

July 14, 1959

R. E. RYAN ET AL

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APPARATUS FOR HANDLING AND COOLING CAST METAL CAKES

Filed Feb. 27, 1956

7 Sheets-Sheet 1

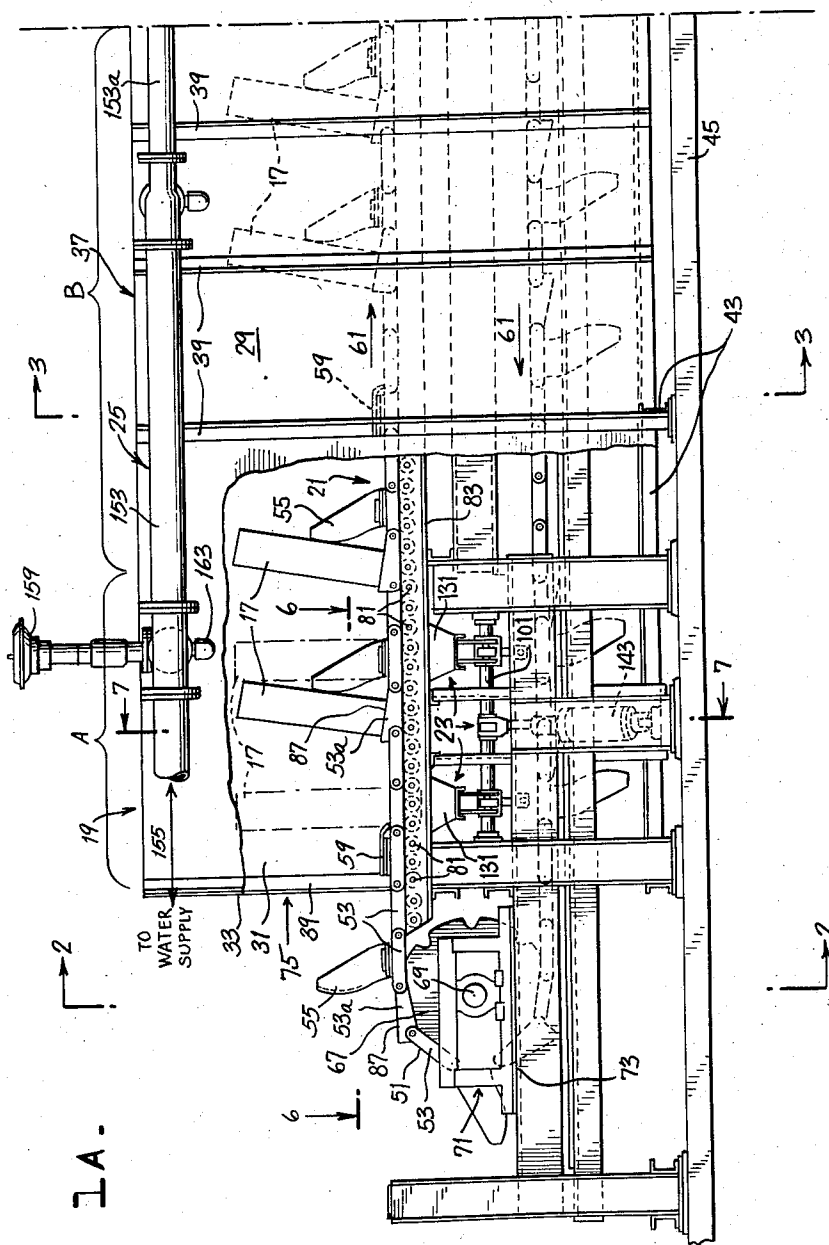


Fig. 1A.

