

Aug. 22, 1961

C. T. BANKS ET AL
CANDLE DIPPING MACHINE

2,996,761

Filed Aug. 5, 1959

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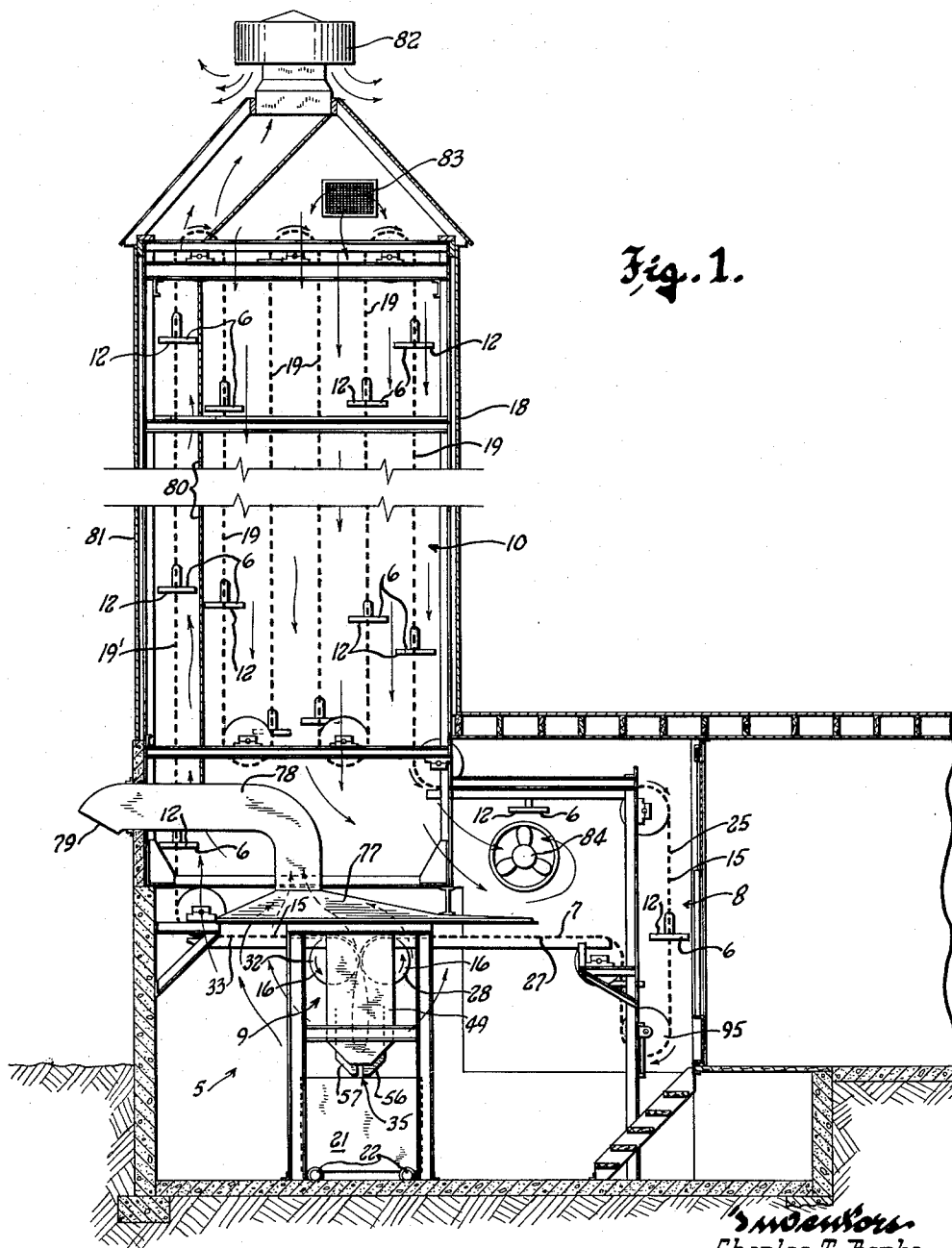


Fig. 1.

