Feb. 24, 1953 W. F. HARDER 2,629,310

COOLER FOR ALFALFA MEAL AND THE LIKE

Filed April 29, 1950 4 Sheets-Sheet 1

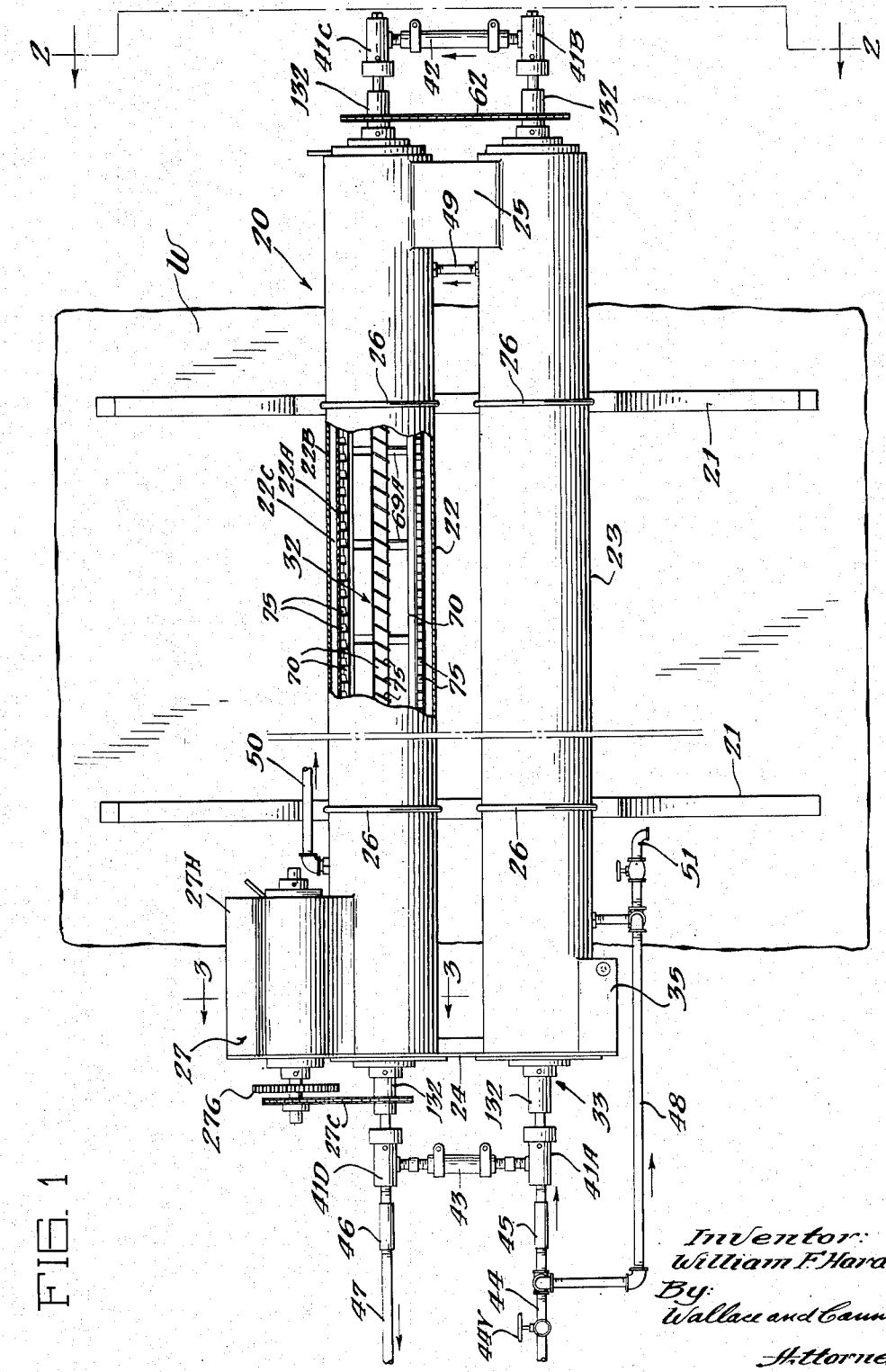

FIG. 1

Inventor:
William F. Harder
By:
Wallace and Cannon
Attorneys

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COOLER FOR ALFALFA MEAL AND THE LIKE