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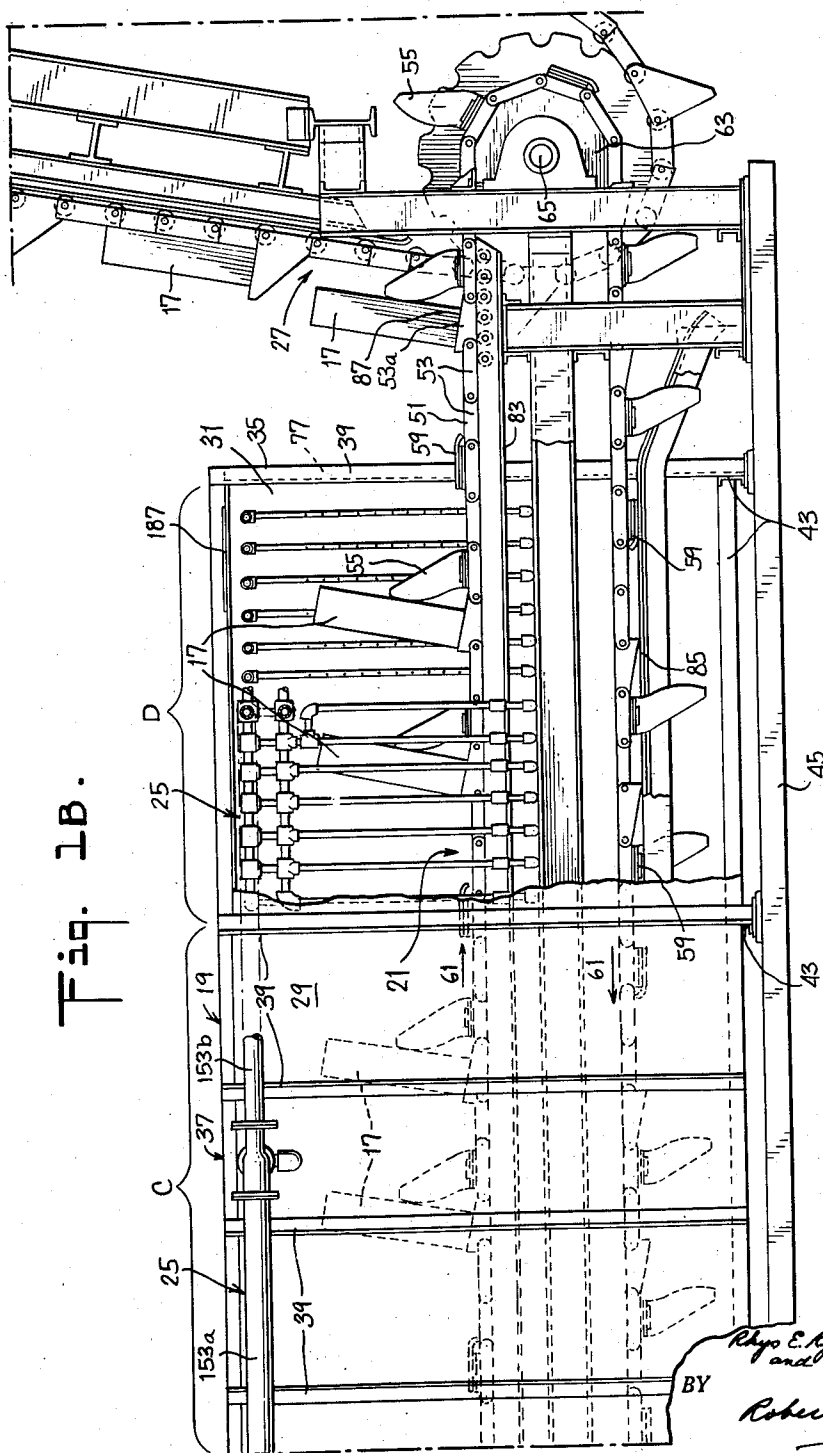
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7 Sheets-Sheet 2



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Fig. 2.

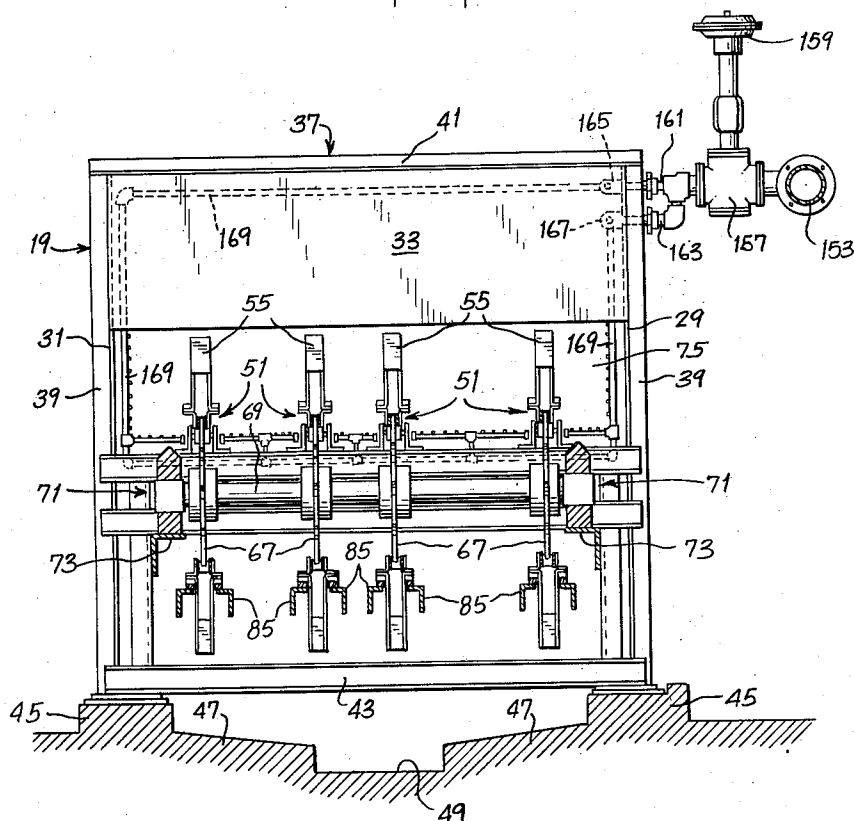
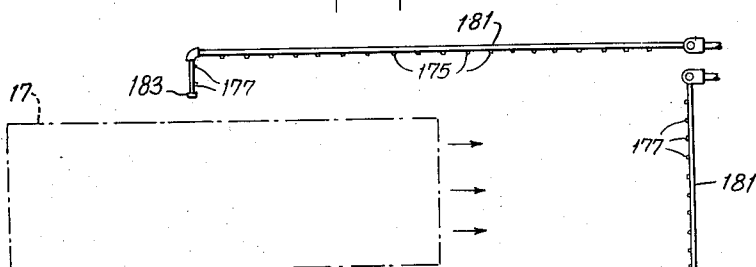


Fig. 10.



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Fig. 3.

