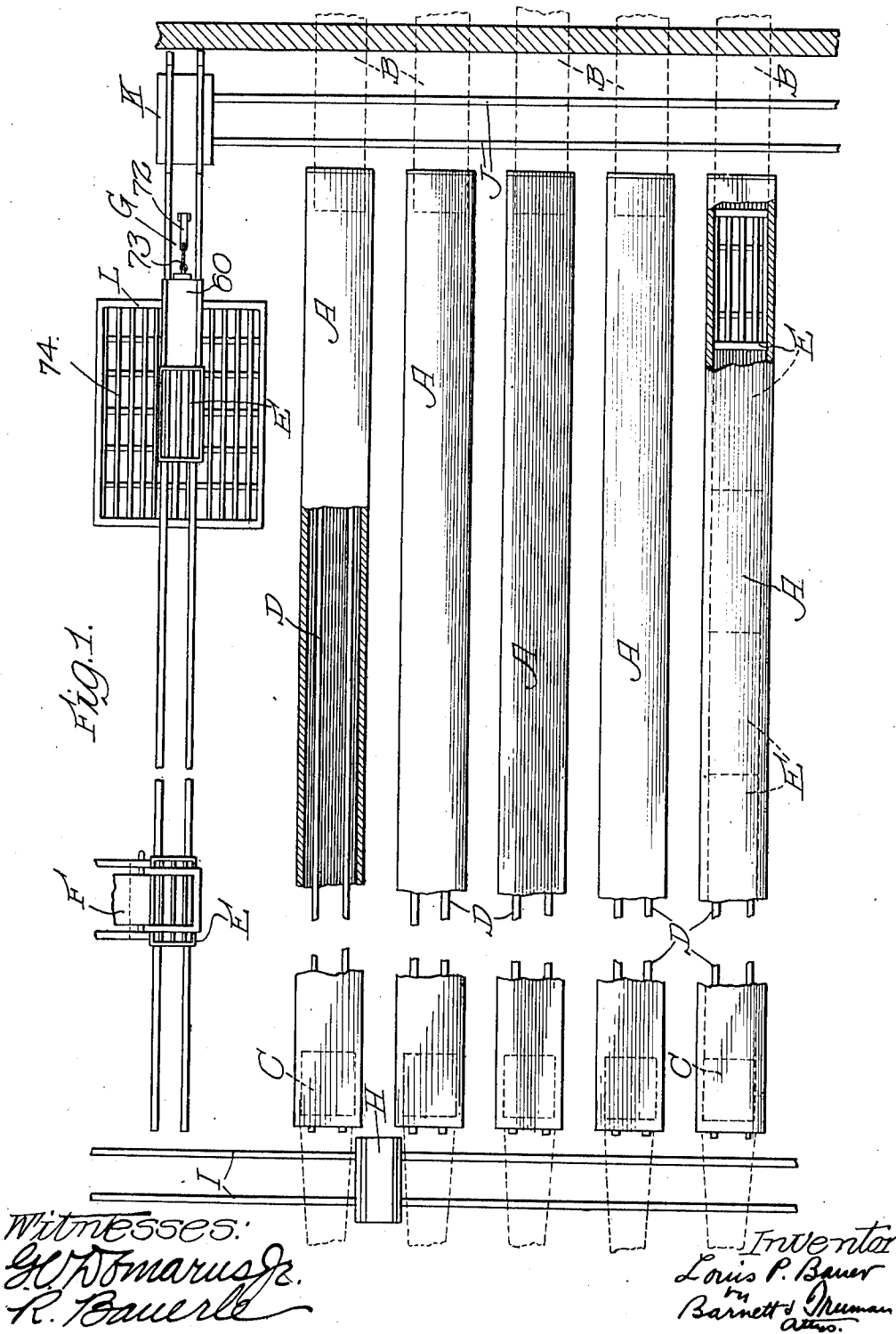


L. P. BAUER.
 APPARATUS FOR DRYING STARCH.
 APPLICATION FILED JAN. 30, 1913.

1,061,720.

Patented May 13, 1913.

