Feb. 26, 1935. A. P. DIESCHER 1,992,361

COOLING RACK

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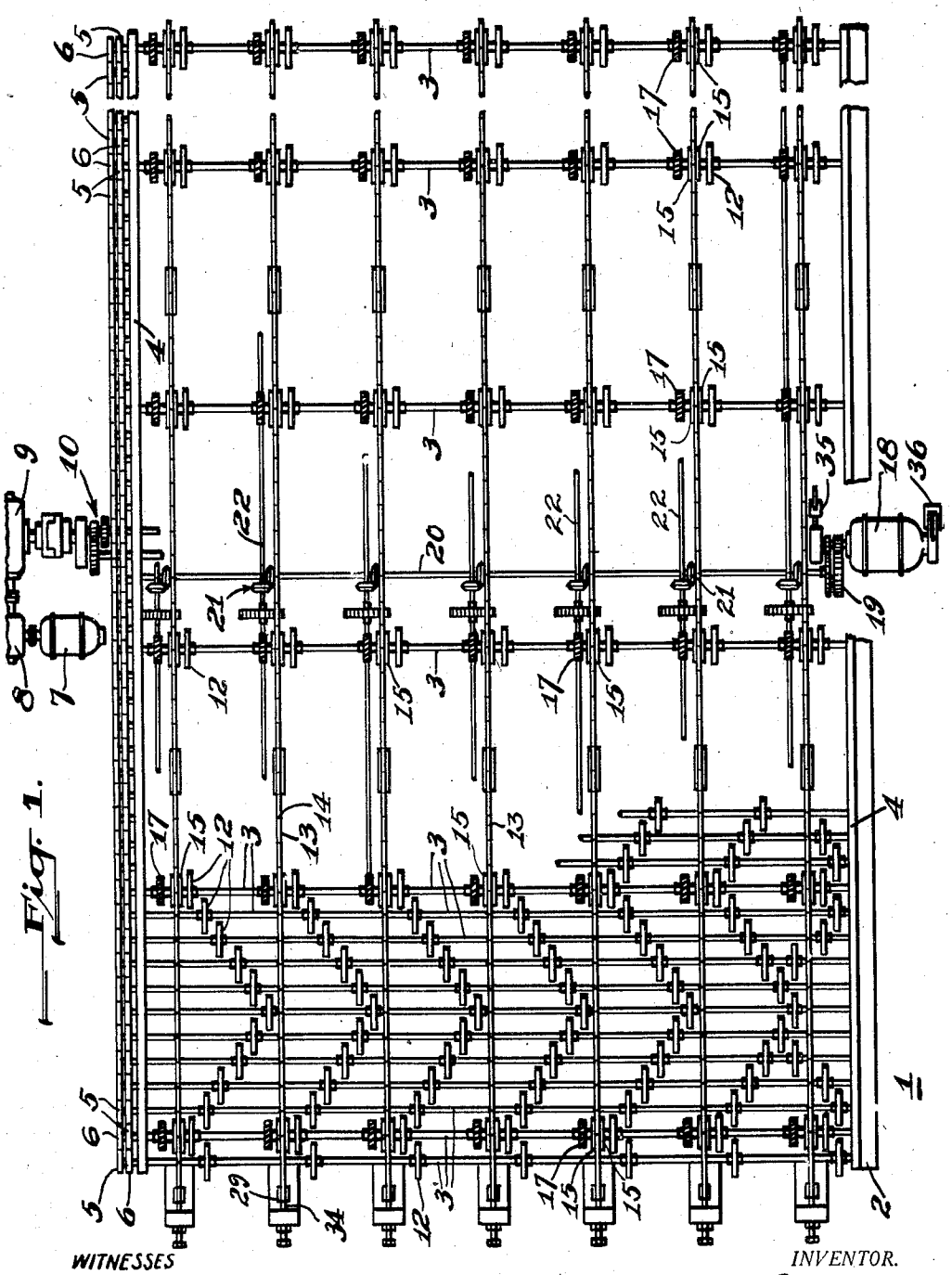


Fig. 1.