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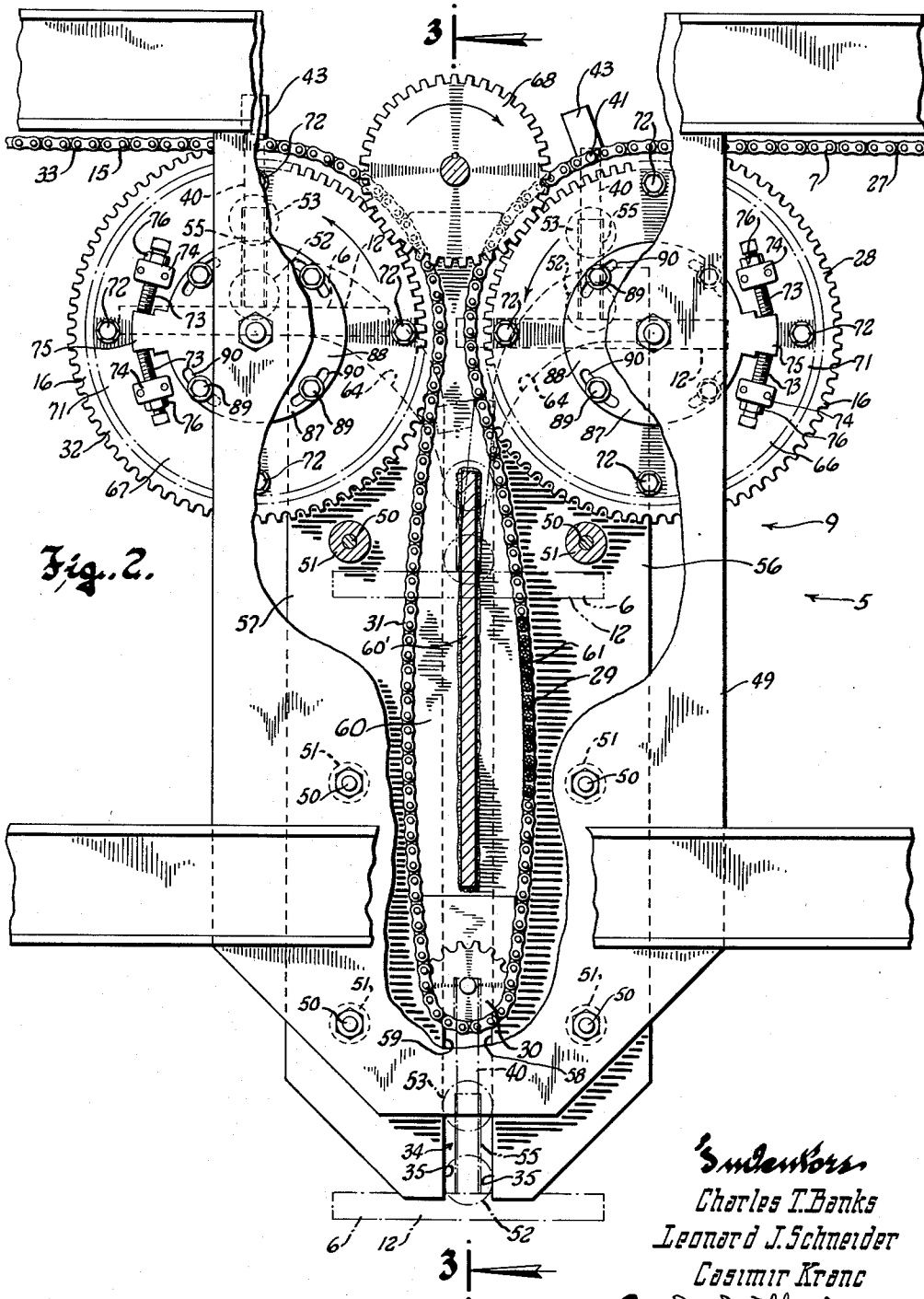
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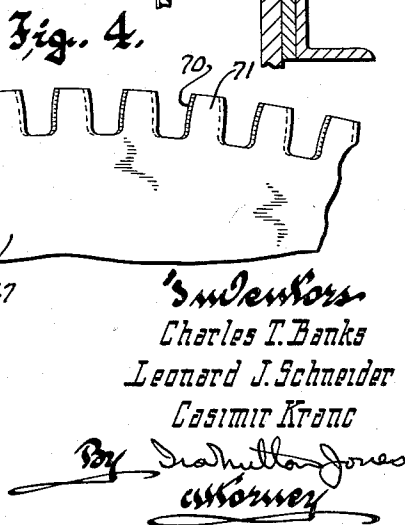