6 SHEETS—SHEET 1.

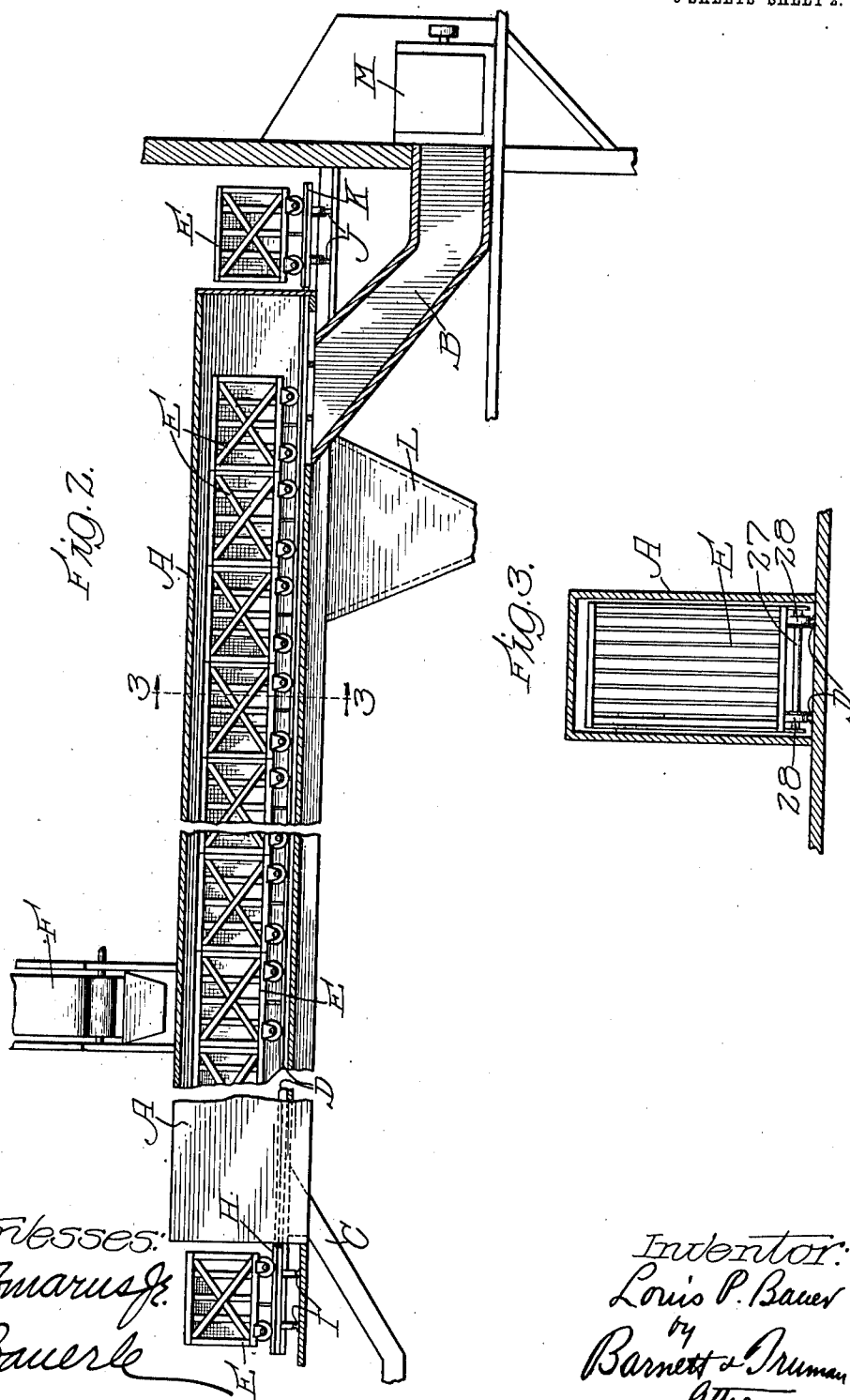


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8 SHEETS—SHEET 2.



Witnesses:
 G. W. Marus Jr.
 R. Bauer

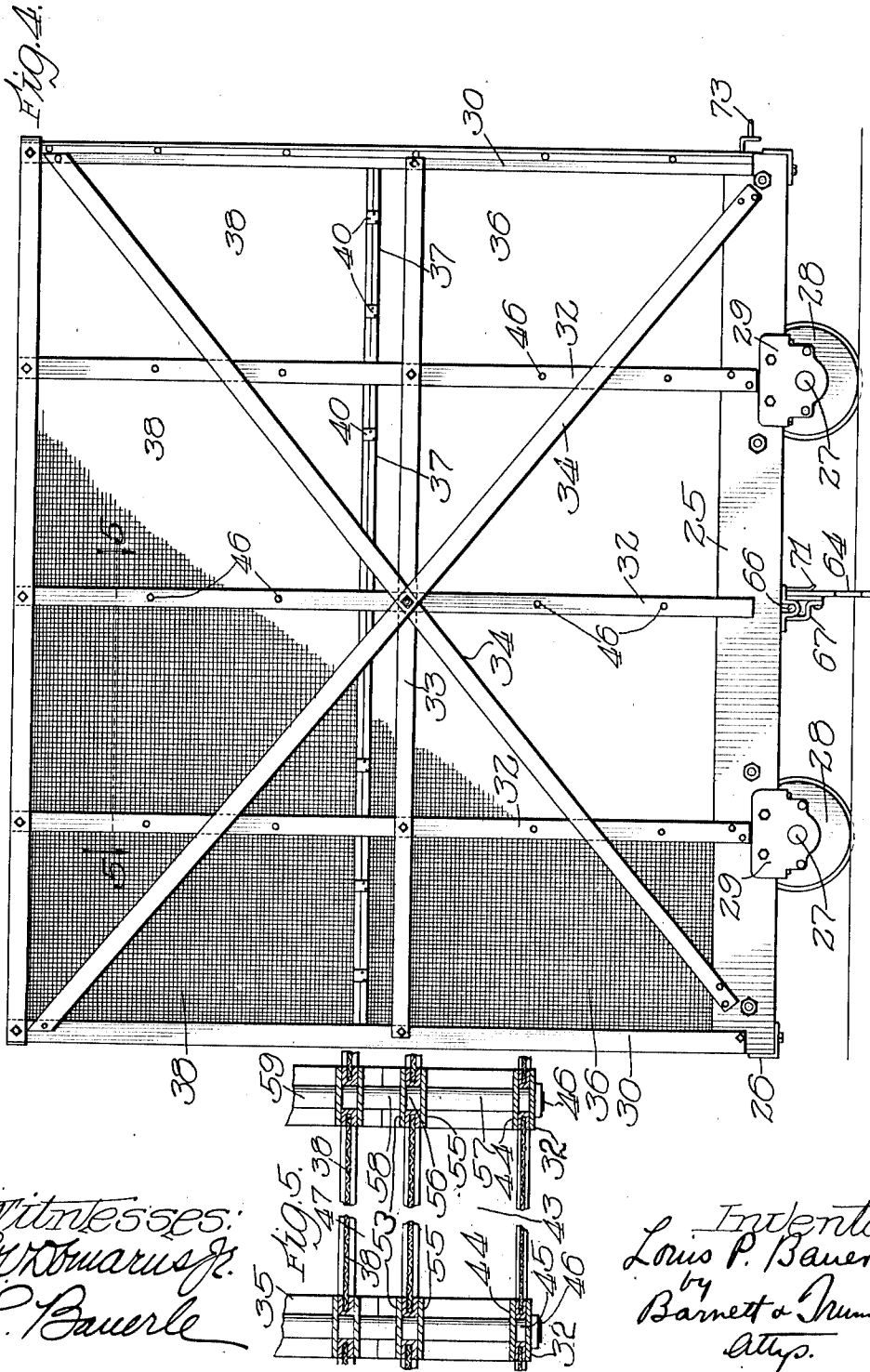
Inventor:
 Louis P. Bauer
 by
 Barnett & Truman
 Attys

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6 SHEETS—SHEET 3.