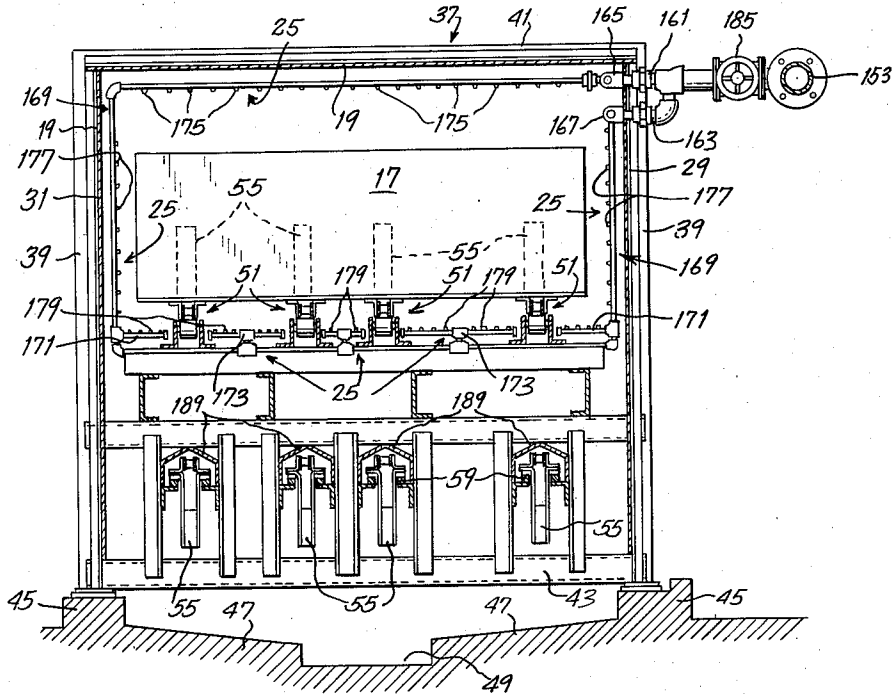


Fig. 4.

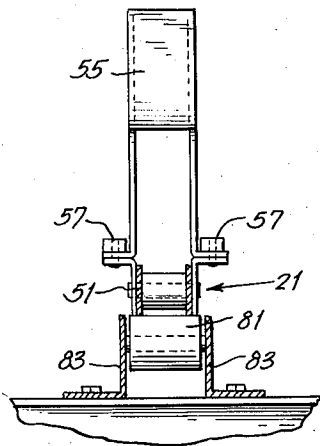
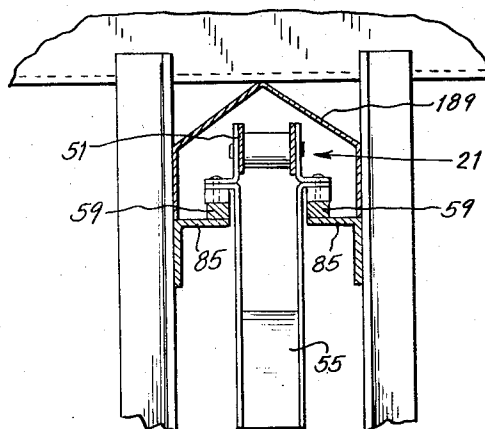


Fig. 5.



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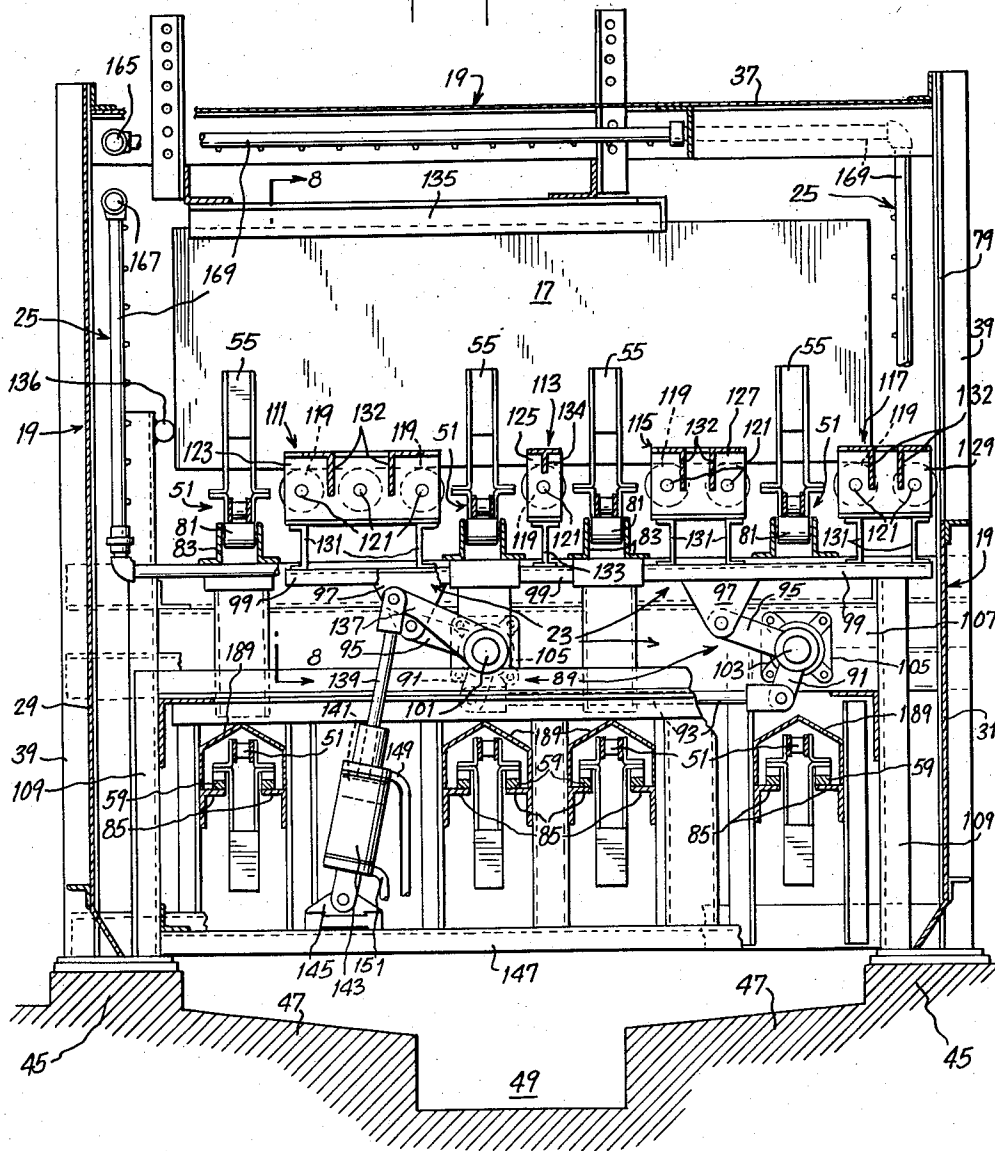
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Fig. 7.