Filed April 29, 1950 4 Sheets-Sheet 2

FIG. 2

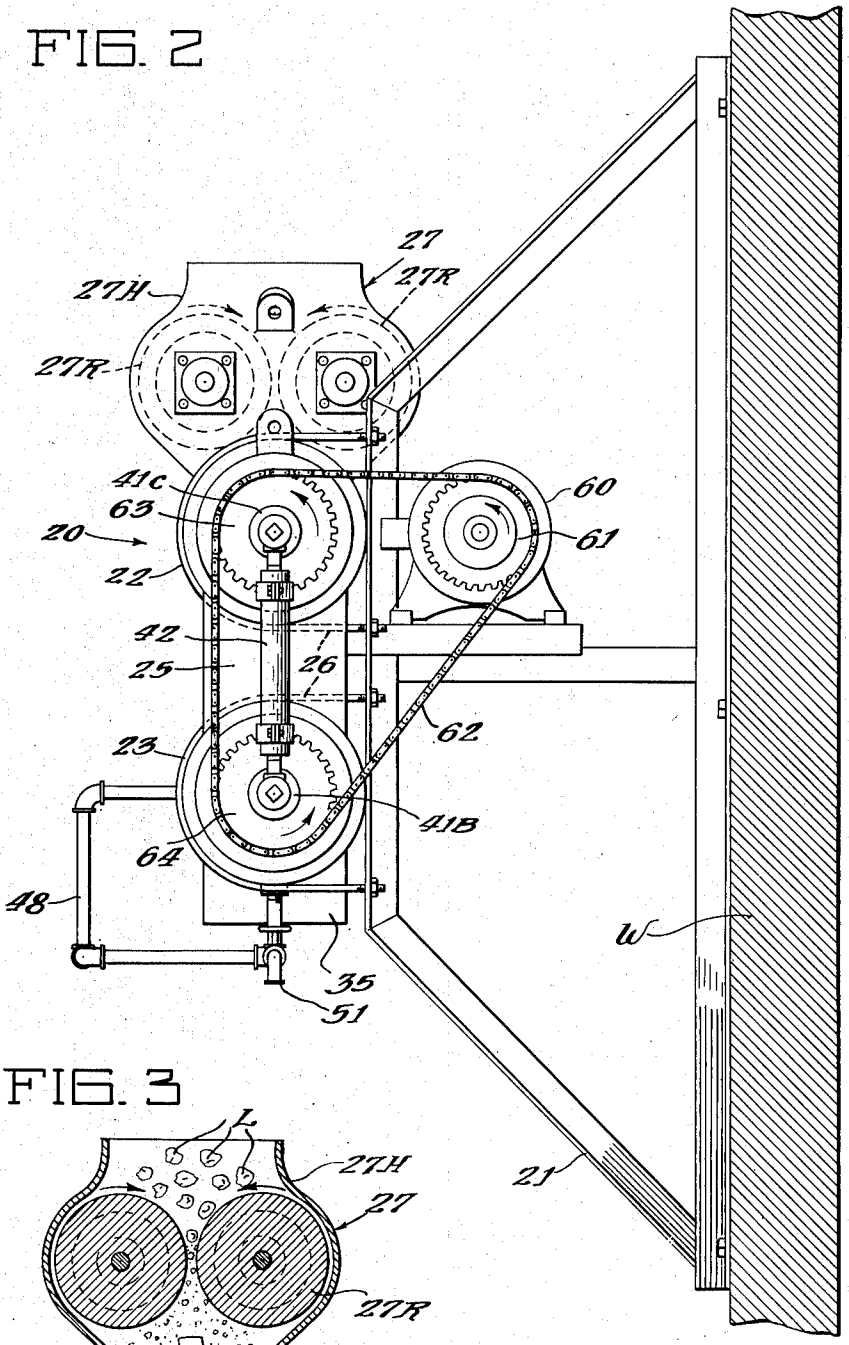

FIG. 3

Inventor:
William F. Harder
By: Wallace and Cannon
Attorneys

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COOLER FOR ALFALFA MEAL AND THE LIKE