Witnesses:
 G. K. Mearns
 R. Bauerle

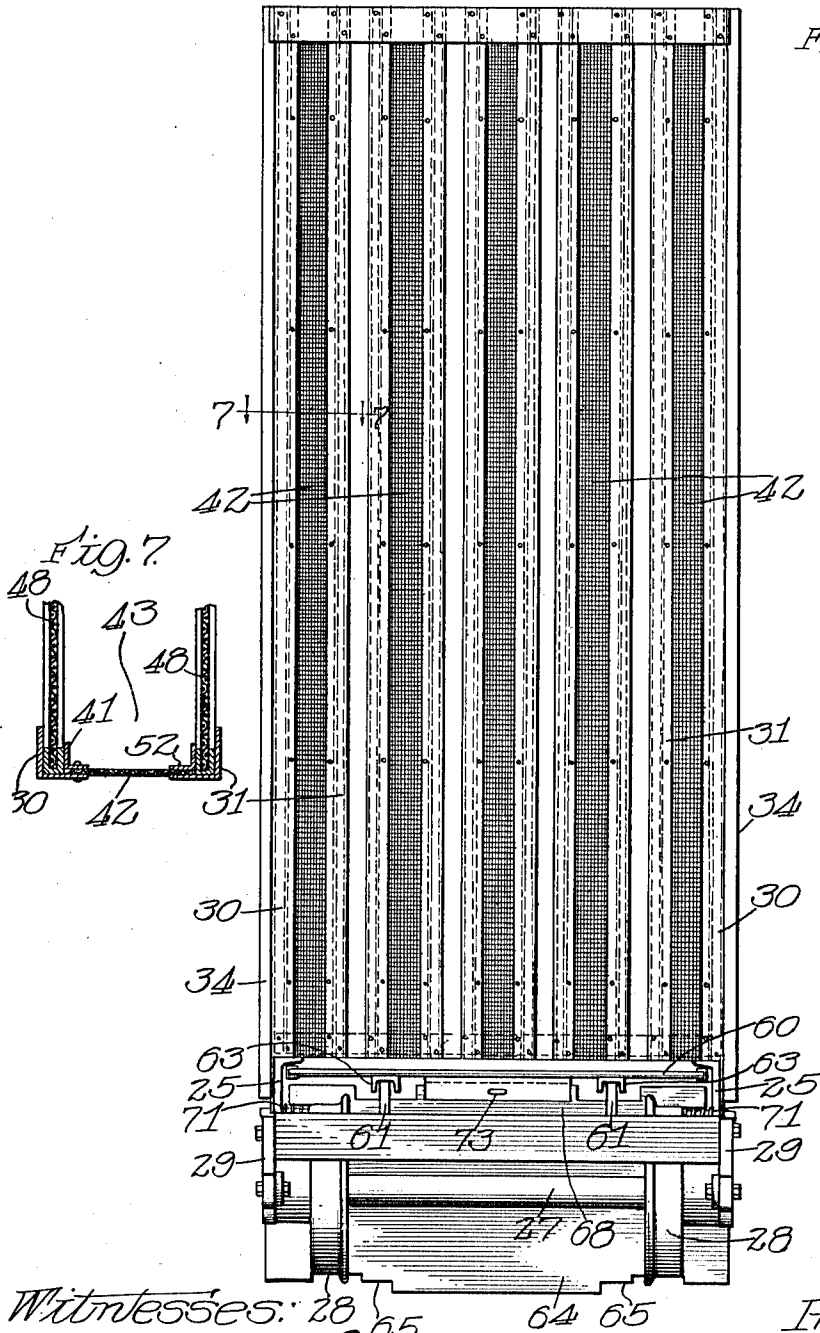
Inventor:
 Louis P. Bauer
 by
 Barnett & Mearns
 Atty.

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6 SHEETS—SHEET 4.



Witnesses: 28 65
 H. W. Marus Jr.
 R. Bauer

Inventor:
 Louis P. Bauer
 by Barnett & Truman
 attys.

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6 SHEETS—SHEET 5.

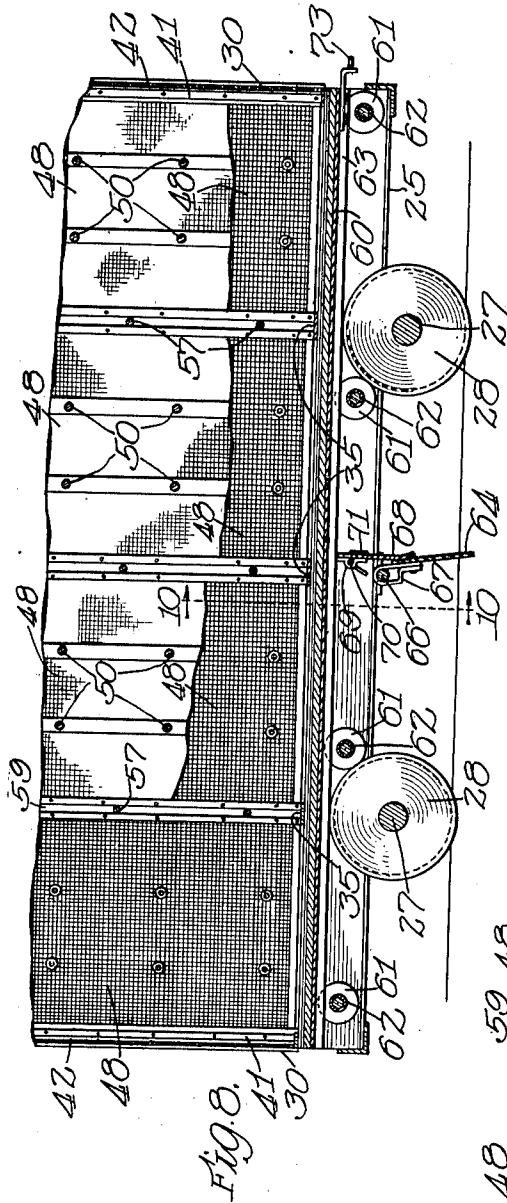


Fig. 8.

