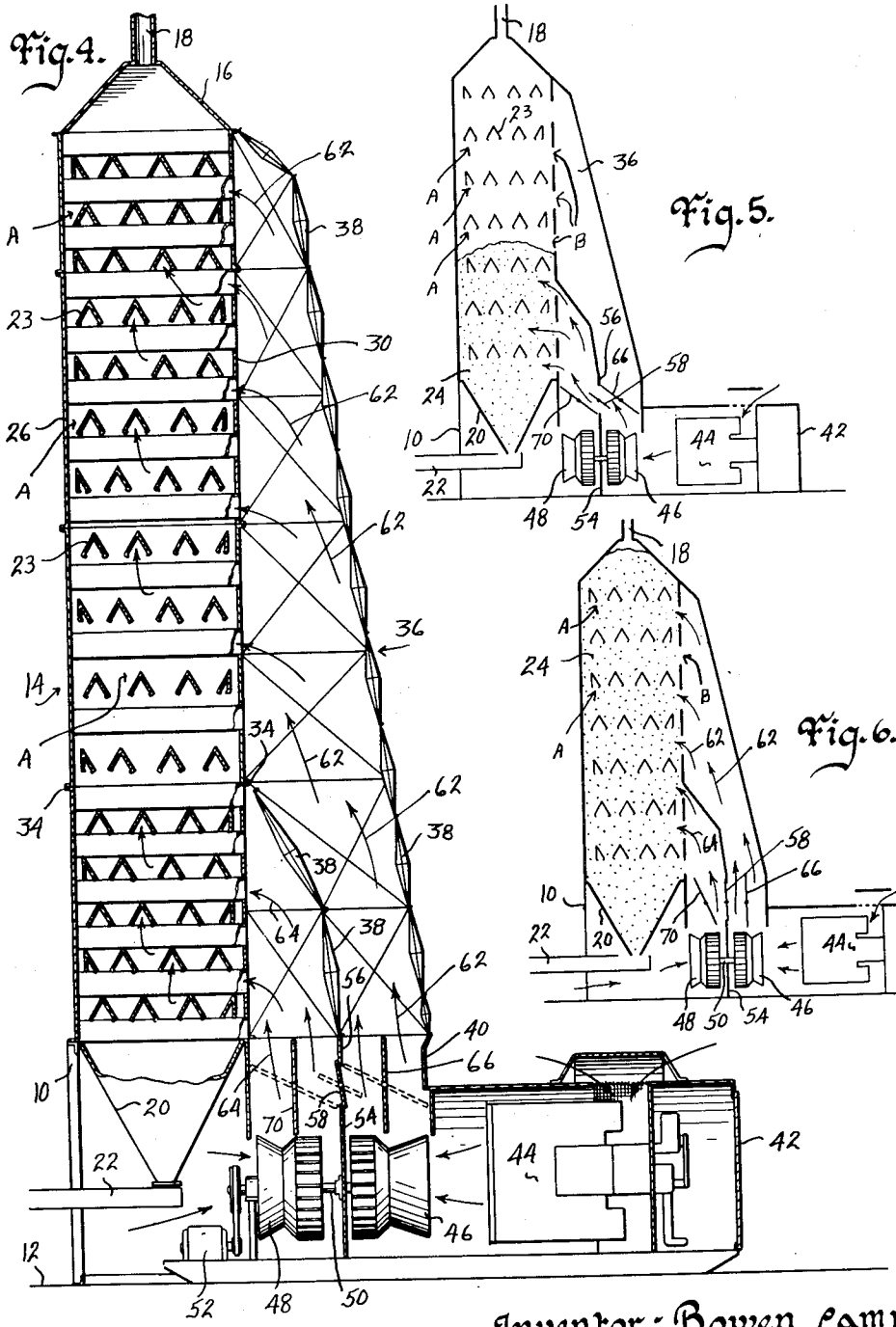


Fig. 5.

Fig. 6.

Inventor: Bowen Campbell

by Talbert Dick & Adler

Attorneys

Witness

Edward P. Healey

United States Patent Office 2,701,920 Patented Feb. 15, 1955

2,701,920

GRAIN DRIER

Bowen Campbell, Des Moines, Iowa

Application August 18, 1952, Serial No. 304,920

10 Claims. (Cl. 34—65)

My invention relates to grain dryers and has for one of its objects the providing of a heated air fan and a cooling air fan mounted on a single shaft and driven by a single motor.