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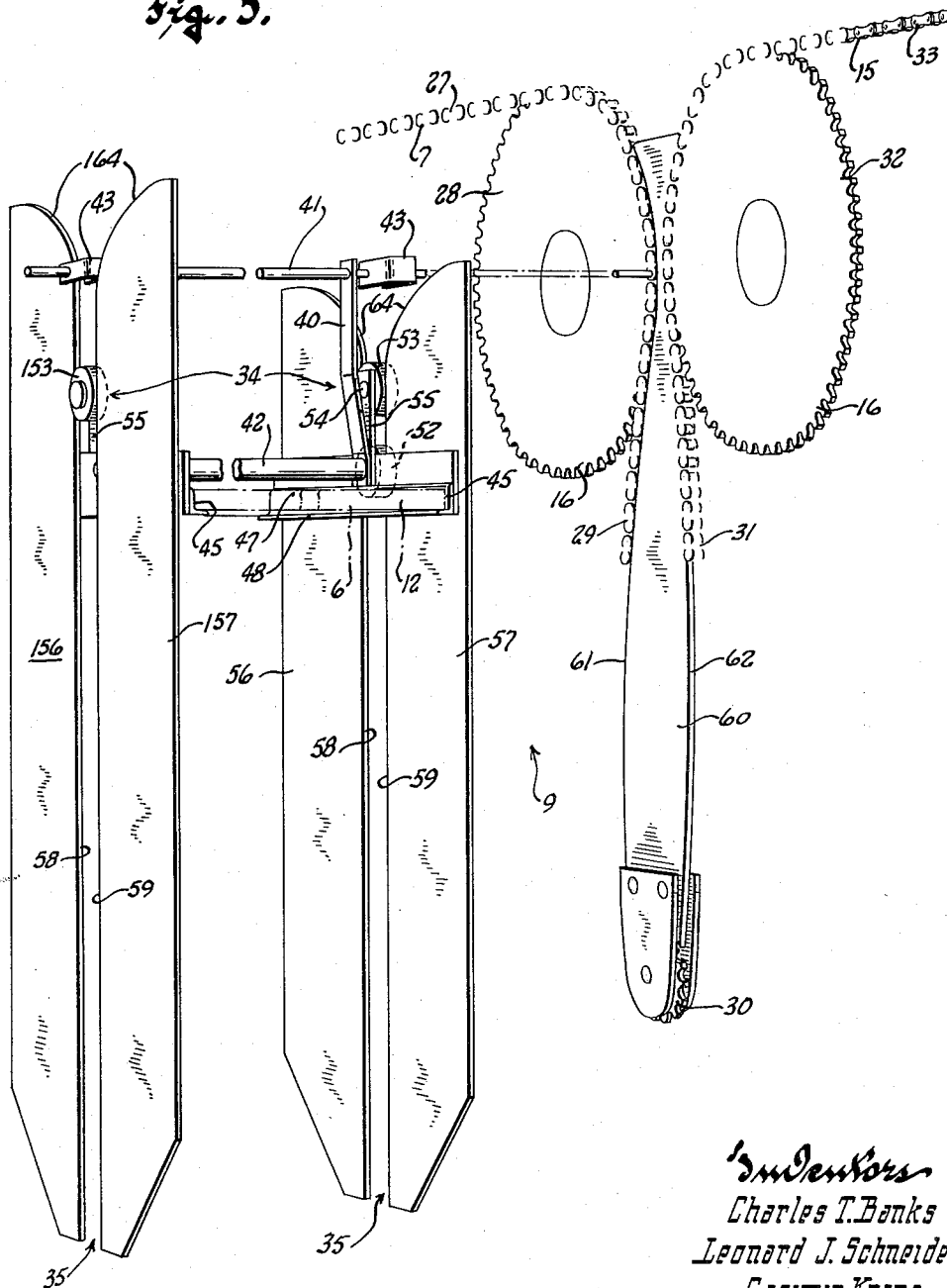
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Fig. 5.