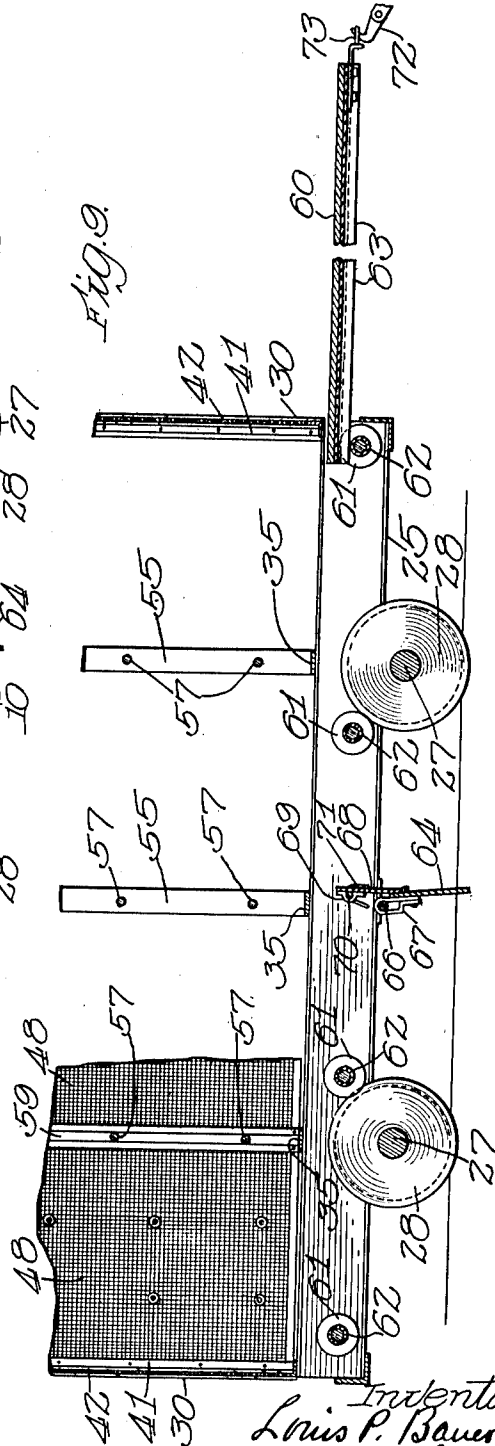


Fig. 9.

Witnesses:
 G. W. Marus Jr.
 R. Bauerle

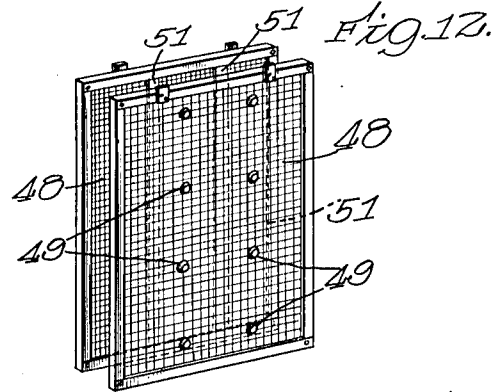
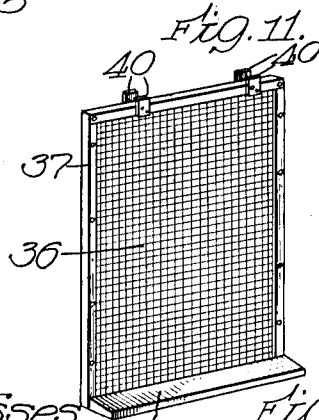
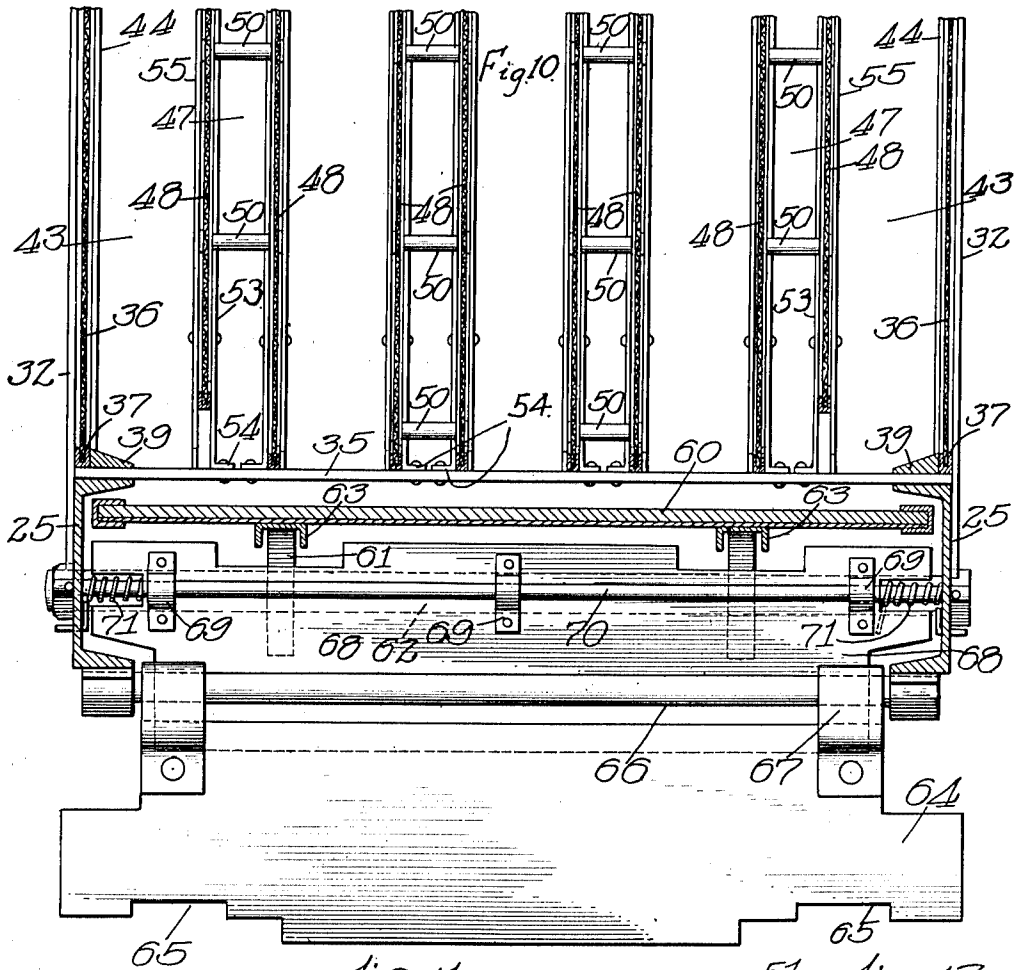
Inventor:
 Louis P. Bauer
 by Barnett & Freeman
 attys.

