July 10, 1928.

1,676,474

A. E. BROUGHTON

MACHINE AND METHOD FOR DRYING MACARONI

Filed March 29, 1926

2 Sheets-Sheet 1

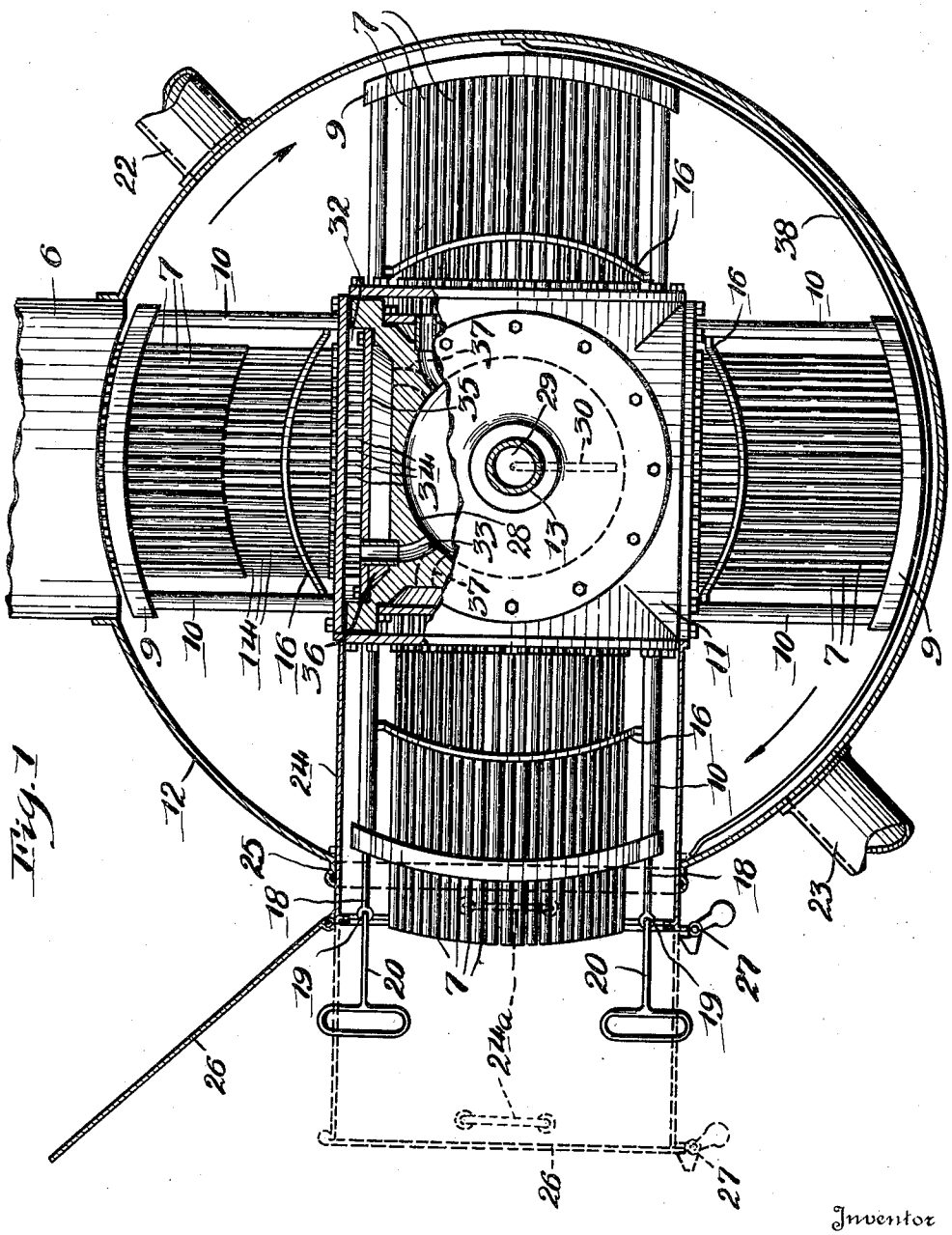


Fig. 1

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Fig. 3