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CANDLE DIPPING MACHINE

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Filed Aug. 5, 1959, Ser. No. 831,790
10 Claims. (Cl. 18—24)

This invention relates to machines for the manufacture of dipped candles, and refers more particularly to a machine for practicing the process of manufacturing candles by repeatedly dipping candle wicks into a bath of wax or paraffin and allowing the dipped pieces to cool after each dipping, the dipping and cooling steps being repeated until a candle of the desired body and diameter has been attained.

Candles made by the dipping process are regarded as generally superior to molded candles, both because they possess a more pleasing appearance and because the dipping process permits them to be made so that they will burn substantially without dripping.

In a machine for automatically making candles by the dipping process, wick carrying racks are suspended at lengthwise spaced apart intervals from a chain conveyor which transports the racks around an orbit that includes a dipping station and one or more cooling zones. Each rack comprises a frame that is at all times maintained in a horizontal attitude and from which a substantially large number of wicks are suspended. At the dipping station each rack is moved translatingly downwards toward a tank containing a bath of hot wax or paraffin to immerse the wicks in the bath, and the rack is then carried upwards to withdraw the wicks from the wax. Thereafter the rack is moved through the cooling zone or zones, where the wax that accumulated on the wicks during the dipping step is cooled below its solidifying temperature; and the conveyor subsequently brings the rack back to the dipping station, at which the dipping operation may be repeated.

In order to insure that machine-made candles formed by the dipping process will have the best possible shape, it is essential that the wicks or partly formed candles on each rack hang straight down from the rack as they enter the dipping bath, and that both the downward and upward movements of the rack at the dipping station be accomplished with a smooth translatable motion, avoiding shaking and jerking of the rack. If the wicks are not immersed in and withdrawn from the bath with a straight axial motion wax will tend to accumulate unevenly around the circumference of the partially-made candles with the result that the finished candles will not have a round cross section.

With these facts in mind it is an object of the present invention to provide a candle dipping machine having means at its dipping station for insuring that wick carrying racks are constrained to smooth vertical translatable motion at the dipping station so that the wicks carried on each rack enter and leave the wax bath with a perfectly straight axial motion, avoiding any shaking or swinging of the wicks or partly formed candles carried on the racks.

Another object of this invention resides in the provision of a candle dipping machine of the type having an endless conveyor chain for transporting a plurality of wick carrying racks through an orbit that includes a dipping station at which the chain is trained over a pair of coplanar, horizontally spaced apart sprockets, from one of which a stretch of the chain moves downwardly and to the other of which an adjacent stretch of the conveyor moves upwardly, in which machine each rack is provided with guide elements that cooperate with track means fixed on the machine at the dipping station to accomplish the two-fold

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purpose of guiding the rack in smooth downward and upward motion at the dipping station and of maintaining the rack in a horizontal attitude during such downward and upward motion.

It is also an object of this invention to provide a candle dipping machine of the character described having a chain conveyor for carrying wick carrying racks horizontally toward and from a dipping station and moving them vertically down and up at the dipping station, in which machine the transition from horizontal to vertical motion of each rack is accomplished smoothly and without any tendency to shake or joggle the rack, all by reason of the relationship between the sprocket on which the conveyor chain is trained in the zone where it carries the rack into the dipping station and track defining means fixed on the machine at the dipping station, by which the rack is guided for vertical motion at the dipping station.

It is also an object of this invention to provide a candle dipping machine of the character described which occupies substantially less floor space than previously known machines of this character, but which nevertheless provides for more effective and quicker cooling of partly finished candles without danger of their being deformed during cooling.

In this connection it is a more specific object of this invention to provide a candle dipping machine of the character described wherein the conveyor means is so disposed in the cooling zone of the machine that the wick carrying racks are mainly transported along vertical paths, and wherein air is caused to flow vertically through the cooling zone so that the movement of cooling air over the partly formed candles on each rack will have no tendency to distort the shape of the candles.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is an elevational view of a candle dipping machine embodying the principles of this invention;

FIGURE 2 is a side elevational view on an enlarged scale of the dipping station of the candle making machine of this invention, with portions thereof cut away to show details;

FIGURE 3 is a vertical sectional view taken on the plane of the line 3—3 in FIGURE 2;

FIGURE 4 is a fragmentary elevational view showing a detail of an anti-backlash gear employed in the candle dipping machine of this invention; and

FIGURE 5 is a fragmentary perspective view of a portion of the machine at the dipping station, more or less diagrammatically showing the manner in which the chain guiding means and the rack guiding means cooperate with one another to insure smooth translatable motion of the rack through the dipping station.

Referring now more particularly to the accompanying drawings, in which like numerals designate like parts throughout the several views, the numeral 5 designates generally a candle dipping machine embodying the principles of this invention, wherein a plurality of candle wick carrying racks 6, suspended from a chain conveyor 7 at spaced intervals along the conveyor, are carried orbitally by the conveyor through a loading and unloading station

8, a dipping station 9 and a cooling zone designated generally by 10.