L. P. BAUER.
 APPARATUS FOR DRYING STARCH.
 APPLICATION FILED JAN. 30, 1913.

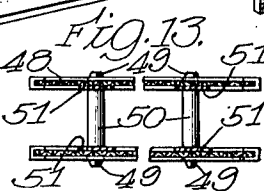
1,061,720.

Patented May 13, 1913.

6 SHEETS—SHEET 6.



Witnesses:
 G. W. Marus Jr.
 R. Bauer



Inventor:
 Louis P. Bauer
 by Barnett & Truman
 Atty.

UNITED STATES PATENT OFFICE.

LOUIS P. BAUER, OF PEKIN, ILLINOIS, ASSIGNOR TO CORN PRODUCTS REFINING COMPANY, A CORPORATION OF NEW JERSEY.

APPARATUS FOR DRYING STARCH.

1,061,720.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed January 30, 1913. Serial No. 745,191.

To all whom it may concern:

Be it known that I, LOUIS P. BAUER, a citizen of the United States, residing at Pekin, in the county of Tazewell and State of Illinois, have invented certain new and useful Improvements in Apparatus for Drying Starch, of which the following is a specification.

My invention relates to the manufacture of starch, and particularly to the operation of drying the starch after it is taken from the settling tables.

According to the method of drying starch commonly employed in starch factories for a number of years prior to my invention, the starch after being removed from the settling tables is broken up and spread out upon trays consisting of wooden frames having burlap bottoms. These trays are placed one above another in carriers or wagons and the carriers moved intermittently through kilns or drying tunnels through which a constant circulation of hot air is maintained. The method of procedure is to keep the tunnels full of wagons, a freshly loaded wagon being introduced at one end of the tunnel and the whole line of wagons moved along whenever a wagon with its contents completely dried is removed from the other end of the tunnel. The wagons are introduced at the ends of the tunnels from which the hot air is discharged and therefore are moved in the direction opposite to that of the circulation. The wagons taken from the tunnels are removed to some suitable place and the trays taken out and dumped. The disadvantages of this method of drying have been recognized for a long time and persistent efforts have been made to devise a drying system which would obviate these disadvantages but without success so far as I am aware, until the system of my present invention was perfected.

Broadly speaking, my invention consists in providing carriers in which the starch, instead of being disposed in horizontal layers, is supported, by means of foraminous partitions, in thin upright bodies extending from top to bottom of the car and lengthwise thereof, between which are circulation spaces. The advantages of this system over the old system are very great. In the first place, the amount of heat required for drying a given quantity of starch is very considerably decreased. When the starch is ar-

anged in horizontal layers the circumstance that only one surface, the upper surface, of the layer is exposed to direct contact with the heat diminishes the rapidity of the drying operation. With the vertical arrangement of the starch bodies both sides of such bodies are directly exposed to the heat through the foraminous partitions. Furthermore, with the starch arranged in horizontal layers when the wagons are first introduced into the tunnels there is a very considerable precipitation of moisture upon the starch due to the contact of the hot, moisture laden air about to be discharged from the tunnel with the relatively cold and uneven surfaces of the starch. As a result an additional amount of heat is required to dry out this increased moisture. The vertical arrangement of the starch between the foraminous partitions does away almost entirely with precipitation on the in-coming starch. Finally, the thickness of the vertical layers and the width of the circulation spaces in my system are constant, whereas they are bound to vary with the old system. One tray will be loaded more heavily than another, with the result that the starch wagons must be kept in the tunnels for a sufficiently long period to insure the complete drying of the thickest layers. For similar reasons the starch can be much more uniformly dried by my method than by the old method. The degree of dryness may also be accurately fixed. Starch taken from the tables ordinarily contains about fifty per cent. of moisture. Different kinds or grades of starch have to be dried to different degrees, the amount of moisture in commercial starch of different sorts varying from ten to fifteen per cent. Under the old system it is almost impossible to fix the degree of dryness whereas, conditions being uniform in my system, the amount of moisture removed can be accurately determined by proper regulation of the heat and period of drying. The system of drying in horizontal layers involves a process of loading the wagons which is at best only semiautomatic. While apparatus has been devised for spreading the starch on the trays, the trays have to be placed in the wagons by hand. The unloading of the trays must also be done by hand and these operations require a large number of laborers where the amount of starch handled is considerable. In the apparatus here-

in disclosed the wet starch may be automatically fed into the wagons and automatically dumped therefrom.