Filed April 29, 1950 4 Sheets-Sheet 3

FIG. 4

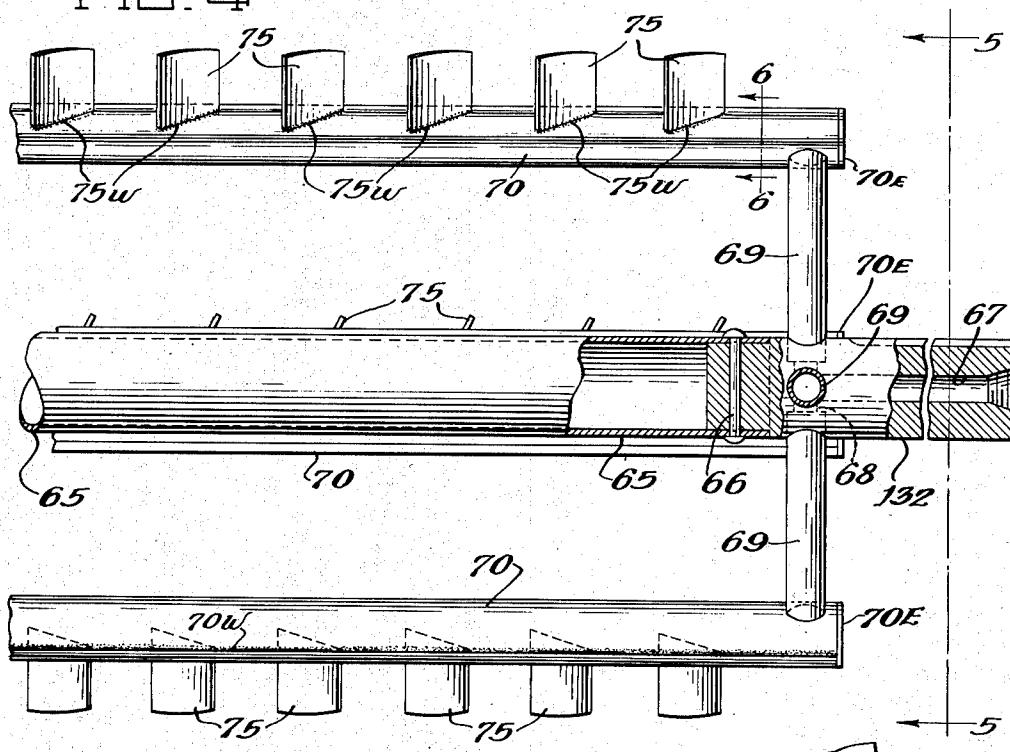
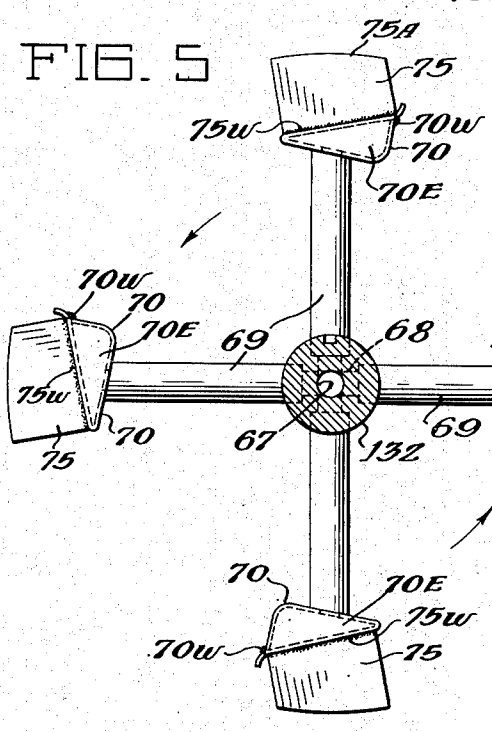