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Fig. 2.

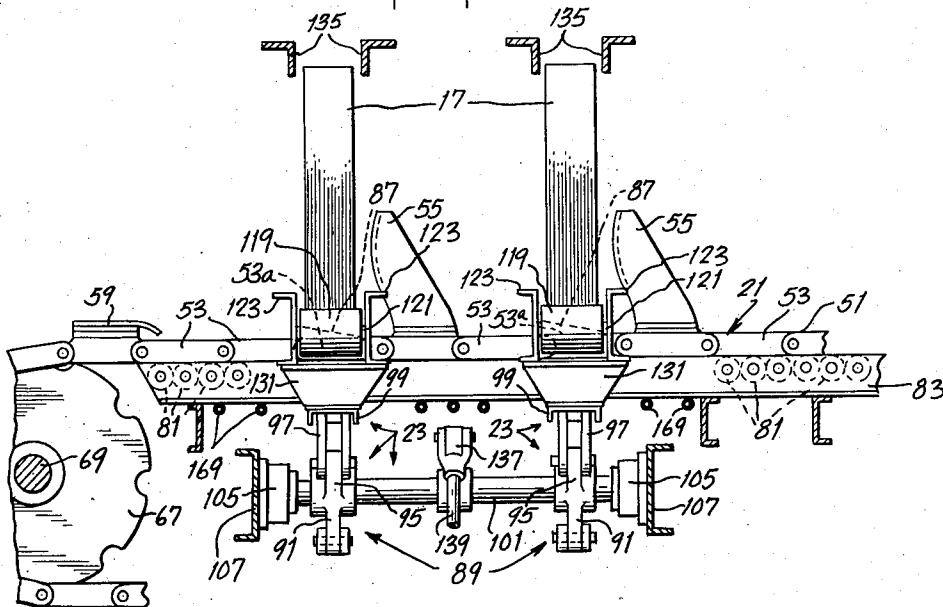
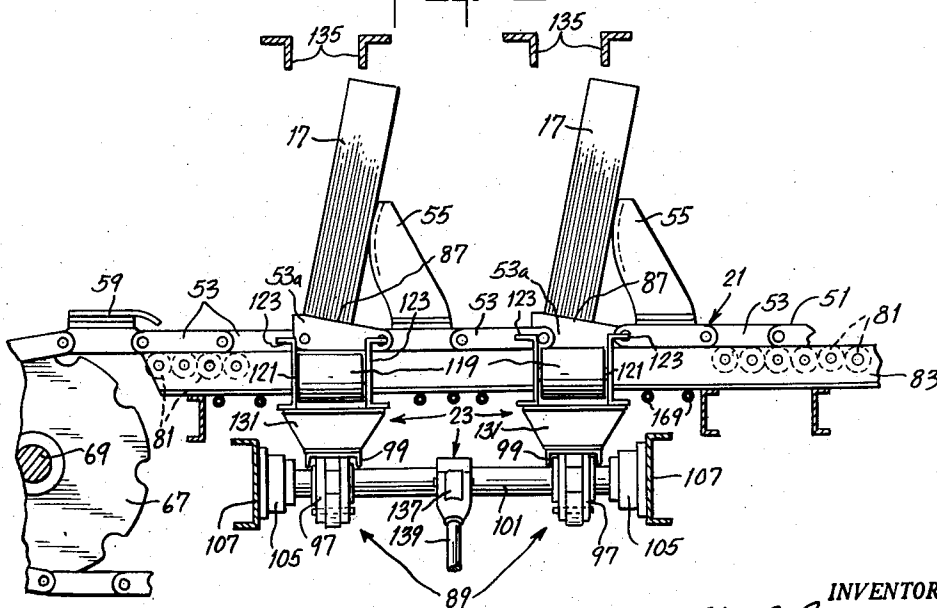


Fig. 3.