Another object of this invention is to provide a dryer of the above class in which the cooling area or portion thereof normally in communication with the cooling air fan can be quickly and easily placed in communication with the heated air fan alone for drying a small batch of grain relative to the quantity for which the dryer is fully capable of.

Still another object of my invention with respect to grain dryers is to provide means for adjustably controlling the volume of air flow of both the cooling air and heated air fans.

A still further object of this invention is to provide in the grain drying portion of a dryer a plurality of obstacles in the flow path of grain that have a progressively increasing vertical spaced relationship to each other whereby the depth of grain through which air is forced is graduated for maximum drying efficiency and resulting quality.

Another object of my invention is to provide in grain dryers of the above class a screen covered and shield protected air exhaust port that is co-extensive with the height of the drying tower. In this respect the air exhaust openings are shielded from the weather and the screen element eliminates condensation and icing.

These and other objects will be apparent to those skilled in the art.

My invention consists in the construction, arrangement, and combination of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, and specifically pointed out in my claims, and illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of my dryer with a portion of the tower cut away to more fully illustrate its construction,

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1,

Fig. 3 is an enlarged perspective view of a panel section used in the tower housing with a portion broken away to more fully illustrate its construction in providing insulation,

Fig. 4 is an enlarged longitudinal section view of this dryer taken on the line 4—4 of Fig. 1,

Fig. 5 is a schematic view of the dryer showing the cooling portion only filled with grain and in communication with the source of heated air for a small batch drying, and

Fig. 6 is a schematic view of the dryer filled with grain and illustrating the flow of both the cooled and heated air.

Referring to the drawings I have used the numeral 10 to designate an enclosed frame support member arranged on a suitable supporting surface such as the ground 12. A tower housing 14 having a truncated shaped top 16 is mounted on the support 10 as illustrated in Fig. 4. An inlet conduit 18 in the top 16 communicates with the inside of the tower 14 and is designed to extend to a source of grain supply for the filling of the tower therewith. At the bottom of the tower a funnel shaped portion 20 extends into the enclosed frame 10 and communicates with a conveyer 22 or any other suitable means for carrying the grain away. No invention is claimed in the structure thus far described as the elements recited and their relationship in general are common in the construction of grain dryers.

The interior of the tower contains a plurality of baffle members 23 over and past which the grain 24 must flow in the drying process and for purposes of identification of the respective tower sides in describing the baffle arrangements and the drying elements I have designated these sides by the numerals 26, 28, 30 and 32 as shown more particularly in Fig. 2. Each baffle 23 is in the form of an inverted V-shaped channel and a plurality are arranged in parallel spaced relationship to form a horizontal row thereof that extends transversely of the longitudinal axis of the tower. A plurality of such rows are arranged in vertical spaced relationship within the tower and in alternating rows the longitudinal axes of all the baffle members in one respective row are perpendicular to the longitudinal axes of the baffle members in the adjacent row, thus providing a criss-cross baffle arrangement that thoroughly mixes the grain as it moves through the tower. It is pointed out in Fig. 4 that from the top of the tower downwardly to point 34 is considered the drying portion of the tower and below point 34 is what is known as the cooling portion, and that in the drying portion, the vertical spaced relationship between the rows of baffle members progressively increases from top to bottom. By this arrangement, the depth of grain through which air is forced, as will be later described, is graduated for maximum efficiency and quality.

The inverted channel-like baffle members 23 are each open on each end and one series of alternate rows identified by the letter A in Fig. 2 and as shown in Fig. 1 has the open ends extending between the tower sides 28 and 32. The other series of alternating rows B likewise has its ends extending between the tower sides 26 and 30 and in each of the rows A the respective ends of the baffle member communicate with the outside of the tower sides 28 and 32. The rows B each communicate with the outside of the tower side 30 as illustrated in Figs. 1 and 2.

An air duct 36, progressively narrower from bottom to top, is formed by adding three sides to the tower side 30 co-extensive with the height of the tower 14, as shown in Fig. 1. Each side forming the duct, exclusive of the tower side 30, is formed from a plurality of individual panel members 38. Each panel 38 is of a double thickness with the inner and outer thicknesses spaced from each other and cross-broken so that there is an air space therebetween as shown in Fig. 3. This not only stiffens the panel considerably but when shiny aluminum is used, for example, an insulating effect is produced by the plurality of reflective surfaces.