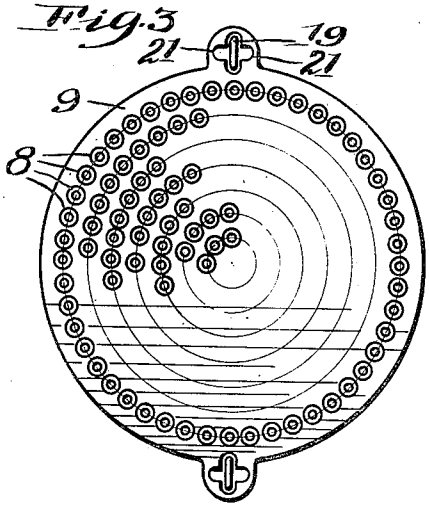


Fig. 4

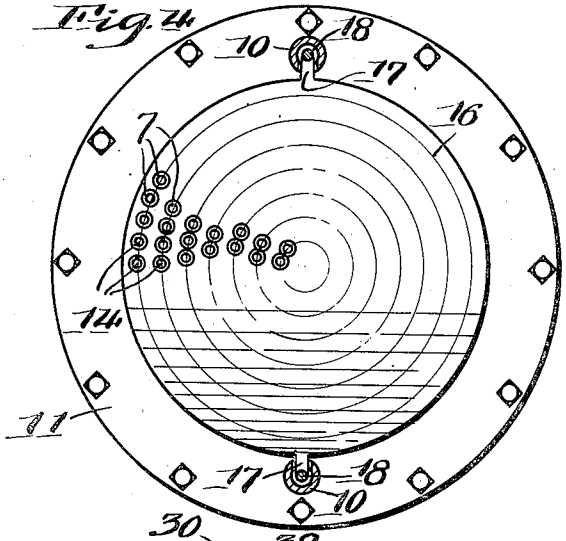
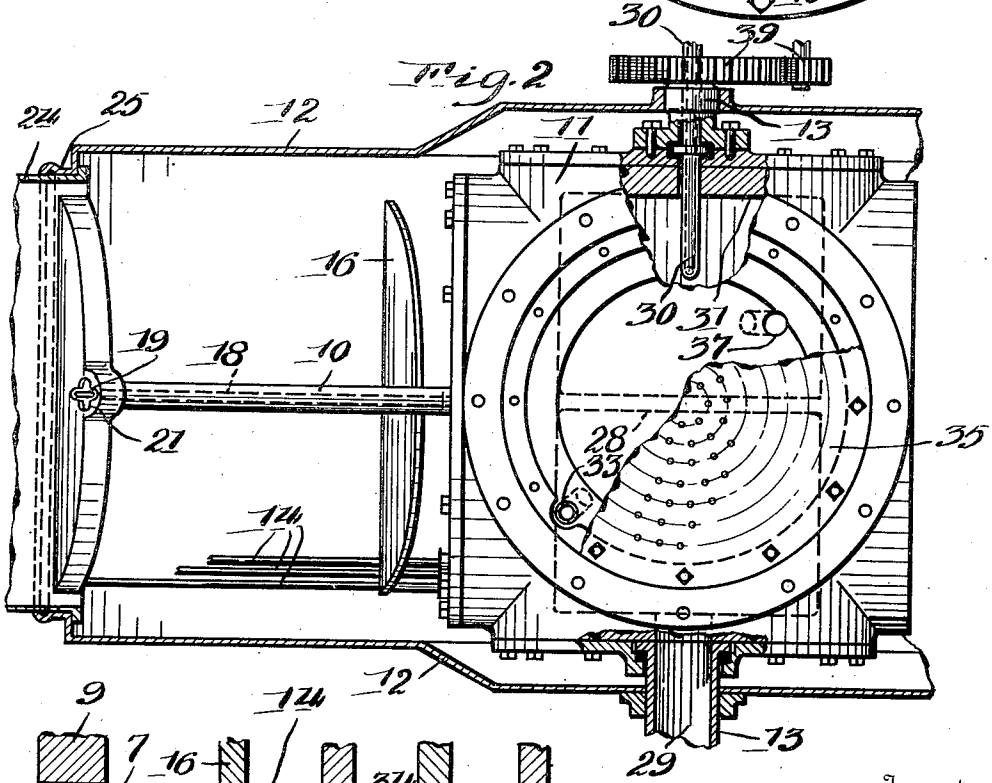


Fig. 2



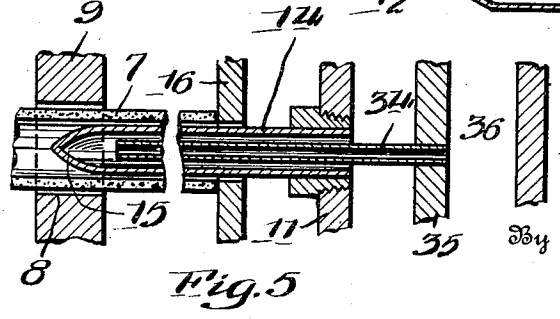


Fig. 5

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UNITED STATES PATENT OFFICE.