FIG. 5



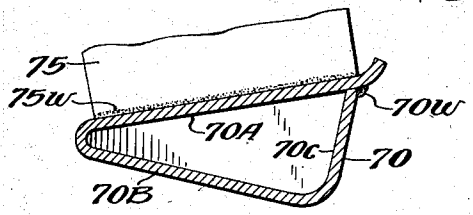


FIG. 6

Inventor:
William F. Harder
By: Wallace and Cannon
Attorneys

Feb. 24, 1953 W. F. HARDER 2,629,310

COOLER FOR ALFALFA MEAL AND THE LIKE

Filed April 29, 1950 4 Sheets-Sheet 4

FIG. 7

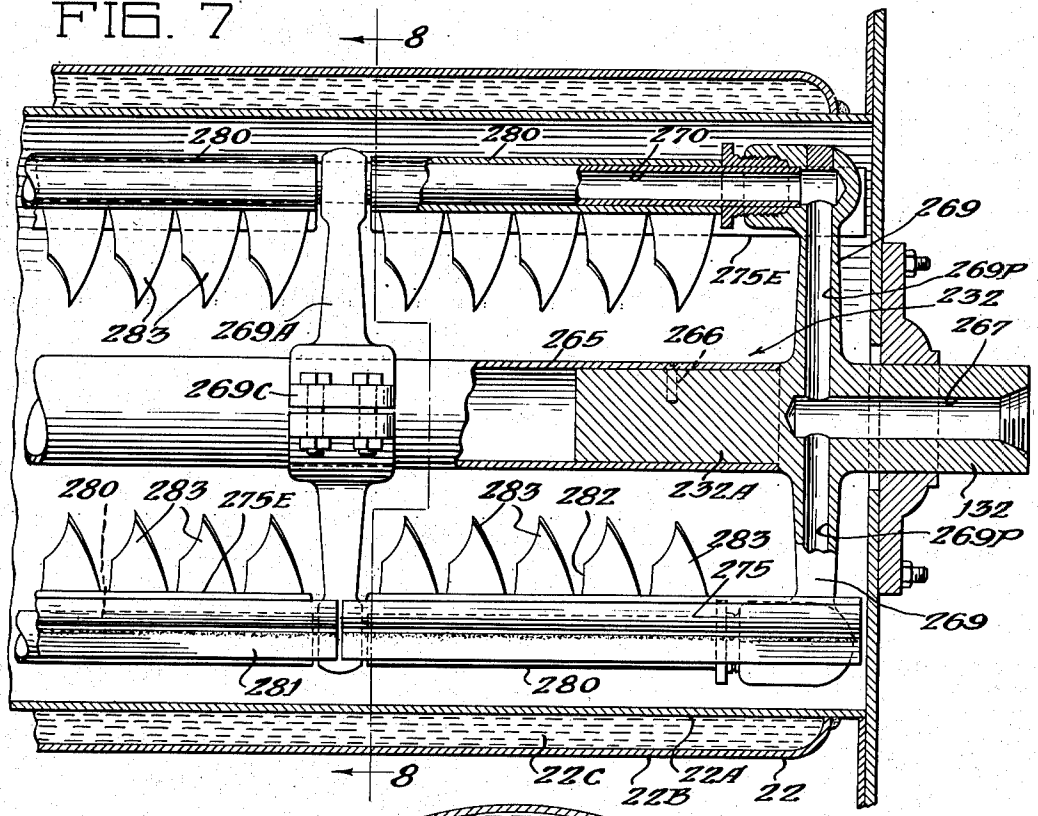
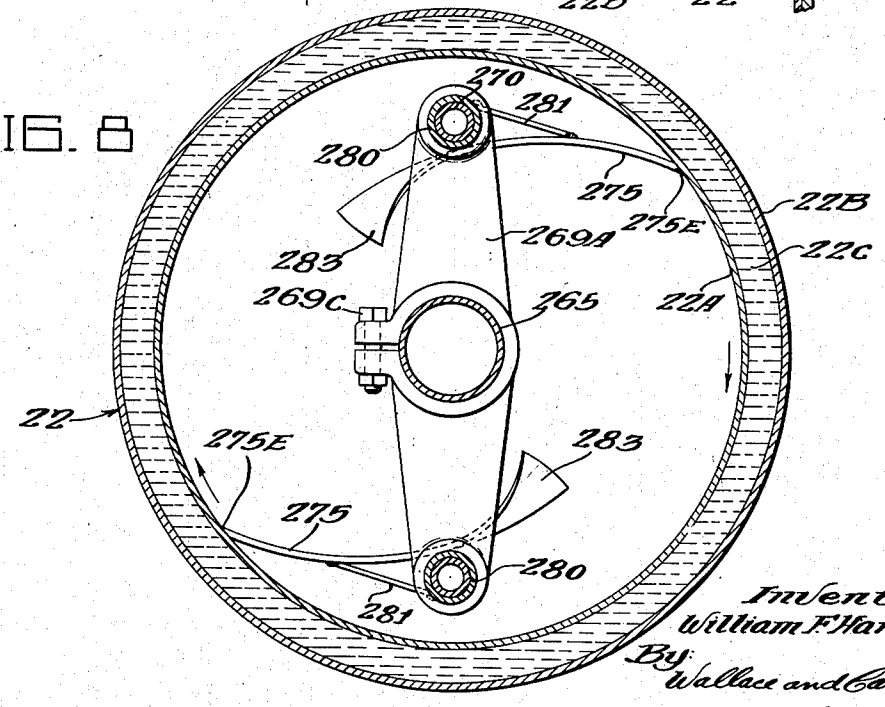


FIG. 8



Inventor:
William F. Harder
By:
Wallace and Cannon
Attorneys

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UNITED STATES PATENT OFFICE

2,629,310

COOLER FOR ALFALFA MEAL AND THE LIKE

William F. Harder, Lincoln, Nebr.

Application April 29, 1950, Serial No. 159,097

2 Claims. (Cl. 99—235)

1

This invention relates to cooling apparatus and particularly to such an apparatus adapted for cooling the material, such as dehydrated alfalfa meal.

Dehydrated alfalfa meal is recognized as being an important source of vitamin "A" or carotene, and in practice it has been found that where the alfalfa meal is not promptly cooled after the dehydrating operation there is a material loss of carotene content. The value and price of dehydrated alfalfa meal is based in a large measure upon its carotene content so that the retention of the initial carotene content as nearly as possible is highly important.