For one reason or another it has been necessary to make the trays of the ordinary starch drying wagons of wood with burlap bottoms. Metal trays have been tried but have not proven successful. The starch wagons of my invention may be made entirely of metal. As a result the cost of upkeep is very considerably reduced. Moreover, with the use of wood and cloth trays it is necessary to carefully inspect all of the starch after it has been dried because of the likelihood that splinters of wood, bits of cloth, nails, and the like, from the trays will be found in the dried starch.

The process involved in the operation of the within described apparatus is not claimed herein, this process forming the subject matter of my Patent No. 1,035,302, granted August 13, 1912.

While the apparatus herein described is intended particularly for drying starch it might be used with advantage in the drying of other materials where similar conditions prevail.

The invention is illustrated, in a preferred embodiment, in the accompanying drawings, wherein—

Figure 1 is a plan view showing the general organization of the apparatus; Fig. 2, a longitudinal sectional elevation of the same; Fig. 3, a sectional view taken on line 3—3 of Fig. 2, these three views being somewhat diagrammatic in their character; Fig. 4 is a side elevation of one of the starch wagons; Fig. 5, a sectional plan taken on line 5—5 of Fig. 4; Fig. 6, an end elevation of the wagon; Fig. 7, a sectional plan taken on line 7—7 of Fig. 6; Fig. 8, a fragmentary longitudinal vertical sectional view taken through the wagon showing the bottom member in position to close the starch compartments; Fig. 9, a similar view showing the bottom member withdrawn to allow the dried material to discharge; Fig. 10, a sectional view on line 10—10 of Fig. 8; Fig. 11, a view, in perspective, of one of the lower screens forming part of the foraminous outer side walls of the wagon; Fig. 12, a view, in perspective, of a pair of attached screens employed to form the inner foraminous partitions, and Fig. 13, a sectional plan illustrating the means for attaching the screens together.

Like characters of reference designate like parts in the several figures of the drawings.

Referring first to Figs. 1 to 3 inclusive showing the general organization of the apparatus, A designate tunnels arranged side by side and supplied with hot air through the ducts B. The moisture laden air is discharged from the other ends of the tunnels through suitable ducts C. The tun-

nels are provided with tracks D for the drying wagons designated generally by the letter E. The wagons are filled by any suitable means. I have shown a belt conveyer F which is arranged to deliver the starch to the wagon as the latter stands on a track G. After being filled the wagon is moved along the track to a transfer car H which runs on a track I which extends across the ends of the tunnels from which the hot air is discharged. The tunnels are preferably kept full of wagons. A freshly loaded wagon is introduced and the line of wagons pushed along as a wagon with its contents dried is removed from the other end of the tunnel in question. J designates a track extending across the ends of the tunnels into which the hot air is introduced, and K is a transfer truck which takes the wagons as they come from the tunnel and transports them to the track G. L designates a discharge hopper over which the track G extends. After the dried contents of the wagons have been discharged into the hopper L the wagons are re-filled and are re-introduced into the tunnel so that the operation is continuous.

The preferred construction of the drying wagons is shown in Figs. 4 to 13 inclusive. The wagons are constructed as follows: 25 designates channel bar side sills connected by the angle bar end sills 26. The axles 27 of the wheels 28 turn in journal boxes 29 secured to the side sills 25. The body of the wagons is made up of a framework and a plurality of screens which latter, for the purpose of repair and replacement, are removably engaged with the framework. The framework consists of angle iron corner posts 30 and intermediate angle iron end members 31, vertical side strips 32, horizontal side strips 33, diagonal strips 34 and, at the bottom of the body, horizontal transverse strips 35, resting upon and secured to the channel sills 25. The outer side walls of the wagon are composed, in each case, of a lower series of screens 36 (Fig. 11) each consisting of a metal frame 37 inclosing a piece of woven fabric made of heavy steel wire, and of a similarly constructed upper series of screens 38. Preferably the lower screens 36 are provided with base members 39 which rest upon the cross pieces 35 and with clips 40 to receive the lower edges of the upper screens 38. The outer edges of the screens at the ends of the wagon fit into grooves formed by the angle iron corner pieces 30 and the smaller angle irons 41, the latter being riveted to the former through the strips of woven wire fabric 42 used for closing the ends of the starch compartments 43 (Fig. 7). The edges of the intermediate screens and the inner edges of the screens at the ends of the side walls fit into grooves formed between the upright side strips 32 and adjacently arranged strips 44, the strips

32 and 44 being secured together, with the interposition of spacers 45, by means of bolts 46 (Fig. 5). The partition walls, dividing the body of the wagon into starch compartments 43 and intervening circulation spaces 47, are preferably composed of screens 48 joined together in pairs (Fig. 12). One screen of each pair forms a portion of the wall of a starch compartment and the other screen of the pair a portion of the adjacent wall of the next starch compartment. Each pair of partition screens are secured together by rivets 49 passing through spacing sleeves 50 which bear against reinforcing strips 51 secured to the screens. The outer edges of the partition screens at the ends of the wagon fit into grooves formed by the intermediate angle iron end members 31 (Fig. 7) and angle strips 52 secured thereto by rivets which pass through the edge of the end screens 42. The edges of the intermediate partition screens and the inner edges of the end partition screens are received in grooves formed between the upright strips 53, which are provided with flanges 54 riveted to the cross pieces 35, and the adjacent vertically arranged strips 55 which are secured to the strips 53, with the interposition of spacers 56, by means of the bolts 46; the strips 55 which are nearest the outer side walls of the wagon being spaced from the strips 44 by the spacing sleeves 57. Similar spacing sleeves 58, 59 are employed for rigidifying the structure employed for supporting the partition screens.