Connected to the bottom of the duct 36 and frame 10 and resting on the same plane as frame 10 is the fan housing 40 which also is connected on one side to a housing 42 on the same level which contains any suitable heat producing apparatus 44. A heating air fan 46 and a cooling air fan 48 are positioned within the housing 40 and the rotors for each fan are on the same shaft 50 and driven by a single motor 52. The fans 46 and 48 are separated by a vertical partition 54 that extends from the bottom of housing 40 toward but not to the top thereof as shown in Fig. 4. A stub partition member 56 depends from the top of housing 40 in vertical alignment with partition 54 but is spaced therefrom and a movable barrier 58 connected to a lever handle 60 on the outside of housing 40 is adjustable as shown in Fig. 4 to open and close the space between partitions 54 and 56. The bottom portion of air duct 36 is divided into two air channels by means of a partition formed from a plurality of panels extending in endwise relationship as a continuation of partition 56 to point 34 on the tower (Fig. 4) which is the division point between the cooling and drying sections of the tower as previously described. Thus, when the barrier member 58 is closed one air channel in duct 36 communicates with the heating air fan 46 to carry warm air to the upper or drying portion of the tower 14 as indicated by the arrows 62 and the other air channel communicates with the cooling air fan 48 to carry cool

air to the lower or cooling portion of the tower, as illustrated by the arrows 64 in Fig. 4.

A damper 66 in the housing 40 operated by a lever 68 on the outside of the housing is adapted to control the volume of heated air from the fan 46 to the drying portion of the tower and a like damper 70 with control lever 72 is similarly used for the cooling air from fan 48 intended for the cooling portion of the tower.

Fig. 6 illustrates the operation of this dryer in what is known as continuous drying. Here grain 24 has entered the tower 14 through inlet 18 and flows by gravity downwardly past the baffle members 23. At the same time heat and cool air is blown into the respective drying and cooling sections through the openings in tower side 30 of the B series of baffle rows as shown in Figs. 1 and 2. Eventually this warm and cool air will circulate under the baffle members in rows A and B and leave the tower through tower sides 28 and 32, as indicated by arrows 74 in Fig. 2. To protect the air exhaust ports in the tower sides 28 and 32 from direct contact with the outside atmosphere, I provide the respective shield members 76 and 78 which extend from the respective ends of tower side 30 to the respective points 80 and 82 in line with and spaced from the respective ends of tower side 26 as shown in Fig. 2. An exhaust screen member 84 is secured between the end of each respective shield 76 and 78 and the respective adjacent end thereto of tower side 26.

When the tower is initially filled with grain for a drying operation it is obvious that grain in the lower or cooling portion would not receive the benefit of the heated air in the normal drying operation, and in this regard, reference is made to Fig. 5 which illustrates the manner in which my dryer can be adapted to convert the cooling section thereof to a drying section. For this purpose damper 70 is closed to cut off cool air from fan 48, damper 66 is closed to cut off warm air from the upper or normal drying portion of the tower and barrier 58 is opened so that heated air blown by fan 46 will pass through the air channel which normally receives cool air. By this arrangement, shown in broken lines in Fig. 4, warm air is now furnished to the lower portion of the dryer for a drying process. It is also pointed out that this last described arrangement is usable also in drying only a small batch of grain. It will also be appreciated that the dampers 70 and 66 are adjustable so that the air from the fans may be used to best advantage in the drying of light weight grains such as oats, flax, etc., and this is material since a full volume of air needed for heavier grains could blow the lighter ones out of the tower. Also, the air volume control by means of these dampers is advantageous in very cold weather when little cooling is necessary. It will be observed that when outdoor humidity is high, the cooling air quite often puts moisture into the grain in cooling it and therefore in winter, for example, when the relative humidity of air is usually rather high and not much cooling air is necessary, it is a decided advantage to reduce air volume to prevent adding any more moisture than necessary in the cooling process.