In view of the foregoing, it is an important object of the present invention to enable material such as dehydrated alfalfa meal to be effectually cooled, and an object related to the foregoing is to afford such a cooling apparatus in which the cooling operation is carried on at the maximum rate so as to avoid the necessity for utilizing a cooler of an unduly large capacity or size.

The problem of cooling material such as dehydrated alfalfa meal has been found to be quite difficult because of the light and fluffy texture of the material, which makes it quite difficult to obtain a good contact between the meal and the cooling surfaces, and in addition, it is recognized that such meal has excellent insulating properties, so that in order to attain cooling of the meal at an economical rate the meal must come into direct contact with the cooling surfaces. Another difficulty involved in cooling such material is the tendency of the meal to stick to the surfaces of the cooler, this being due primarily to the introduction of moisture into the cooler by air that may enter the cooler, and such moisture has a tendency to condense within the cooler so that it combines with the water soluble residues that are present in the meal. This forms a syrup which acts as a bonding agent and causes the meal to build up on the surfaces of the cooler.

In view of the foregoing difficulties, it is a further object of the present invention to enable alfalfa meal and the like to be cooled in such a way that effectual contact between the meal and the cooling surfaces is insured, and to accomplish this in such a way that the entrance of warm air into the cooler is minimized so as to reduce the tendency toward sticking of the meal within the cooler.

Other and further objects are to afford a cooling apparatus for alfalfa meal and the like which provides for maximum mixing and turnover of the meal within the cooler so as to thereby assure frequent contact of the small particles of the meal with the cooling surfaces of the cooler, and to afford such a cooler in which a large number of meal engaging cooling surfaces are arranged in an extremely efficient heat transfer relationship with respect to a source of cooling liquid.

2

When a cooler of the aforesaid character is commercially utilized, the intake end of the cooler is normally arranged so that the output of the drying mechanism is fed directly into the intake of the cooling mechanism, and where this arrangement is employed, experience has shown that a relatively large number of fires may be expected in the final output of the system because of the enclosure of sparks within balls or relatively large bodies of the meal. Such enclosed sparks have in the past been so well enclosed and protected in many instances that even the passage of the meal through a cooler was insufficient to extinguish the sparks, and it is therefore another important object of the present invention to afford a cooler in which the lumps of meal which might enclose sparks are in every instance broken up in the course of passage of the meal through the cooler. A related object is to afford such a cooler in which the initial feeding of the warm meal into the cooler is accomplished by means which serve to crush and break up the lumps that might enclose live sparks, and a further object is to accomplish this result by means which act to reduce and minimize the entry of warm air into the cooler, thereby to reduce the objectionable condensation within the cooler.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principles thereof and what I now consider to be the best mode in which I have contemplated applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a side elevational view of a wall-mounted cooler embodying the features of the invention;

Fig. 2 is an end view of the right-hand end of

the cooler as viewed from the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary vertical sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a side elevational view taken partially in section and illustrating the structure of the rotating cooling means of the mechanism;

Fig. 5 is a vertical sectional view taken substantially along the line 5—5 of Fig. 4;

Fig. 6 is an enlarged transverse sectional view taken substantially along the line 6—6 of Fig. 4;

Fig. 7 is a view similar to Fig. 4 and illustrating another form in which the rotating cooling means may be embodied; and

Fig. 8 is a vertical sectional view taken substantially along the line 8—8 of Fig. 7.

For purposes of disclosure, the invention is herein illustrated as embodied in a cooler 20 adapted for rapidly and effectually cooling material such as alfalfa meal. The cooler 20 may be mounted in any conventional way, but, as herein shown, the cooler is adapted or arranged for wall mounting on a wall W by means of spaced wall brackets 21, as will be described hereinafter. The cooler 20 comprises at least one elongated, jacketed cooling cylinder into which the hot meal or the like is introduced at one end through means that break up any lumps of meal while at the same time limiting entrance of warm and humid air into the cylinder, and the meal is advanced through the jacketed cooling cylinder toward an outlet by a rotating cooling reel structure which has a stirring and advancing action on the meal which assures contact of the meal with cooling surfaces of the reel so as to effect proper and thorough cooling of the meal in the course of its passage to the outlet.