By the arrangements above described starch compartments are provided, spaced one from another and having foraminous sides, which are capable of withstanding the pressure and weight of the wet starch. If any screen is injured or becomes worn it may be removed for repair or replacement. The starch compartments are preferably closed by a bottom member 60 which is slidably mounted so that it may be withdrawn in order to permit the dry starch to be discharged from the wagon. In the drawings I have shown the bottom member supported on rollers 61 carried on the transverse shafts 62; the under side of the bottom member being preferably provided with channel section tracks 63 for the rollers. In order to prevent the hot air from short circuiting under the wagons the latter are preferably provided with baffle plates.

Referring particularly to Figs. 4, 8, 9 and 10, 64 designates a plate which is notched out at 65 to fit the rails on which the wagon runs and hinged to a shaft 66 secured to the under side of the side sills 25 by means of clips 67. Between the channel sills 25 is another plate 68 pivoted by means of the keepers 69 to a shaft 70 passing through and secured to the channel sills 25. Coiled

around the extremities of the shaft 70 are springs 71 which tend to keep the lower edge of the plate 68 pressed against the plate 64 so that the latter is caused to bear against the floor of the tunnel. The bottom member 60 may be withdrawn to permit the discharge of the dried starch by any suitable means. I have provided for this purpose an anchor 72 secured to the floor adjacent the discharge hopper L. The ring 73 on the end of the bottom member is attached to the anchor 72 and the movement of the wagon on the track withdraws the bottom member. Preferably the discharge hopper L is covered with a grating 74. Any suitable means may be employed for directing hot air into the tunnels. I have shown conventionally in Fig. 2 a fan designated M.

Operation: A wagon E filled from belt F is moved on track G to the left (Fig. 1) to the transfer truck H by which it is carried to one of the tunnels A. Whenever a wagon is removed from one of the tunnels a freshly loaded wagon is introduced at the other end of such tunnel and all of the wagons moved along one step. The hot air enters the tunnels through ducts B and is discharged through ducts C, the circulation being therefore in the direction opposite to the movement of the wagons. When the contents of a wagon is dried it is run out of the tunnel on the transfer truck K which carries it to the track G. The wagon is moved on the track G beyond anchor 72 and the ring 73 on the bottom member 60 is attached to the anchor. The further movement of the wagon brings it over the discharge hopper L and withdraws the bottom member so that the contents of the starch compartments are discharged into the hopper. The wagon is then re-filled and again introduced into one of the tunnels as before.

I claim:

1. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through the tunnel and formed with a plurality of relatively narrow starch compartments extending from top to bottom of the carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces extending lengthwise of the carrier.

2. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through the tunnel and formed with a plurality of relatively narrow compartments extending from top to bottom of the carrier, open at the top and adapted to discharge through the bottom, the sides of which are foraminous and which are spaced apart so as to form circula-

tion spaces extending lengthwise of the carrier.

3. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through the tunnel and formed with a plurality of relatively narrow compartments extending from top to bottom of the carrier, open at the top, the sides of which are foraminous and which are spaced apart so as to form circulation spaces extending lengthwise of the carrier, and closing means for the bottoms of the compartments adapted to be shifted so as to allow the compartments to discharge by gravity.

4. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through the tunnel and formed with a plurality of starch compartments, the sides and ends of which are foraminous, and which are spaced apart so as to form circulation spaces extending lengthwise of the carrier.

5. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through the tunnel comprising running gear, a framework, foraminous sides and substantially vertical foraminous partitions dividing the space between the sides into a plurality of starch compartments and between each of the same circulation spaces; said sides and partitions being made up each of a plurality of screens removably arranged in said framework.

6. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of means for supporting the starch to be dried in thin, upright bodies and for causing the same to be moved through said tunnel.

7. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of carriers for supporting the starch to be dried in thin, upright bodies which are adapted to be moved through said tunnel in the direction opposite to that of the circulation of air therethrough.

8. In apparatus for drying starch, the combination with a drying tunnel and means for causing the circulation of hot air through the same from end to end, of carriers for supporting the starch to be dried in thin, upright bodies disposed longitudinally with respect to the tunnel which are adapted to be moved through said tunnel

in the direction opposite to that of the circulation of air therethrough.

9. In apparatus for drying starch, the combination with a drying tunnel and means for causing circulation of hot air through the same from end to end, of a carrier for the starch comprising running gear, and supported thereon a plurality of relatively narrow starch compartments extending from top to bottom of the carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces, and a baffle plate arranged between the starch compartments and the floor of the tunnel, for the purpose described.

10. In apparatus for drying starch, the combination with a drying tunnel and means for causing circulation of hot air through the same from end to end, of a carrier for the starch comprising running gear, and supported thereon a plurality of relatively narrow starch compartments extending from top to bottom of the carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces, and a baffle plate hinged to the carrier beneath said starch compartments, for the purpose described.

11. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through said tunnel and formed with a plurality of relatively narrow starch compartments extending from top to bottom of the carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces, said carrier being provided with a bottom member adapted to close the lower ends of the starch compartments which can be withdrawn to permit the discharge of the dried starch.

12. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through said tunnel and formed with a plurality of relatively narrow starch compartments extending from top to bottom of the carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces, said carrier being provided with a bottom member which is slidably sustained beneath the starch compartments, for the purpose described.

13. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through said tunnel and formed with a plurality of relatively narrow starch compartments extending from top to bottom of the

carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces, said carrier being provided with a bottom member which is slidably sustained beneath the starch compartments for the purpose described, a discharge hopper, a track for the carrier arranged above said hopper, and an anchor adjacent said hopper to which said bottom member of the carrier is adapted to be attached.