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APPARATUS FOR HANDLING AND COOLING CAST METAL CAKES

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Application February 27, 1956, Serial No. 567,896

2 Claims. (Cl. 134—131)

This invention relates generally to means for handling and cooling cast metal cakes and, more specifically, to such treatment immediately following the discharge of such cakes from the molds within which they are cast.

An important object of the invention is to provide improved control over the cooling of such cakes.

Another important object is to provide improved control over the handling of such cakes immediately after their discharge from the molds.

Another important object is to provide improved cooling means which function during mechanical conveying of such cakes from the molds to various stations at which they are inspected and given any treatment that may be necessary prior to rolling of the cakes into sheet form.

Another important object is the provision of improved means for depositing a cast cake upon a conveyor, while the cake is still hot, without subjecting the cake to substantial banging or other stresses which might objectionably deform or otherwise damage it.

The foregoing and other more or less obvious objects are accomplished by the present invention of which a single embodiment is shown in the accompanying drawings, for illustrative purposes, without, however, limiting the invention to that particular embodiment.

In the drawings:

Figures 1A and 1B, if placed respectively in left and right, end-to-end relationship, constitute a side elevational view of a cooling, spray-chamber housing and a cake conveyor, operating within said housing in apparatus according to a preferred embodiment of this invention.

Fig. 2 is a vertical, cross-sectional view, substantially on the line 2—2 of Fig. 1A, showing said conveyor as comprising plural conveyor chains with cake supports fixed thereto.

Fig. 3 is a vertical, cross-sectional view, substantially on the line 3—3 of Fig. 1A, illustrating a preferred arrangement of water-spraying means in association with said conveyor.

Figs. 4 and 5 are enlarged views of details shown in Fig. 3, particularly of the manner of association of cake supports with the conveyor chains.

Fig. 6 is a top plan view of the cake-receiving end of said conveyor, substantially as viewed from the line 6—6 of Fig. 1A, with parts broken away to show portions of a mechanism for supporting cakes being moved laterally above said conveyor and for then lowering the cakes onto the conveyor.

Fig. 7 is a vertical, cross-sectional view, substantially on the lines 7—7 of Figs. 1A and 6, including a showing of operating parts of the mechanism for thus supporting and lowering the cakes onto the conveyor.

Fig. 8 is a side elevational view of portions of said cake supporting and lowering mechanism, substantially as viewed from the lines 8—8 of Figs. 6 and 7, showing cakes as before being lowered onto the conveyor.

Fig. 9 is a view similar to Fig. 8 but showing cakes after having been lowered onto the conveyor.

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Fig. 10 is a detail view, illustrating a type of spray pipe which is usable at points where cast metal cakes are moved laterally into the spray chamber.

The illustrated apparatus comprises, as its principal parts, two pairs of rollers 15 constituting parts of fixed conveying means for horizontally conveying two cast metal cakes 17 at a time from a receptacle (not shown) within which said cakes were received in upright positions directly from their molds and turned about an angle of 90° to a horizontal attitude (only two rollers of two series of such rollers 15 being shown in Fig. 6 of the drawings), an elongate, cooling, spray-chamber housing 19 into which the cakes move from the rollers 15, an intermittently operable, horizontal chain conveyor 21 for conveying the cakes longitudinally through said housing, a cake receiving and lowering mechanism 23 for receiving the cakes 17 from the rollers 15 and lowering them onto the conveyor 21, and a spray system 25 for distributing a cooling fluid, such as water, for example, into and about the interior of the housing 19 and spraying the cooling fluid directly upon cakes on the conveyor in said housing. Operatively associated with the discharge end of conveyor 21 is a take-off conveyor 27 which carries the cooled cakes to various stations for processing.

The spray-chamber housing 19 is in the form of a metal structure having front and back side walls 29 and 31, end walls 33 and 35, and roof 37, all held together upon suitable uprights 39, roof beams 41 and floor beams 43. This metal structure is on a concrete foundation 45 integral with opposite, concrete, sloping floor portions 47 leading to a central, longitudinally extending water trough 49 having suitable conduit or channel means (not shown) for carrying water off to waste or to a collecting tank for reuse.

The conveyor 21 comprises plural (four as illustrated), similar, endless sprocket chains 51, all constrained to operate horizontally in unison and adapted to support cakes 17 in upright positions while carrying them through the housing 19. Each of these chains includes, in addition to pivotally interconnected links 53, a plurality of cake-supporting arms 55, suitably fixed rigidly to the chain 51 as by bolts 57, and plural sliding shoes 59 are also provided on the chains at opposite sides of the latter's center line. On each chain, the arms 55 are arranged in pairs the arms of which are spaced three links apart and the pairs being spaced six links apart. In operation, the arms 55 and the pairs of said arms of all the chains are maintained in transverse alignment.

The chains 51 work within housing 19, in the direction indicated by arrows 61 in Figs. 1A and 1B, upon similar sprocket wheels 63 rigidly mounted externally of the discharge end of said housing and all keyed to a common shaft 65, and upon similar sprocket wheels 67 adjustably mounted, externally of the cake-receiving end of the housing, on a common shaft 69. The latter is carried in bearing assemblies 71, horizontally, slidably adjustable, for chain-tensioning purposes, upon horizontal supporting members 73 and lockable in adjusted positions on said members in any suitable manner.