In the interests of space economy, the cooler 20 is constructed so that the meal is passed back and forth through successive relatively short cooling cylinders, the number of such cylinders being determined by the output to be handled, and in the present instance, the cooler 20 is illustrated as embodying parallel upper and lower cylinders 22 and 23. At their left-hand ends as shown in Fig. 1, the upper and lower cylinders 22 and 23 are connected together by a plate 24 which extends across the ends of the cylinders, while adjacent their right-hand ends the cylinders are connected together by the walls of a vertical duct 25 which affords a transfer passage through which meal may pass downwardly from within the cylinder 22 into the right-hand end of the cylinder 23. So far as the cylinder 22 is concerned, the passage 25 may, of course, be said to constitute an outlet. The two cylinders 22 and 23 thus constitute a rigid unit which is secured on the wall brackets 21 by U-bolts 26 which embrace the respective cylinders 22 and 23 and are connected to the brackets 21.

The meal or the like that is to be cooled is fed into the upper left-hand end of the upper cylinder 22 by a feed unit 27 that constitutes the inlet of the cooler, and such meal is advanced to the right through the cylinder 22 and to the duct 25 by a rotating advancing reel 32 mounted within the cylinder 22, and when such meal drops through the duct 25 into the lower cylinder 23, it is fed to the left therein by a similar rotatable reel 33 so as to be discharged downwardly from the cylinder 23 through a downwardly opening discharge duct 35.

The two cylinders 22 and 23 have a similar water jacket construction, and as shown in Figs. 1, 3, 7 and 8 in respect to the cylinder 22, inner and outer spaced walls 22A and 22B are provided that are welded together to afford a jacket space 22C. Moreover, the reels 32 and 33 are also arranged to have a cooling liquid such as water passed therethrough as will be described hereinafter. Thus, each end of each reel 32 and 33 has a central supporting stub shaft, as 132, projecting therefrom and rotatable fluid coupling structures 41A, 41B, 41C and 41D are respectively associated therewith for transmission of cooling liquid to the internal structures of the reels, as will be described in some detail hereinafter.

The coupling structures 41A and 41D are associated respectively with the left-hand ends of the reels 33 and 32, while the coupling structures 41B and 41C are associated with the right-hand ends of the respective reels 33 and 32. A transfer pipe 42 connects the non-rotating members of the coupling structures 41B and 41C so that water may flow as indicated by the arrow from the reel 33 to the reel 32. The non-rotating parts of the couplings 41A and 41C are connected by a plugged pipe 43 which merely serves to hold the elements against rotation.

A cooling liquid such as water is supplied to the coupling 41A from a valved supply pipe 44 through means including a flexible connector section 45, and after passing through the reel 33, the cross connection 42 and the reel 32, such liquid passes from the coupling 41D and a flexible connector 46 to a discharge pipe 47. To supply cooling liquid to the water jackets of the cylinders, a branch pipe 48 extends from a point between the valve 44V and the coupling 45 to the water jacket of the cylinder 23 near the left-hand end thereof, and after passage through such water jacket, this liquid passes to the water jacket of the cylinder 22 through a cross connecting pipe 49 near the right-hand end of the cylinders. Such water is discharged from the water jacket of the cylinder 22 near the left-hand end thereof through a discharge pipe 50. A drain faucet 51 is preferably associated with the branch 48, as shown in Fig. 1.

The moving parts of the cooler 20 are driven from a reduction geared motor 60 having an output sprocket 61 connected by a chain 62 to sprockets 63 and 64 fixed on the right-hand ends of the shafts 132 of the reels 32 and 33, and while the direction and speed of rotation of the reels may be varied, I prefer to rotate these reels in the same direction, as indicated in Fig. 2, and at a speed of approximately 100 R. P. M. The meal feed unit 27 is driven from the same power source, as will now be described.

As shown in Figs. 1, 2 and 3, the meal feed unit 27 has a hopper 27H with a pair of cylindrical feed rolls 27R mounted on horizontal axes therein, and these rolls 27R are spaced apart in a distance of about $\frac{3}{16}$", and by meshed gears 27G fixed on their respective shafts, the rolls 27R are operated in unison so as to have a downward feeding action between the bight of the rolls. A chain and sprocket connection 27C from the shaft of the reel 32 to the shaft of one of the rolls 27R serves to drive the rolls, and preferably the rotative speed of the rolls 27R is somewhat less than that of the reels. The feed unit that is thus provided serves not only to minimize entry of moisture laden warm air into the cooler, but also to break up lumps, as L, of meal, thereby to disclose any smoldering fires or sparks that might otherwise pass unnoticed. When thus exposed, such sparks are effectually cooled and extinguished by the action of the cooling elements of the cooler.