14. In apparatus of the character described, the combination with a plurality of drying tunnels arranged side by side, of carriers formed with a plurality of relatively narrow compartments extending from top to bottom thereof, the sides of which are foraminous and which are spaced so as to form circulation spaces, tracks for said carriers extending through said tunnels, tracks at each end of the tunnels, a third track extending between the same, a discharge hopper beneath said last named track, and a filling apparatus arranged so as to discharge into the upper ends of the starch compartments of the carriers as they stand on said last named track.

15. In apparatus of the character described, the combination with a plurality of drying tunnels arranged side by side, of means for causing hot air to be passed through said tunnels from end to end, carriers formed with a plurality of relatively narrow compartments extending from top to bottom thereof, the sides of which are foraminous and which are spaced apart so as to form circulation spaces and provided with slidably mounted bottom members, tracks for said carriers extending through said tunnels, tracks at each end of the tunnels, a third track extending between the same, filling apparatus for the carriers arranged above the portion of said last mentioned track adjacent the ends of the tunnels from which the hot air is discharged, a discharge hopper under the portion of said last mentioned track adjacent the ends of the tunnels which the hot air enters, and an anchor adjacent said discharge hopper with which the bottom members of the carriers are adapted to be attached.

16. In apparatus of the character described, the combination with a plurality of drying tunnels arranged side by side, of means for causing hot air to be passed through said tunnels from end to end, carriers formed with a plurality of relatively narrow compartments extending from top to bottom thereof, the sides of which are foraminous and which are spaced apart so as to form circulation spaces, tracks for said carriers extending through said tunnels, tracks at each end of the tunnels, a third track extending between the same, filling apparatus for the carriers arranged above

the portion of said last named track adjacent the ends of the tunnels from which the hot air is discharged, and a discharge hopper under the portion of said last named track adjacent the ends of the tunnels which the hot air enters.

17. In apparatus of the character described, a carrier comprising running gear, a framework thereon, a plurality of screens providing narrow receptacles and intervening circulation spaces extending from top to bottom of the carrier and lengthwise thereof, and a bottom member which is slidably supported so that it may be withdrawn to allow the discharge of the material in said receptacles.

18. In apparatus of the character described, a carrier comprising running gear, a framework thereon, a plurality of screens providing narrow receptacles and intervening circulation spaces extending from top to bottom of the carrier and lengthwise thereof, rollers arranged below the receptacles, and a bottom member mounted on said rollers.

19. In apparatus of the character described, a carrier comprising running gear, a framework thereon, a plurality of screens providing narrow receptacles and intervening circulation spaces extending from top to bottom of the carrier and lengthwise thereof, a bottom member which is slidably supported so that it may be withdrawn to allow the discharge of the material in said receptacle, and a baffle plate below said bottom member.

20. In apparatus of the character described, a carrier comprising running gear, a framework thereon, a plurality of screens providing narrow receptacles and intervening circulation spaces extending from top to bottom of the carrier and lengthwise thereof, a bottom member which is slidably supported so that it may be withdrawn to allow the discharge of the material in said receptacles, and a baffle plate hinged to the carrier below said bottom member.

21. In apparatus of the character described, a carrier comprising running gear, a framework thereon, a plurality of screens providing narrow receptacles and intervening circulation spaces extending from top to bottom of the carrier and lengthwise thereof, a bottom member which is slidably supported so that it may be withdrawn to allow the discharge of the material in said receptacles, a baffle plate hinged to the carrier below said bottom member, and a spring adapted to force said baffle plate against the surface over which the carrier runs.

22. In apparatus of the character described, a carrier comprising side sills, supporting wheels, a framework carried on said sills, a plurality of screens providing narrow receptacles and intervening circular spaces extending from top to bottom of the

carrier and lengthwise thereof, means for closing the bottoms of said receptacles, a baffle plate hinged to the carrier beneath said sills, a baffle plate pivotally mounted between the sills, and a spring which forces said upper plate against the lower one.

23. In apparatus of the character described, a carrier comprising running gear, a framework supported thereon, a plurality of screens providing narrow receptacles and intervening circulation spaces extending from top to bottom of the carrier and longitudinally thereof, means for closing the bottoms of said receptacles, and a baffle plate on the carrier below said receptacles.

24. In apparatus of the character described, a carrier comprising running gear, a framework supported thereon, a plurality of screens providing narrow receptacles and intervening circulation spaces extending from top to bottom of the carrier and longitudinally thereof, means for closing the bottoms of said receptacles, and a hinged spring pressed baffle plate on the carrier below said receptacles.

25. In apparatus of the character described, a carrier having a plurality of upright foraminous walls providing narrow receptacles extending from top to bottom of the carrier and longitudinally thereof, each of said walls composed of fixed frame members, and a plurality of screens removably engaged with said fixed frame members.

26. In apparatus of the character described, a carrier having upright foraminous side walls and intervening partition walls parallel therewith providing alternately arranged compartments and circulation spaces, said walls composed, in each case, of fixed frame members and a plurality of removable screens, the screens forming the partitions walls being attached together in pairs

by attaching members extending across the circulation spaces.

27. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through the tunnel and formed with a plurality of relatively narrow starch compartments extending from top to bottom of the carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces.

28. In apparatus for drying starch, the combination with a drying tunnel and means for causing a circulation of hot air through the same from end to end, of a carrier for the starch adapted to be moved through the tunnel and formed with a plurality of relatively narrow starch compartments extending from top to bottom of the carrier, the sides of which are foraminous and which are spaced apart so as to form circulation spaces, said carrier provided with a slidably mounted bottom which normally closes the starch compartments.

29. In apparatus for drying starch, the combination with a drying tunnel and means for conveying the starch therethrough comprising foraminous elements adapted to support the starch in upright narrow bodies.

30. In apparatus for drying starch, the combination with an inclosed drying space, of means comprising foraminous elements for supporting the starch therein in thin upright bodies spaced apart, and means for directing hot air through the spaces between said bodies.

LOUIS P. BAUER.

Witnesses:

JAMES P. ST. CREARY,
W. B. COONEY.