The end wall 33 of the housing 19 is designed to provide an opening 75 large enough to permit passage therethrough of the several chains 51 and the latter's arms 55 or, if desired, separate openings could be provided in the wall 33 for each of said chains and arms. The end wall 35 of the housing is formed with an opening 77 large enough to permit passage therethrough of all chains 51 with cakes 17 supported uprightly thereon. Back wall 31 is formed with two openings 79, large enough to admit two cakes 17 into the housing 19 for cooling.

The upper run of each chain 51 is supported upon a

series of rollers 81 rigidly borne in stringers 83 which are suitably mounted directly below the upper run of each of said chains. Similar horizontal rails 85 are suitably supported rigidly below the lower runs of each of said chains, at opposite sides of the latter's center lines, in positions enabling the shoes 59 of the chains to slide upon said rails and thereby afford support to the lower runs of the chains. Each chain link, numbered 53a, following next after a link upon which an arm 55 is mounted, is formed with its upper surface or surfaces 87 sloping toward the adjacent arm 55 so that when a cake is lowered upon the chain, as hereinafter described, the cake will be stabilized in a tilted position against said arm, as may best be understood from Fig. 9.

The cake receiving and lowering mechanism 23, most clearly illustrated in Figs. 6-9, probably may be most easily understood by first noting that cakes 17 to be cooled move horizontally in pairs upon two series of rollers 15 of which several are shown at the top of Fig. 6. The cakes move into the back of the left end of the housing 19 (as viewed in Fig. 1A), through the openings 79, at a level slightly above the tops of sloping links 53a which at that time are in transverse alignment with the incoming cakes. During this movement, the chains 51 of the conveyor 21 are at rest and the cake receiving and lowering mechanism 23 must assume support of the cakes coming off of the rollers 15 and then lower the cakes onto sloping links 53a, after which the conveyor 21 moves forwardly (rightwardly) until the next pair of sloping links 53a registers with openings 79, whereupon the next pair of cakes is received and lowered onto the conveyor 21.

The operating parts of the cake-handling mechanism 23 are necessarily disposed and arranged to operate between the several chains 51 and between the upper and lower runs of those chains. The mechanism 23 provides for receiving and lowering two cakes 17 at the same time and, as the mechanism is substantially the same with respect to each cake, it should suffice to describe the mechanism for handling one of the cakes.

The mechanism 23, as best shown in Fig. 7, comprises a parallelogram linkage consisting of two similar bell-cranks 89 having lower arms 91 pivotally interconnected by a horizontal link 93 and side arms 95 similarly pivotally connected to brackets 97 rigidly fixed to the underside of a cross-bar 99. The bell-cranks 89 are similarly mounted for oscillatory movement upon shafts 101 and 103 supported within suitable bearings 105 fixed upon rigid cross-members 107 which are rigidly associated with uprights 109 forming a part of the conveyor-supporting framework within the housing 19. It should be obvious that oscillation of the bell-cranks 89 will cause rising and falling of cross-bar 99 and of anything fixed upon the latter.

Fixed upon cross-bars 99 and in line with housing openings 79 and rollers 15 are plural assemblies 111, 113, 115 and 117 of rollers 119 all mounted for rotation about axes which are transverse to a cake moving into said housing on rollers 15. The rollers 119 turn on stub-shafts 121 the ends of which are fixed in opposed bearing-guide members 123, 125, 127, 129 (Fig. 7), and, to attain a proper level for the rollers 119, the channel members 123 are fixed upon brackets 131, 133 which themselves are fixedly mounted directly upon the cross-bars 99 in the spaces between the several chains 51 and between back wall 31 of the housing and the chain 51 nearest to that wall. Thus, the chains will not interfere with rising and falling of the roller assemblies 111-117. Said roller assemblies are so mounted that when raised to their upper limit of movement, the rollers 119 are at the same level as rollers 15, and when said assemblies are at their lowermost limit of movement, the rollers 119 and the members 123, 125, 127 and 129 are entirely below the level of the sloping surfaces 87.

The roller assemblies 111, 115 and 117, on the two

cross-bars 99, preferably are braced by angle brackets 132 rigidly interconnecting the nearest guide members 123 of the assemblies on said two cross-bars, and the roller assemblies 113 are somewhat similarly braced by a T bracket 134, or by two angle brackets placed back to back.

It may be seen, from Fig. 8, that the bearing-guide members 123 extend above the level of rollers 119, thereby functioning as guides for assuring that the cakes 17 will not slide sidewise off the rollers 119. Fixed upper guide bars 135 are provided to prevent material sideways tipping of the incoming cakes 17, and stops 136 (one being shown in Fig. 7) are provided to limit the inward movement of the cakes.

The shafts 101 and 103 serve with respect to the bell-cranks 89 of the two parallelogram linkages which function in receiving and lowering two incoming cakes 17, as may be seen with respect to shaft 101 in Figs. 8 and 9. The bell-cranks 89 which are on shaft 101 are keyed to that shaft in angular alignment; hence, the two parallelogram linkages are constrained to remain in perfect alignment with each other and to work always in unison. These linkages are actuated to raise and lower rollers 119 by means of a crank-arm 137, keyed to shaft 101.

The crank-arm 137 is operated by a hydraulically actuated rod 139, which is pivotally connected at one end to crank-arm 137 and has a piston 141 at its other end working in a hydraulic cylinder 143, which is pivoted at its lower end to a lug 145 rigidly mounted on a fixed cross-member 147. The piston 141 is double-acting, the cylinder 143 having hydraulic lines 149 and 151 at opposite ends thereof so that conventional valving of fluid under pressure with respect to opposite ends of cylinder 143 enables the latter and piston 141 to function to raise and lower the rollers 119.