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MACHINE AND METHOD FOR DRYING MACARONI.

Application filed March 29, 1926. Serial No. 98,240.

Heretofore, in the manufacture of macaroni, the step of drying the tubular particles or strings has contributed largely to the cost of the product. With the methods in common use, slow drying is required, because heat is applied externally to the moist strings, and if heat so applied is allowed to dry the particles rapidly, a hard, outer coating is formed before the interior of each particle is dried, and cracking into pieces or the formation of smaller, detrimental checks in the outer surfaces of the particles results. I have found that the cost of manufacture may be reduced and the product improved by rapid drying of the tubular particles with heat applied in the axial opening or bore of each particle.

It is my object to improve the product and to greatly reduce the time required in the manufacture by a method of drying the particles from within.

A further object is to provide a machine for economically and rapidly handling the moist strings during the drying operation, and for delivering them, when dry, in straight sections of uniform length.

This invention also includes certain other novel features of construction, which will be more fully pointed out in the following specification and claims.

In the drawings, Figure 1 is a vertical section through the outer casing or hood of my improved machine, the rotor being shown partially in vertical section; Fig. 2 is a fragmentary, horizontal section through the hood and portions of the rotor; Fig. 3 is a plan view of one of the heads for guiding the material to be dried to the outer ends of the drying elements; Fig. 4 is a transverse section through a pair of the supports for one of the heads shown in Fig. 3, and also illustrating one of the plates for removing the macaroni particles from the drying elements and Fig. 5 is a longitudinal section through one of the drying elements and the adjacent parts of the machine.

As shown in the drawings, my machine is adapted to receive the macaroni particles or strings from the delivery die 6 of an extruding machine. The particles of macaroni, indicated by the numeral 7, are forced out of the die 6, and enter registering perforations 8 in one of a series of guiding heads 9. It will be understood that there are a large number of perforations in the die 6, each adapted to deliver a tubular string of moist macaroni, and a corresponding number of holes 8 are formed in each of the heads 9 adapted to register with the perforations in the die 6. The lower face of the die 6 is convex and the heads 9 are curved upon a suitable radius to fit closely said face of the die as the heads are rotated to register therewith in the manner hereinafter described. Each of the heads 9 is supported upon a pair of tubular bars 10, which project from a rotor 11 within a hood 12. As illustrated, this hood 12 is supported on the lower extremity of the die 6, and the axial shaft 13 of the rotor 11 is journalled in suitable bearings in the hood 12. Series of tubular heating elements 14 are rigidly supported on the rotor 11 and extend at their outer ends part way into the openings in the heads 9. As shown in detail in Fig. 5, the outer ends of the heating elements 14 are closed and tapered or pointed so as to readily receive the particles of macaroni 7 upon the exterior of the heating elements. Four groups of the heating elements 14 are provided, the several groups being arranged to be successively brought beneath the dies 6 as the rotor 11 turns upon the shaft 13.

Slidable upon each group of heating elements 14 is a plate 16, which is perforated to receive said elements and has projecting ears 17 extending through slots in the supports 10 for the head 9. These plates 16 are curved to conform to the inner surface of the heads 9, and each plate is adapted to be operated by a pair of rods 18 extending longitudinally in the tubular members 10. The rods 18 are connected at their inner ends to the ears 17 on the plate and have eyes 19 on their outer ends which may be engaged by suitable hand hooks 20 (Fig. 1). As shown in Fig. 3, the eyes 19 on the rods 18 normally are positioned within suitable recesses 21 in the plates 9. The recesses 21 permit insertion of the hand hooks 20 into the eyes 19 for withdrawing the rods 18 and connected plate 16.

The hood 12 encloses the rotor 11 and several groups of drying elements and facilitates rapid removal of the expelled moisture. Previously dried air may be admitted to the hood 12 through a pipe 22 and a pipe 23 at the opposite side of the hood may be connected with a suitable exhauster adapted to create a partial vacuum.

To facilitate withdrawing the particles of dried macaroni from the elements 14, with-

out entirely relieving the vacuum within the hood 12, I provide an auxiliary casing 24 of tubular form, which may be extended into the hood 12 to encase one of the groups of drying elements, as illustrated in Fig. 1. This auxiliary casing 24 is slidable in bearings 25 surrounding an opening in the hood 12, and a swinging door 26 is mounted on the outer end of said casing. The inner end of the casing 24 is adapted to fit snugly against the rotor 11 when extended into the hood 12. The door 26 has a suitable latch 27, adapted to normally maintain it in closed position, but arranged to be manipulated to free the door when the macaroni is to be withdrawn from a group of the dryers 14.