Each of the racks 6 comprises a rectangular frame 12 from which a substantially large number of wicks 13 may be releasably suspended, as best seen in FIGURE 3. The details of the structure by which the wicks are held in the frame are not illustrated because they are familiar to those skilled in the art, being described and shown, for example, in Patent No. 2,478,202, issued to A. E. Moore.

The conveyor comprises a pair of endless chains 15, each trained over a plurality of coplanar sprockets 16 by which the chains are disposed in parallel planes, the sprockets on which the two chains are carried being of course arranged in coaxial pairs so that the chains are opposite each other at all points in their orbits and cooperate to function as a single conveyor.

Preferably the structure in which the machine is housed includes a tower 18 in which is located the cooling zone 10 defined by a number of upright stretches 19 of the conveyor, each stretch extending through a substantial portion of the height of the tower. The dipping station 9, which may be located directly beneath the cooling zone, includes an open topped tank 21 that holds a bath of paraffin or wax. It will be understood that suitable heating means (not shown) are provided to keep the wax in the tank at a temperature above its melting point. Preferably the tank is mounted on wheels 22 to permit it to be readily moved out of its normal position below the dipping station and replaced with another tank to facilitate changing from one type of wax to another. Each tank is provided with suitable means (not shown) to keep the wax therein at a constant level.

To one side of the dipping station is a loading and unloading station 8 in which the conveyor has an upright stretch 25 where racks on the conveyor are readily accessible to an operator. As the wick carrying racks move orbitally with the conveyor they pass through this loading and unloading zone after they have left the cooling zone and before entering the dipping station, so that racks carrying candles that have been dipped the required number of times can be removed from the conveyor and racks of undipped wicks can be loaded onto the conveyor to be carried directly to the dipping station.

The racks move along a substantially horizontal stretch 27 of the conveyor as they approach the dipping station. At the dipping station each chain is trained over a first upper sprocket 28 from which a downwardly movable stretch 29 of the chain extends to a lower sprocket 30, and thence an upwardly movable stretch 31 of the chain extends to a second upper sprocket 32 which is horizontally spaced from the first upper sprocket and from which a substantially horizontal stretch 33 of each chain extends to the first upright stretch 19' in the cooling zone. Thus at the dipping station each chain has a pair of substantially upright stretches, one of which imparts downward movement to each rack as it moves therethrough and the other of which imparts upward movement to the rack. Guide elements 34 on the ends of each rack cooperate with stationary guide tracks 35 fixed on the machine at the dipping station to confine the rack to vertical translatory motion at the dipping station, despite the fact that the conveyor stretches 29 and 31 are horizontally spaced from one another and from the centerline of the path of vertical motion of the rack. The cooperating guide members 34 and 35 are described in detail hereinafter.

A pair of links 40 pendulously suspends each rack from a tie rod 41 that has its ends connected to the two chains constituting the conveyor. At its upper end each link 40 is swingably trunnioned on said tie rod, near an end thereof, while the lower end portion of each link is pivotably connected to a shaft 42 on the rack. Preferably the end portions of the tie rod 41 constitute roller pins in the two chains, and the tie rod has a U-shaped laterally offset portion 43 near each of its ends to permit

it to clear the stationary guide tracks 35 as the rod moves along the upright conveyor stretches 29 and 31 at the dipping station.

It will be seen that the swinging connection between each rack and the conveyor, provided by the tie rod 41 and the links 40, constrains the rack to move generally with the chain portions to which the tie rod is connected, but leaves the rack free for a limited degree of relative swinging motion about the tie rod axis, so that the rack can be confined to exactly vertical translatory motion at the dipping station despite the fact that the upright conveyor stretches 29 and 31 must necessarily be spaced to opposite sides of the centerline of the path of vertical motion of the rack.

Each rack comprises a rectangular candle wick carrying frame 12 removably mounted on a carriage consisting of a pair of end members 45 rigidly held in opposing relationship by the shaft 42, which is anchored in the end members in any suitable manner. Each end member comprises an angle iron having one flange 47 projecting upwardly and the other flange 48 projecting horizontally inwardly to cooperate with its opposite corresponding member in supporting the frame 12.