The spray system 25 comprises primarily a network of pipes, within the housing 19, having a multiplicity of orifices therein, so positioned as to direct a cooling medium, such as water, in various directions, upon cakes 17 moving through said housing on the conveyor 21. Obviously, a great variety of dispositions are available with respect to the individual sections of pipes in such a network; hence, the disposition of the water piping shown in the drawings is merely illustrative and is not presented in a limiting sense.

The spray system comprises a main manifold 153 disposed outside the housing 19 and connected to a source of supply of water at suitable pressure, as indicated at double-headed arrow 155 in Fig. 1A. Said manifold may include several successive sections 153a and 153b of reduced diameters. The spray system, as illustrated, is subdivided into four substantially similar sections or pipe groups located successively within the housing 19. These sections are generally identified as A, B, C, D and are located within the housing approximately where indicated by said letters in Figs. 1A and 1B.

Section or pipe group A of the spray system is located at the cake-receiving end of the housing 19, and includes a valve 157 controlled by a fluid (preferably air) actuated valve controller 159, said valve being connected between the manifold 153 and a pair of input pipes 161, 163 for conducting water into said housing and into separate distribution manifolds 165, 167 which are interconnected by a plurality of spray-loop pipes 169 one of which is best illustrated in Fig. 3. Each pipe 169 has side branches 171 and bottom T-shaped branches 173, all of these branches being disposed between or alongside of and in right-angular relationship to the sprocket chains 51 and below the level at which cakes 17 are carried on said chains. Each pipe 169 has orifices 175 directing water downwardly, orifices 177 directing water sidewise and inwardly, and orifices 179, in the branches 171 and 173, directing water upwardly.

The water pressure in the pipes 169 should be great enough and the orifices therein of such size and design

that water issuing from all the orifices will reach all surfaces of cakes 17 disposed on the chains 51 within the spray-loop pipes 169. Although spray-loop pipes somewhat similar to pipes 169 could be provided with connections only to a single distribution manifold such as 165, the disclosed arrangement by which water is supplied at both ends of pipes 169 by the two manifolds 165 and 167 gives assurance of a more uniform emission of water from all the mentioned orifices. Although water emitted from all orifices in each pipe 169 may move in or very close to a vertical plane, it should be apparent that at least some of the mentioned orifices in pipe 169 and its branches may advantageously be arranged to direct water at a slight angle relatively to such a vertical plane, thereby giving greater assurance that a substantial volume of the sprayed water will impinge upon the sides of upright cakes 17 on the chains 51.

In pipe group A, now being described, complete spray-loop pipes 169 may be quite evenly distributed longitudinally of the cake-receiving end of the housing 19 except that such a pipe, having branches 171 and 173, cannot be used in alignment with cakes 17 coming into the housing 19 because at those points the spaces where said branches and the bottom portions of pipes 169 would be located are occupied by the rising and falling roller assemblies 111, 113, 115 and 117. Thus, such pipes may be provided where indicated at 169 in Figs. 6, 8 and 9. In transverse alignment with said rising and falling roller assemblies, however, spray pipes 181 (Fig. 10) may be provided which have a top and side portions, one long and one short, but which do not have any bottom portions or any branches such as those numbered 171 and 173. The lower ends of pipes 181 are suitably closed as by caps 183. As diagrammatically shown in Fig. 10, the provision of the short side portions of pipes 181, at the certain indicated locations in the spray chamber, enables the cakes 17 to be moved laterally into position in the spray chamber without interference from said pipes.

It is important, in order to control or minimize oxidation of cakes being cooled, that they be initially subjected to the effect of the cooling water substantially instantaneously over their entire surfaces. For this reason, it is preferred that no water be directed upon them as they are moving into the housing 19 but that, as soon as their movement into the housing has been completed, water be so emitted from the pipes 169 and 181 that the water simultaneously blankets the entire cake. It is for this reason that valve 157 is arranged to be opened and closed by controller 159.

The air line or lines leading to controller 159 for operating the latter are suitably connected through air-control valves to a source of compressed air, and the hydraulic lines 149 and 151 to hydraulic cylinder 143 are suitably connected through hydraulic-fluid control valves to a source of hydraulic fluid under pressure. The conveyor 21 may be operated by a motor (not shown) arranged to drive sprocket wheels 63, either indirectly or directly, through shaft 65, the controls of such a motor being such as to enable intermittent operation of said conveyor. The precise control devices for the mentioned control of such air and hydraulic control valves and for the control of such a motor do not constitute essential details of this invention. For this reason and also because such control means in general are well known to those familiar with the art to which this invention relates, said air, hydraulic and motor means and their controls are not illustrated in the drawings.

It should suffice to observe that the mentioned air, hydraulic and motor means and their controls are so arranged and interrelated that during movement of the cakes 17 into the casing 19, the conveyor 21 is at rest, the roller assemblies 111, 113, 115 and 117 are raised, and valve 157 is closed. Then, upon cakes 17 coming

to rest against stops 136, the various mentioned controls function to cause substantially simultaneous opening of valve 157, to suddenly deluge the cakes with water, and lowering of roller assemblies 111, 113, 115 and 117 to deposit the cakes upon then underlying sloping links 53a. Immediately upon such deposit, the conveyor 21 starts and continues moving with the two mentioned cakes until the next pair of sloping links 53a are in position to receive another two cakes 17 to be cooled, when the conveyor 21 again comes to rest. Approximately at or slightly before the time when the conveyor thus comes to rest, the valve 157 is closed and roller assemblies 111, 113, 115 and 117 rise to their uppermost positions to condition them for receiving the next pair of cakes for treatment and handling in the manner just described.