Some changes may be made in the construction and arrangement of my grain dryer without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

1. In a grain dryer, a tower having an inlet port and an outlet port, means for supporting said dryer, a housing arranged adjacent said tower supporting means, an air duct co-extensive in height with and mounted on said tower and having its bottom end in communication with said housing, said air duct also in communication with the tower interior, a partition in the lower portion of said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, a partition in said housing dividing the same into two compartments, one of which communicates through one of said channels to the upper portion of said tower and the other communicates through the other channel with the lower portion of said tower, a movable barrier in said last mentioned partition whereby said compartments can be in communication with each other, a shaft rotatably mounted in said housing so that a portion thereof extends into each of said compartments, means for rotating said shaft, two fans in said housing each in one compartment respectively and having their rotors mounted on said shaft, one fan being a cool air fan in communication with the outside atmosphere and the other a heated air fan in communication with a source of heated air, the cool air fan furnishing cool air to the lower portion of the tower and the heated air fan normally furnishing heated air to the upper portion of the tower, a damper in each compartment for controlling or closing off the volume of air from the cool air and heated air fans to the lower and upper tower portions respectively, and when each of said dampers is closed and said movable barrier is opened, said heated air fan can furnish warm air to the lower portion of said tower only.

2. In a grain dryer, a rectangular tower having a grain inlet port and grain outlet port, a series of horizontal vertically spaced apart rows of inverted V-shaped open end elongated baffle members in said tower, the longitudinal axes of each baffle in each respective row being parallel to each other and the rows arranged so that in alternate rows the longitudinal axes of the baffles in respective rows are perpendicular to each other to form a network of criss-cross baffles through which the grain must pass, an open end of each baffle in one alternate series of rows each communicating with the outside of one tower side to provide air exhaust openings, and one open end of each baffle in the other series of alternate rows communicating with the outside of another side of the tower to provide an air inlet opening, an air duct mounted on said tower and in communication with each of said air inlet openings, a partition in the lower portion of said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, a housing connected to and communicating with said air duct at the bottom thereof, a shaft rotatably mounted in said housing, means for rotating said shaft, two fans in said housing each having their rotors mounted on said shaft, one of said fans communicating with cool air from the atmosphere and the other communicating with a source of heated air, one fan propelling heated air to the upper portion of the tower and the other furnishing cool air to the lower portion of the tower.

3. In a grain dryer, a rectangular tower having a grain inlet port and grain outlet port, a series of horizontal vertically spaced apart rows of inverted V-shaped open end elongated baffle members in said tower, the longitudinal axes of each baffle in each respective row being parallel to each other and the rows arranged so that in alternate rows the longitudinal axes of the baffles in respective rows are perpendicular to each other to form a network of criss-cross baffles through which the grain must pass, an open end of each baffle in one alternate series of rows each communicating with the outside of one tower side to provide air exhaust openings, and one open end of each baffle in the other series of alternate rows communicating with the outside of another side of the tower to provide an air inlet opening, an air duct mounted on said tower and in communication with each of said air inlet openings, a partition in the lower portion of said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, a partition in said housing dividing the same into two compartments, one of which communicates through one of said channels to the upper portion of said tower and the other communicates through the other channel with the lower portion of said tower, a movable barrier in said last mentioned partition whereby said compartments can be in communication with each other, a shaft rotatably mounted in said housing so that a portion thereof extends into each of said compartments, means for rotating said shaft, two fans in said housing each in one compartment respectively and having their rotors mounted on said shaft, one fan being a cool air fan in communication with the outside atmosphere and the other a heated air fan in communication with a source of heated air, the cool air fan furnishing cool air to the lower portion of the tower and the heated air fan normally furnishing heated air to the upper portion of the tower, a damper in each compartment for controlling or closing off the volume of air from the cool air and heated air fans to the lower and upper tower portions respectively, and when each of said dampers is closed and said movable barrier is opened, said heated

air fan can furnish warm air to the lower portion of said tower only.

4. A device as defined in claim 3 characterized by a shield member secured to said tower and extending outwardly across and spaced from said air exhaust openings.

5. In a grain dryer, a tower having an inlet port and an outlet port, means for supporting said dryer, a housing arranged adjacent said tower supporting means, an air duct co-extensive in height with and mounted on said tower and having its bottom end in communication with said housing, said air duct also in communication with the tower interior, a partition in the lower portion of said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, a shaft rotatably mounted in said housing, means for rotating said shaft, two fans in said housing each having their rotors mounted on said shaft, one of said fans communicating with cool air from the atmosphere and the other communicating with a source of heated air, one fan propelling heated air to the upper portion of the tower and the other furnishing cool air to the lower portion of the tower, and means in said housing closing off cool air to the lower portion of the tower and heated air to the upper portion thereof and directing the heated air to the lower portion only of said tower.