The guide elements 34 that cooperate with the stationary track means 35 at the dipping station comprise a pair of rollers 52 and 53 at one end of the carriage, journaled for free rotation on horizontal axes that are vertically spaced from one another and lie in a plane normal to the wick carrying frame and along its longitudinal centerline, and a single freely rotatable roller 153 at the other end of the carriage, coaxial with the upper roller 53. Preferably the lower roller 52 is journaled on a reduced diameter end portion on the shaft 42, projecting outwardly beyond the end member 45. The upper rollers 53 and 153, which are of course of the same diameter as the roller 52, are journaled on stub shafts 54 projecting outwardly from a rigid upright bracket 55 on each end member 45.

The fixed guide tracks 35, with which the rollers 52, 53 and 153 cooperate to confine the rack to vertical translatory motion at the dipping station, comprise a pair of rail members 56 and 57 at one side of the machine and a somewhat similar pair of rail members 156 and 157 at the other side of the machine. These rail members, which may suitably be formed as flat plates, are fixed to the adjacent portions 49 of the frame of the machine by tie bolts 50 and spacers 51. In this manner the plates or rail members 56 and 57, and 156 and 157, at each side of the machine, are rigidly held in planes inwardly adjacent and parallel to the planes of the dipping station sprockets 28, 30 and 32. The plate or rail members 56 and 57 have upright straight edges 58 and 59, respectively, which oppose one another and are spaced apart by a distance substantially equal to the diameter of the rollers 52 and 53, thus cooperating to define the track 35 in which said rollers are guidingly confined. The rail members 156 and 157 have similar spaced apart straight edges 58 and 59, respectively, which cooperate to define the track 35 in which the roller 153 is guided. Since the rollers 52 and 53 are vertically spaced apart, they cooperate with their track to prevent any tilting of the racks as they move up and down at the dipping station, and in short, confine the racks to purely vertical motion.

In order to avoid any joggling or shaking of the rack as its guide rollers come into engagement with the tracks 35, the centers of the tracks are tangent to the pitch lines of the upper sprockets 28 from which the downwardly moving stretch 29 of the chains descend. To assure this condition the straight track defining edges 58 and 59 of each pair of rail members are equi-spaced from a vertical plane transverse to the machine and tangent to the pitch lines of the sprockets 28; and these straight edges extend upwardly far enough to be engaged by the upper rollers 53 and 153 as well as by the lower roller 52 when the tie rod 41 reaches the point of tangency between

the center of the track and the pitch line of the sprockets 28.

Although the space between the track defining edges 58 and 59 is very nearly equal to the diameter of the guide rollers, some clearance must be provided, and this could be a source of difficulty if the rollers were free to shift back and forth between these edges. To assure against this possibility a chain guide 60 holds the stretches 29 and 31 of each chain spaced substantial distances to opposite sides of the transverse plane containing the track center line. These chain guides are fixed to the frame of the machine exactly coplanar with the sprockets 28, 30 and 32 by spacer webs 60' welded to the guides and the adjacent frame portions 49. Their longitudinal edges 61 and 62 have concavely curved upper portions which are concentric to the sprockets 28 and 32 and lie closely adjacent to the peripheries thereof, and convexly curved lower portions extending downwardly substantially to the lower sprocket 30.

As the chain stretches 29 and 31 respectively ride along the edges 61 and 62 of the chain guide, they are held bowed away from the plane of the track center line, as best seen in FIGURES 2 and 5. Accordingly, as the chain carried tie rods 41 move through the stretch 29, downwardly along the edges 61 of the chain guides, the links 40 are swung laterally in a direction to maintain the rollers 52, 53 and 153 engaged with the track edges 58. When the rods 41 move around the bottom sprocket 30 the racks supported thereon remain substantially stationary while the links 40 swing over to the other side of the center line of the track. Thereafter, as the rods travel up the stretch 31, the concavely curved portions of the chain guide edges 62 hold the rollers 52, 53 and 153 firmly against the track edges 59.

The sprockets 32, although horizontally spaced from the other upper sprockets 28 to provide clearance for the chains, are mounted as close as possible to sprockets 28 so as to reduce to a minimum any possible sideward motion of the racks as their rollers move upwardly out of engagement with the tracks. At their upper end portions the track defining edges of the rail members are curved away from one another as at 64 and 164, to further insure a smooth transition of the rack from horizontal to vertical motion and vice versa. The curved portion 164 of the rail members 156 guides the roller 153 at the same time that the curved edge 64 of the rail member 56 is engaged with roller 52 at the other end of the carriage, and because of the vertical spacing between rollers 52 and 153 the carriage is thus held level even before it begins its purely vertical downward motion and while it is riding on the sprockets 28.