In Figs. 1, 3, 4, 5 and 6 of the drawings, one form of reel structure is illustrated, while in Figs. 7 and 8 another form of reel structure is shown, and in both such forms of reel structure embodying the invention, means are afforded whereby effectual stirring and moving or advancing of the meal are effected by meal engaging elements which act with an unusually efficient heat transfer action. Thus, in the form of reel shown in detail in Figs. 4 to 6, the end portions 132 of the central shaft of the reel are formed from short lengths of solid shafting, and these end portions are fitted into opposite ends of a tube or pipe 65 and are fixed thereto in aligned relation by pins 66. The outer end of each portion 132 is centrally bored as at 67 and each such bore terminates at and in communication with a plurality of radial bores 68, and in these radial bores 68, outwardly projecting support tubes 69 are fixed. At the ends of these support tubes 69, hollow coolant ducts 70 are secured so as to extend parallel to the axis of the reel. Four ducts 70 are provided in the present instance on each reel, and each such duct 70 communicates at its opposite ends with the interior of the support tubes 69 on which it is mounted, and intermediate its ends, each duct 70 is supported from the central pipe 65 by supplemental struts or arms 69A.

In the form shown in detail in Figs. 4 to 6 of the drawings, the ducts 70 are formed by processes of welding from sheet metal. Thus, each duct 70 is formed from a single sheet of sheet metal bent to provide angularly related outer side walls 70A and 70B that are disposed at a relatively small angle to each other, and one edge of the wall 70B is bent to form a relatively short side wall 70C that abuts against the adjacent inner face of the wall 70A. Along this line of abutment, the edge of the wall 70C is welded as at 70W to the adjacent face of the side wall 70A. This affords a duct 70 of a generally triangular cross section, and the ends of the duct are closed by end plates 70E that are welded in position.

The ducts 70 are arranged so that the outer faces of the walls 70A are spaced a substantial distance from the inner surface of the cylinder wall 22A, and within the space that is thus afforded, means are mounted upon the ducts 70 for stirring the meal and imparting gradual advancing movements to such meal along the cylinder 22. Thus, in the form of the invention illustrated in Figs. 4, 5 and 6, a plurality of individual stirring and advancing blades 75 are secured to the outer face of the wall 70A of each duct 70, and these blades 75 are secured to the wall 70A by welding, as indicated at 75W in Fig. 4 of the drawings. The reel structure illustrated in Figs. 4 to 6 is primarily intended to rotate in the direction indicated by the arrow in Fig. 5, and the angle of the blades 75 is chosen so that when the reel is rotated in such direction, the meal within the cylinder will be advanced in desired longitudinal direction and at the desired rate. The outer edges of the blades 75 are formed with an arcuate edge 75A as indicated in Fig. 5 of the drawings, and this arcuate edge is centered upon the axis of the central supporting shaft so that these edges 75A will substantially engage the internal surfaces of the cylinder, thus to engage and move the meal longitudinally of the cylinder.

In the form of the invention illustrated in Figs. 7 and 8 of the drawings, the reel structure is identified as a reel structure 232. In this form of the invention, the end members 132 are formed as castings that have an outwardly extending bearing structure and an inwardly extending connecting arm 232A. This inwardly extending connecting structure is extended into the end of a central supporting pipe 265, and is secured therein by means of a screw 266. The end structure 132 also is formed with a plurality of radially extending arms 269 that have radial passages 269P formed therein which connect with a central passage 267 formed in the element 132. In the present instance, two arms 269 are provided, and at their outer ends, these arms are arranged to support longitudinally extending ducts 270 that in the present instance are in the form of cylindrical pipes that extend parallel to the axis of the structure and in spaced relation to the side walls 22A of the cylinder. At intermediate points, the ducts 270 are supported by cross arm structures 269A that are clamped on the central pipe 265 as indicated at 269C. The ducts 70 serve in this instance to support mixing and advancing blade structures which are shown in detail in Figs. 7 and 8. Thus, each duct 270 has a plurality of individual mounting sleeves 280 disposed thereon between the arms 269 and the arms 269A, and each such supporting sleeve is arranged to mount a mixing and advancing blade 275. Each such blade 275 has a relatively long forward edge 275E and the blade 275 is bent to an arcuate form centered on an axis that is parallel to the edge 275E. Along the line that is parallel to the edge 275E, the blade 275 is secured as by welding or soldering to the sleeve 280, and a bracing plate 281 is extended between the sleeve 280 and the body of the blade 275 and is soldered or welded to these two elements so that the blade 275 is rigidly supported with respect to the sleeve 280. On the other or controlling side of the sleeve 280, the blade 275 is slit at 282 to form a plurality of tongues that are each bent to an angular relationship which resembles the form of a plowshare, thus to afford advancing elements 283 at the rear edges of the blades 275 for imparting advancing movements to the meal longitudinally of the cylinder. The sleeves 280 are secured on the ducts 270 in such a position that the edge 275E of each blade 275 engages the inner surface of the wall 22A and hence, upon rotation of the reel structure 232, the meal is stirred and is advanced in a direction longitudinal with respect to the cylinder.