6. In a grain dryer, a tower having an inlet port and an outlet port, a housing adjacent said tower, an air duct mounted on said tower and in communication with said housing, said air duct also in communication with the tower interior, a partition in said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, a shaft rotatably mounted in said housing, means for rotating said shaft, two fans in said housing each having their rotors mounted on said shaft, one of said fans communicating with cool air from the atmosphere and the other communicating with a source of heated air, one fan propelling heated air to the upper portion of the tower and the other furnishing cool air to the lower portion of the tower, and means in said housing closing off cool air to the lower portion of the tower and heated air to the upper portion thereof and directing the heated air to the lower portion only of said tower.

7. In a grain dryer, a tower having an inlet port and an outlet port, means for supporting said dryer, a housing arranged adjacent said tower supporting means, an air duct co-extensive in height with and mounted on said tower and having its bottom end in communication with said housing, said air duct also in communication with the tower interior, a partition in the lower portion of said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, two fans in said housing, means for operating the same, one of said fans communicating with cool air from the atmosphere and the other communicating with a source of heated air, one fan propelling heated air to the upper portion of the tower and the other furnishing cool air to the lower portion of the tower, and means in said housing closing off cool air to the lower portion of the tower and heated air to the upper portion thereof and directing the heated air to the lower portion only of said tower.

8. In a grain dryer, a tower having an inlet port and an outlet port, a housing adjacent said tower, an air duct mounted on said tower and in communication with said housing, said air duct also in communication with the tower interior, a partition in said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, two fans in said housing, means for operating the same, one of said fans communicating with cool air from the

atmosphere and the other communicating with a source of heated air, one fan propelling heated air to the upper portion of the tower and the other furnishing cool air to the lower portion of the tower, and means in said housing closing off cool air to the lower portion of the tower and heated air to the upper portion thereof and directing the heated air to the lower portion only of said tower.

9. In a grain dryer, a tower having an inlet port and an outlet port, a housing adjacent said tower, an air duct mounted on said tower and in communication with said housing, said air duct also in communication with the tower interior, a partition in said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, a partition in said housing dividing the same into two compartments, one of which communicates through one of said channels to the upper portion of said tower and the other communicates through the other channel with the lower portion of said tower, a movable barrier in said last mentioned partition whereby said compartments can be in communication with each other, two fans in said housing each in one compartment respectively, means for operating said fans, one fan being a cool air fan in communication with the outside atmosphere and the other a heated air fan in communication with a source of heated air, the cool air fan furnishing cool air to the lower portion of the tower and the heated air fan normally furnishing heated air to the upper portion of the tower, a damper in each compartment for controlling or closing off the volume of air from the cool air and heated air fans to the lower and upper tower portions respectively, and when each of said dampers is closed and said movable barrier is opened, said heated air fan can furnish warm air to the lower portion of said tower only.

10. In a grain dryer, a rectangular tower having a grain inlet port and grain outlet port, a series of horizontal vertically spaced apart rows of inverted V-shaped open end elongated baffle members in said tower, the longitudinal axes of each baffle in each respective row being parallel to each other and the rows arranged so that in alternate rows the longitudinal axes of the baffles in respective rows are perpendicular to each other to form a network of criss-cross baffles through which the grain must pass, an open end of each baffle in one alternate series of rows each communicating with the outside of one tower side to provide air exhaust openings, and one open end of each baffle in the other series of alternate rows communicating with the outside of another side of the tower to provide an air inlet opening, an air duct mounted on said tower and in communication with each of said air inlet openings, a partition in said air duct to divide the same into two channels, one of which communicates with the lower portion of the tower only and the other communicating only with the upper portion of the tower, a housing communicating with said air duct, two fans in said housing, means for operating said fans, one of said fans communicating with cool air from the atmosphere and the other communicating with a source of heated air, one fan propelling heated air to the upper portion of the tower and the other furnishing cool air to the lower portion of the tower, and means in said housing closing off cool air to the lower portion of the tower and heated air to the upper portion thereof and directing the heated air to the lower portion only of said tower.

References Cited in the file of this patent

UNITED STATES PATENTS

38,723	Beach	June 2, 1863
1,014,122	Cornwall	Jan. 9, 1912
1,276,044	Ellis et al.	Aug. 20, 1918
1,502,858	Little	July 29, 1924
1,587,582	Galloway	June 8, 1926