It will be apparent that for smooth movement of the racks through the dipping station there must be no slack in the portion of each chain between its upper sprockets 28 and 32, and said sprockets must rotate in absolute unison. To insure the attainment of these objectives the sprockets 28 and 32 are mounted coaxially with driven gears 66 and 67, respectively, and said driven gears are meshingly engaged with a drive gear 68. Each of the driven gears 66 and 67 comprises a pair of identical flat gear elements 70 and 71 secured flatwise adjacent to one another with their teeth substantially coinciding. Only one gear element 70 is anchored directly to the sprocket, but the two gear elements are fastened together by means of screws 72 which may be loosened to permit a limited degree of relative rotation between the gear elements whereby the effective width of the driven gear teeth may be increased or decreased to correspond precisely to the gaps between the drive gear teeth, so that all play and back-lash can be eliminated from the gears. The manner in which such effective widening of the driven gear teeth is accomplished is illustrated in FIGURE 4.

Each of the driven gears is connected with its coaxial sprocket in such a manner as to provide for adjusting relative rotation between the sprocket and the driven

gear, to thus permit all slack to be taken up in the chain stretches 29 and 31. As best seen in FIGURE 2, the hub portion 87 of each sprocket projects coaxially through the driven gear and has a flange 88 which flatwise overlies the face of the driven gear remote from the sprocket. Screws 89 extending through arcuate slots 90 in the flange engage in the driven gear and constrain the driven gear and sprocket to rotate in unison when the screws are tightened but permit limited relative rotation between them when the screws are loose. For effecting relative adjusting rotation between the driven gear and sprocket, a pair of adjusting screws 73 are provided on each driven gear, facing in opposite circumferential directions and engaging opposite sides of a radially projecting lug 75 on the flange 88. The adjusting screws are threaded into blocks 74 mounted on the face of the driven gear remote from the sprocket, and each is provided with a lock nut 76.

To further insure against slack in chain stretches other than those at the dipping station, an idler sprocket at the bottom of a pair of vertical stretches, preferably the sprocket 95 which is accessible at the loading and unloading station, is mounted for free up and down motion so that its weight is imposed upon the entire chain to hold tension thereon.

A hood 77 above the dipping station conducts heated air away from the vicinity of the dipping tank 21 and through a laterally extending duct 78 that has its outlet 79 at one side of the structure that houses the machine, thereby preventing air heated by the dipping tank from mixing with the air in the cooling zone and interfering with the cooling of partly finished candles being moved through said zone. To further avoid mingling heated air with the air in the cooling zone a baffle 80 isolates from the remainder of the cooling zone the stretch 19' that carries racks that have just left the dipping station, said baffle cooperating with the adjacent wall portion 81 of the cooling tower to provide a duct which leads to a ventilator 82 at the top of the structure. The racks of dipped wicks on the other cooling zone stretches 19 of the conveyor are cooled by air drawn into the structure through a suitable inlet port 83 near the top thereof, which may be provided with means for cooling the air, and expelled near the loading zone through an exhaust fan 84.

From the foregoing description taken together with the accompanying drawings it will be apparent to those skilled in the art that this invention provides a candle dipping machine wherein racks of wicks and partially finished candles move through a dipping station with a smooth steady motion and are confined to vertical translatory motion as they present the wicks to the wax bath at the dipping station, all as a result of cooperation between simple guide means on each rack and rail means fixed on the machine at the dipping station.

What is claimed as our invention is:

1. In a candle dipping machine of the type wherein substantially horizontal candle wick carrying racks extending transversely across the machine are transported by an endless conveyor consisting of a pair of parallel spaced apart endless chains at opposite sides of the machine constrained to travel in unison through an orbit that includes a dipping station at which the conveyor has a downwardly moving stretch that travels from first upper sprocket means rotatable on a horizontal axis, around lower sprocket means and upwardly to second upper sprocket means spaced horizontally from the first upper sprocket means, the improvement which comprises: link means for each rack pivotally connected to directly opposite points of the chains and connected with the racks to freely swingingly suspend the same from the conveyor; and means to hold the racks from swinging and/or lateral movement as they move downward and upward at the dipping station, said means comprising vertical track means fixed at the dipping station, and

track followers fixed to each rack and positioned to simultaneously engage vertically spaced portions of the track means, said vertical track means being positioned so that said engagement of the track followers therewith initially occurs substantially at the instant the points of connection between the link means and the chains pass through a horizontal plane containing the axis of the first upper sprocket means.