It is well known that either electric or mechanical controls for controlling motors and air and hydraulic devices may exert control either on an elapsed time basis per cycle of operation or in response to movement of an article from station to station. Thus, within this invention, the means for operating the valve 157, the roller assemblies 111, 113, 115 and 117 and the conveyor 21 may be controlled either on the basis of the speed of movement of the cakes 17 or on the basis of arrival of said cakes at different positions in the housing 19.

Sections or pipe groups B, C and D are all substantially alike and differ from described section A only in that the spray pipes therein are all like spray-loop pipes 169 with their branches 171 and 173, also in that they are not adapted for intermittent spraying operation but are arranged for continuous operation. Groups B, C and D do not include pipes such as 181, as the disposition of the pipes in these groups is not limited by the presence of any mechanism like the rising and falling roller assemblies 111, 113, 115 or 117. Also, as these groups provide for continuous spraying while the apparatus is in operation, they do not include any intermittently operable valve such as valve 157; instead, each of groups B, C and D may, if desired, include manually operable valves of which one is shown at 185 in Fig. 3.

Although openings 75, 77 and 79 may be ample for carrying vapor off from the housing 19, nevertheless, one or more vents 187 may be provided for that purpose in the roof of said housing, one such vent being shown in Fig. 1B.

As water, gravitating from the cakes 17 being cooled, may be contaminated with scale or other particles washed from the cakes, it is desirable to shield the conveyor chains 51 therefrom as far as possible. Therefore, it is desirable, although not essential, to provide angular covers 189 of stainless steels extending lengthwise of the housing 19 and fixed in position over the bottom runs of each of said chains.

Although the operation of the disclosed apparatus will probably be understood from the foregoing description, it may be well very briefly to summarize the operation.

A pair of cast cakes 17 moves in unison into the housing 19 through openings 79, being received on the then elevated rollers 119. Upon being stopped by stops 136, the cakes are deluged with water, meanwhile being lowered onto sloping link surfaces 87, whereupon the cakes clear the upper guide bars and tip into contact with supports 55. The conveyor 21 then carries the cakes toward the discharge end of the housing in an intermittent movement, permitting similar reception and cooling treatment of successive pairs of cakes. The cooled cakes emerge through housing opening 77 and then move from conveyor 21 directly to take-off conveyor 27 which operates in timed relationship to conveyor 21 and carries the cooled cakes to other stations for further processing.

It should be obvious that the concepts of this development may be utilized in various structures other than

those shown and described herein without, however, departing from the invention as defined in the following claims.

We claim:

1. Apparatus for handling upright, cast metal cakes, comprising a conveyor which includes a plurality of similar endless chains in horizontal, side-by-side, spaced relationship and constrained to operate in unison, said chains each having a first plurality of spaced links with upstanding cake-supporting arms mounted thereon, and a second plurality of spaced links, immediately adjoining the links of said first plurality, having top cake-supporting surfaces which slope toward the cake-supporting arms on said adjoining links whereby to tilt cakes resting on said surfaces toward said arms on the adjoining links; said apparatus, further, including a cake-receiving mechanism having separate, operatively interconnected cake-supporting portions between and clear of interference with said chains and adapted to receive and support a cake moving laterally and horizontally to a position above links of said second plurality in said chains, said cake-supporting portions being vertically movable between an uppermost cake receiving and supporting position and a lowermost position in non-interfering relationship to cakes moving along said conveyor; and said conveyor and cake-receiving mechanism both being operative intermittently in such timed relationship that the conveyor is at rest when said cake-receiving mechanism is in said uppermost position and is in operation to convey cakes thereon when said cake-receiving mechanism is in said lowermost position; said apparatus being adapted additionally for cooling cakes handled thereby and including, further, for said additional purpose, a housing through which said conveyor extends, a first group of water emitting pipes within said housing in the vicinity of said cake-receiving mechanism, a second group of water-emitting pipes in said housing in the vicinity of the path of movement of cakes moving on

said conveyor from said cake-receiving mechanism toward a point where such cakes are discharged from the housing, and water-control means operable in timed relationship to said conveyor and cake-receiving mechanism to prevent emission of water from the pipes of said first group upon cakes during such lateral movement of the latter relatively to the conveyor.

2. In apparatus for handling and cooling cast metal cakes, the combination of a housing, a horizontal, intermittently movable conveyor extending within said housing and adapted to receive and move such cakes therewithin, and means for directing cooling fluid upon such cakes on said conveyor and within the housing; said conveyor having upright, cake-supporting members fixed thereto at spaced intervals therealong, and the combination, further, comprising a vertically movable cake-receiving mechanism within said housing, adapted to receive thereon such a cake moved into the housing, horizontally and laterally of said conveyor and between two of said cake-supporting members and to lower a cake thereon onto said conveyor, and means for controlling the intermittent movement of said conveyor and the vertical movement of the cake-receiving mechanism to cause said conveyor to remain at rest during such lateral movement of a cake between two of said cake-supporting members and during such lowering of said cake onto the conveyor.

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