The reel structures that are thus afforded in accordance with the present invention are of such a character that the elements or blades that engage the meal are effectually cooled by direct connection with the ducts through which cooling liquid is fed through the rotating reel structure, and hence, there is a highly efficient heat transfer action that in the present structure is repeated many times due to the thorough stirring of the meal by such blades as the meal is advanced through the cylinder.

From the foregoing description, it will be apparent that the present invention enables material such as dehydrated alfalfa meal to be effectually cooled, and that under this invention a cooling apparatus is afforded in which the cooling operation is carried on at the maximum rate so as to avoid the necessity for utilizing a cooler of an unduly large capacity or size.

It will also be apparent that the present invention enables alfalfa meal and the like to be cooled in such a way that effectual contact between the meal and the cooling surfaces is insured, that this is accomplished in such a way that the entrance

of warm air into the cooler is minimized so as to reduce tendency toward sticking of the meal within the cooler.

It will also be apparent that the present invention provides a cooling apparatus for alfalfa meal and the like which provides for maximum mixing and turn-over of the meal within the cooler so as to thereby assure frequent contact of the small particles of the meal with the cooling surfaces of the cooler, and that this invention affords such a cooler in which a large number of meal engaging cooling surfaces are arranged in an extremely efficient heat transfer relationship with respect to a source of cooling liquid.

It will also be evident that under the present invention a cooler is afforded in which the lumps of meal which might enclose sparks are in every instance broken up in the course of passage of the meal through the cooler, and it will be observed specifically in the cooler of this invention that the initial feeding of the warm meal into the cooler is accomplished by means which serve to crush and break up the lumps that might enclose live sparks, and that the means which accomplish this result also act to reduce and minimize the entry of warm air into the cooler, thereby to reduce the objectionable condensation within the cooler.

Thus, while I have illustrated and described the preferred embodiments of my invention, it is to be understood that these are capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In a cooler for alfalfa meal and the like, a first elongated water-jacketed cylinder having a feed inlet on its upper side at one end and having a feed outlet on its lower side at the other end, a second elongated water-jacketed cylinder connected to the first cylinder through said feed outlet, a supply hopper disposed over said inlet and having a pair of parallel feed rolls disposed in spaced apart relation therein for crushing lumps of meal and the like and feeding the same into said first cylinder, a cooling and advancing reel disposed within each of said cylinders for rotation about the axes of said cylinders and comprising a central shaft structure having liquid passages extended axially for a limited distance into each end, hollow support tubes on each of said shaft structures and extended radially from the inner ends of said passages at each end of the respective shafts, rigid ducts extended parallel to each of said shafts and supported on said hollow support tubes parallel to but spaced inwardly from the inner surface of the associated cylinder, stirring and advancing blades mounted on said ducts and extended into relatively close relation to said inner surface of each of said cylinders, means for supplying cooling liquid to the passages of said reels and to the said water jackets of said cylinders, means for rotating said reels and for imparting advancing movement to the material in opposite directions longitudinally in the respective cylinders whereby the material is advanced toward and away from said feed outlet, and means for imparting feeding rotation to said feed rolls, in timed relation to the reels.

2. In a cooler for alfalfa meal and the like, a first elongated water-jacketed cylinder having a feed inlet on its upper side at one end and having a feed outlet on its lower side at the other end, a second elongated water-jacketed cylinder connected to the first cylinder through said feed outlet, a supply hopper disposed over said inlet and having therein a pair of parallel feed rollers disposed in spaced relation to one another for crushing lumps of meal and the like and feeding the same into the said first cylinder, a cooling and advancing reel disposed within each of said cylinders for rotation about the axes of said cylinders and comprising a central shaft structure having liquid passages extended axially for a limited distance into each end, hollow support tubes extended radially from the inner ends of said passages at each end of each of said shafts, rigid tubular pipe ducts extended parallel to each of said shafts and supported on said hollow support tubes parallel to but spaced inwardly from the inner surface of the associated cylinder, stirring and advancing blade structures mounted on said ducts and each comprising a sleeve surrounding one of said pipe ducts, a plate fixed on each of said sleeves and having a leading edge arranged to engage the inner surface of the associated cylinder and having the other edge thereof cut to afford tongues bent to a plow-share form for imparting longitudinal movement to the meal or the like engaged by such blade, means for supplying cooling liquid to the passages of said reels and to the water-jackets, and means for rotating said feed rollers.

WILLIAM F. HARDER.

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