2. In a candle dipping machine of the type wherein substantially horizontal candle wick carrying racks extending transversely across the machine are transported by an endless conveyor consisting of a pair of parallel spaced apart endless chains at opposite sides of the machine constrained to travel in unison through an orbit that includes a dipping station at which the conveyor has a downwardly moving stretch that travels from first upper sprocket means rotatable on a horizontal axis, around lower sprocket means and upwardly to second upper sprocket means spaced horizontally from the first upper sprocket means, the improvement which comprises: link means for each rack pendulously supported from directly opposite portions of the chains and connected with the racks to freely swingingly suspend the same from the conveyor; guide means on each rack fixed with respect thereto at locations adjacent to the link means and providing vertically spaced upper and lower guide elements; and fixed track means at each side of the machine at the dipping station, defining straight vertical tracks inwardly adjacent to the chains at the downwardly and upwardly moving stretches of the conveyor, said track means being positioned to locate the tracks defined thereby in the path of the guide elements on the racks, so that the guide elements ride the tracks during downward and upward movement of the racks, and thereby constrain the racks to vertical motion and maintain them horizontal as they move down and up at the dipping station, despite the pendulous nature of their connection with the conveyor.

3. The structure set forth in claim 2 wherein said track means is so located with respect to the upwardly and downwardly moving stretches of the conveyor, that the vertical path of the guide elements in moving along the tracks is in a plane tangent to the pitch line of the first upper sprocket means.

4. The structure of claim 3, further having fixed chain guides on the machine at the dipping station extending upwardly from the lower sprocket means, said chain guides having opposite edges along which the chains ride as they travel downwardly and upwardly, and said edges being lengthwise convex and disposed at opposite sides of said plane which is tangent to the pitch line of the upper sprocket means.

5. The structure of claim 2 wherein the guide means at one end of each rack has only an upper guide element; and wherein the track means at the side of the machine adjacent to the end of the racks having only upper guide elements projects above the track means at the opposite side of the machine a distance substantially equal to the vertical spacing between the upper and lower guide ele-

ments, so that an upper and a lower guide element on each rack simultaneously come into guiding engagement with their respective tracks as the rack begins its descent.

6. The structure of claim 5, wherein the guide elements are freely rotatable rollers carried by rigid supporting means fixed to the racks, and wherein the track means are parallel rails spaced apart by a distance substantially equal to the diameter of the rollers.

7. The structure of claim 5, wherein said track means at the opposite sides of the machine have curved approaches to the tracks defined thereby; and wherein said curved approaches are so disposed with respect to the horizontal axis of said first upper sprocket means that the upper and lower guide elements at opposite ends of the racks substantially simultaneously engage their respective track approaches, whereby the racks are held against swinging even before they begin their downward travel.

8. In a candle dipping machine of the type wherein candle wick and partially formed candle carrying racks are carried by an endless conveyor through an orbit that includes a dipping station at which the racks move vertically down and up to dip wicks and partially formed candles hanging from the racks into a tank of molten wax, the improvement which comprises: means constraining the endless conveyor and the racks carried thereby to travel vertically in long up and down stretches substantially directly after they leave the dipping station; means defining a cooling tower enclosing said up and down stretches of the conveyor; and means to cause cooling air to move only vertically in said tower and hence lengthwise along the partially formed candles.

9. In the candle dipping machine of claim 8, the further improvement which comprises: partition means in the cooling tower dividing the same into adjacent ducts, the conveyor having an upwardly moving stretch in one of said ducts and along which the racks carrying the most recently dipped wicks and partially formed candles travel, all other vertical stretches of the conveyor in the cooling tower being outside said one duct, so that the cooling air, flowing over the most recently dipped wicks and partially formed candles does not mingle with the air flowing over the other wicks and partially formed candles traveling in the cooling tower.

10. The structure of claim 8, wherein the cooling tower is substantially over the dipping station; and further having means defining a hood over the dipping station; and an exhaust duct leading from the hood to a discharge zone remote from the interior of the cooling tower to conduct heated air away from the dipping station without mingling it with the cooling air in the tower.

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