In the drawings, I have illustrated mechanism for heating the elements 14 by steam. Thus, steam is admitted to a cylindrical chamber 28 in the rotor 11 through an axial passageway 29 in one of the shafts 13. Condensate is withdrawn through a pipe 30 extending through an axial passageway at the other side of the rotor and communicating with a cylindrical chamber 31 in the rotor 11 (Fig. 2). To distribute steam from the chamber 28 to the several drying elements 14 of each group, I provide a chamber 32 communicating with the inner ends of several tubular drying elements and connect said chamber with the chamber 28 through a port 33. As shown in Fig. 5, condensate is withdrawn from each of the elements 14 by a small tube 34, extending through the element and opening into its outer extremity. These tubes 34 are rigidly supported in a partition 35, which separates the chamber 32 from a condensate chamber 36 for each group of drying elements. A suitable passageway 37 is provided for each group of drying elements to drain the chamber 36 into the common condensate chamber 31. It will be understood that a partial vacuum is maintained in the pipe 30, so as to withdraw the condensate which collects in the lower part of the chamber 31.

Operation.

In operation, the rotor 11 is turned intermittently, a quarter of a revolution at a time, through suitable driving gears, such as the gears 39 shown in Fig. 2. These gears may be connected with the plunger or mechanism for forcing the macaroni out of the die 6, in such a manner that the rotor 11 remains stationary while the macaroni is forced out of the die 6, and is then rotated a quarter of a revolution to bring the succeeding group of drying elements 14 into proper registering position with the openings in the die 6. As it turns, after receiving a batch of moist macaroni, the head 9 severs the particles at the face of the die 6 and forms a group of straight, parallel pieces of equal length. Thus, the rotor 11 is turned in the direction indicated by arrows in Fig. 1, and carries the macaroni threaded upon one group of the dryers 14 first to the horizontal position at the right, as seen in Fig. 1 and then downward to the vertical position in the next step. In the final step of the drying operation, the group of dryers in the lower vertical position are raised to horizontal position at the left (Fig. 1), in which position, the head 9 registers with the end of the casing 24. It will be understood that during the rotation of the drying elements, this casing 24 is withdrawn from the hood 12 to the dotted line position indicated in Fig. 1. The speed of rotation of the rotor 11 is controlled so that the macaroni is dry when it reaches the position opposite the door 26. When a group of dryers reaches this horizontal position, the casing 24 is manipulated by means of handles 24^a (Fig. 1), so as to extend into the hood 12 into engagement with the rotor 11, as indicated in full lines in Fig. 1. Now the door 26 is opened, and by use of the hand hooks 20 the plate 16 is drawn outward, expelling the dried tubular particles from the drying elements 14. The rods 18 are finally actuated to move the plate 16 back to its normal or retracted position, and after removing the hand hooks 20 and closing the door 26, the casing 24 is withdrawn from the hood 12 to dotted line position shown in Fig. 1. The group of drying elements 14 from which the macaroni has thus been removed is now ready to be rotated to its position beneath the delivery die 6 for the succeeding batch to be dried.

In order to prevent the particles of macaroni on the drying elements 14 from sliding off the ends of said elements as the rotor inverts them, I provide a flexible retaining member 38 consisting of a resilient sheet of metal, adapted to brush across the outer surfaces of the heads 9 at the lower periphery of the hood 12. As will now be readily understood, the several elements 14 are heated by steam admitted to the axial passageway 29 into the steam chest or chamber 28. Steam passes from the chamber through a port 33 into the several chambers 32 and then into the tubular elements 14. Condensate, together with a small amount of uncondensed steam, passes through the tubes 34 into the condensate receptacle 31, and is drawn out of said receptacle through the pipe 30.

With my method of drying the macaroni, it will be understood that the moisture is driven out of the tubular particles by the heating elements 14 in the bores thereof, the moisture passing radially out through the walls of each particle. Thus, the outer surface of each particle is the last part to dry, and free escape of the moisture is permitted at all times. The contraction incident to the drying takes place at the inner periphery

of the particles first, and as the drying continues, the outer portions contract uniformly upon the inner portions. In other words, the heat applied to the interior of each particle is greater than that applied to the exterior of the particle, and the drying progresses radially outward from the axial opening. A much higher temperature of drying can thus be employed without causing cracking or checking of the particles, and the drying can be accomplished in a small fraction of the time heretofore required. A further advantage secured by my invention results from forming the dried particles in straight pieces of equal length. The pieces are formed in proper length to fit within the desired containers for shipping and the macaroni occupies a minimum of space in the containers by reason of the straight form of pieces which will lie parallel one with another.

It will be evident that numerous changes in the arrangement and construction of my machine may be made within the broad scope of my invention, and that other methods of heating the elements 14 may be employed. Further, tubular particles, other than macaroni, may be dried by the machine and method of the present invention without departing from the spirit of my invention.

Having described my invention what I claim as new and desire to protect by Letters Patent is:

1. The method of drying macaroni or other moist tubular particles of a pasty consistency without protective covering, which includes the step of applying heat to the individual particles within the longitudinal opening therein, while permitting the free escape of moisture from the exterior thereof and progressively drying the particles from the interior thereof outward, whereby the interior portions of each particle are dried before the outer surfaces thereof are hardened.

2. The method of drying macaroni or other moist tubular particles of a pasty consistency without protective covering, which comprises applying heat to individual particles within the longitudinal opening therein and progressively drying the particles from the interior thereof outward while subjecting the outer surfaces of the particles to a lower temperature than the interior thereof, whereby the outer surfaces of the individual particles are allowed to remain plastic until the inner portions thereof are substantially dry.

3. The method of treating macaroni or other moist tubular particles of a pasty consistency without protective covering, which comprises severing the particles into short rectilinear pieces of uniform length, then applying heat to individual particles within the longitudinal opening therein, while permitting the free escape of moisture from the exterior thereof and progressively drying them from the interior thereof outward while maintaining the rectilinear form of the pieces.

4. The method of drying macaroni or other moist tubular particles of a pasty consistency without protective covering, which includes the steps of applying heat to the individual particles within the longitudinal opening therein and expelling the moisture through the walls of the particles from the inside outward, while subjecting the particles to a partial vacuum and withdrawing the expelled moisture, whereby the external surface of the particles is retained in moist condition until the internal portions thereof are substantially dry.

5. In a machine for drying macaroni or other moist tubular particles, the combination with a machine having openings adapted to deliver simultaneously a plurality of said moist particles, of a group of drying elements severally arranged to register with said delivery openings and adapted to receive a group of said particles to be dried therefrom, said drying elements being formed to extend longitudinally within the openings in the particles to be dried and means for heating said drying elements.

6. In a machine for drying macaroni or the like, the combination with means for delivering tubular particles to be dried, of a movable support, a plurality of groups of drying elements projecting from said support, said groups being arranged to successively receive batches of particles to be dried from said delivery means, and means for removing the dried particles from said drying elements.

7. In a machine for drying macaroni or the like, the combination with means for delivering tubular particles to be dried, of a movable support, a plurality of groups of drying elements projecting from said support, said groups being arranged to successively receive batches of particles to be dried from said delivery means and each group consisting of a plurality of straight, tubular members formed to be inserted in the longitudinal openings in the macaroni and disposed in parallel relation one with another.

8. In a machine for drying macaroni or the like, the combination with means for delivering tubular particles to be dried, of a rotor having a plurality of groups of drying elements projecting therefrom, each drying element being adapted to receive a particle of macaroni externally, means for intermittently turning said rotor to successively present said groups to receive particles to be dried from said delivery means and means for removing the dried particles from said drying elements.

9. In a machine for drying macaroni or

the like, the combination with means for delivering tubular particles to be dried, of a rotor having a plurality of groups of drying elements projecting therefrom, each of said elements being formed to be threaded longitudinally in a particle of macaroni, means for intermittently turning said rotor to successively present said groups to receive particles to be dried from said delivery means, a hood enclosing the groups of drying elements to permit rapid withdrawal of the expelled moisture and means for removing the dried particles from said drying elements.

10. In a machine for drying macaroni or like moist tubular particles without protective covering, the combination with a drying element arranged to be inserted temporarily into the opening in one of said particles and to support the same leaving substantially the entire exterior of said particle exposed for the escape of moisture and means for heating said element whereby moisture may be driven outward through the walls of said particle and the particle is dried progressively from the interior outward.

11. In a machine for drying macaroni or like moist tubular particles without protective covering, the combination with a drying element arranged to be inserted temporarily into the opening in one of said particles and to support the same leaving substantially the entire exterior of said particle exposed for the escape of moisture, means for heating said element whereby moisture may be driven outward and the particle is dried progressively from the interior outward and means for removing said particles from said drying element.

In testimony whereof, I have hereunto signed my name to this specification.

ARTHUR E. BROUGHTON.