WITNESSES

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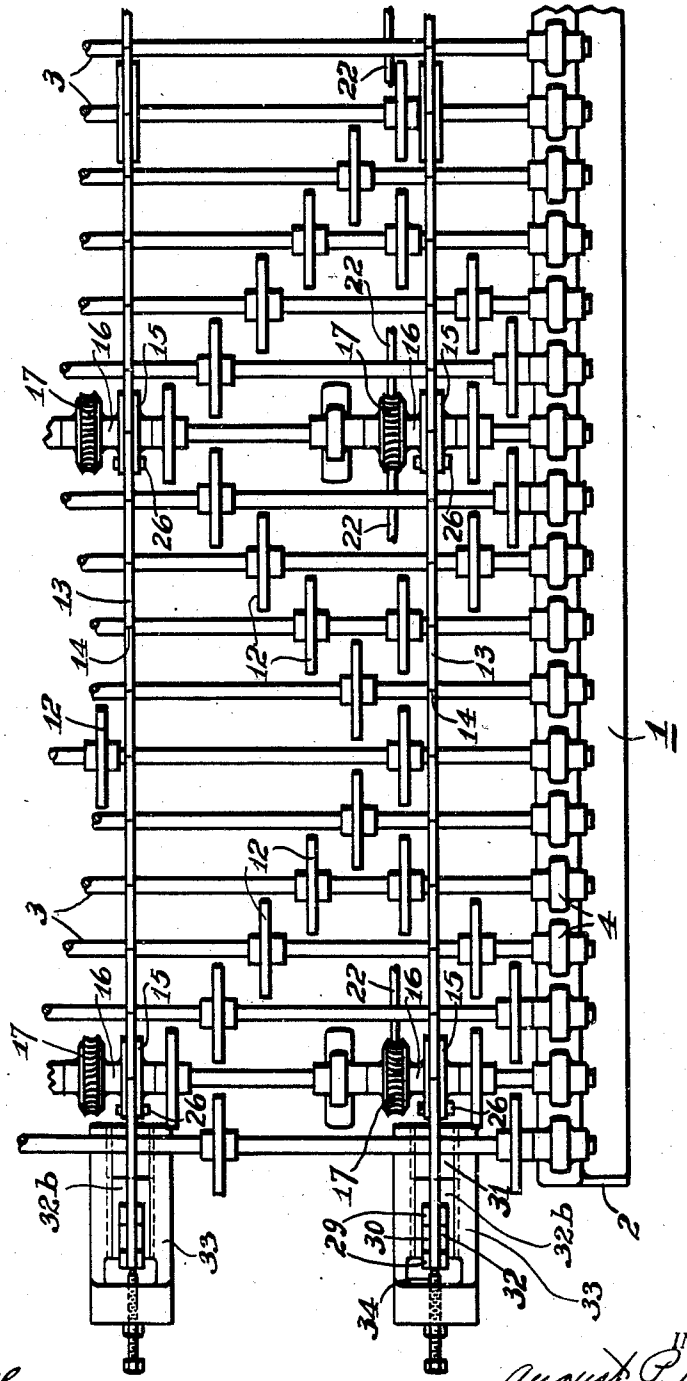
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Fig. 2.



WITNESSES

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COOLING RACK

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Fig. 5.

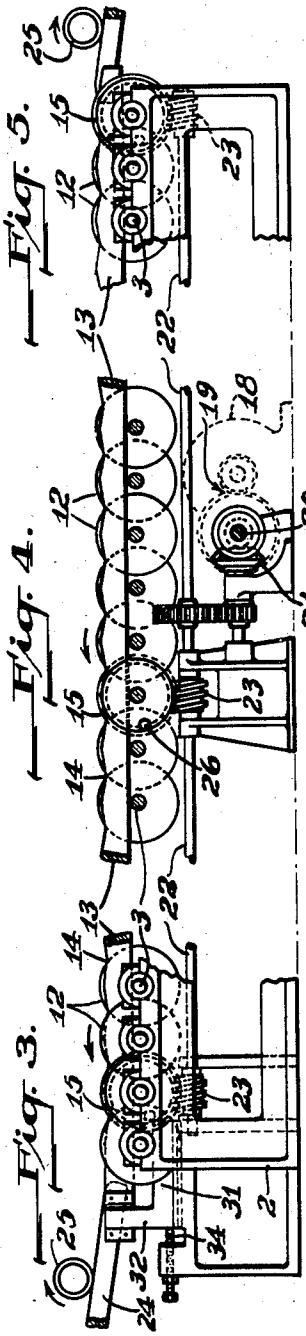


Fig. 4.

Fig. 3.

Fig. 8.

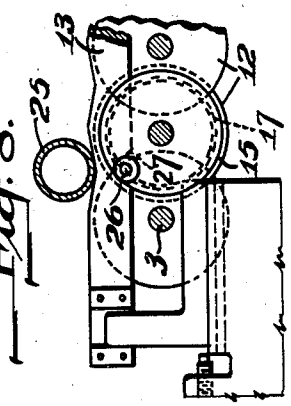


Fig. 7.

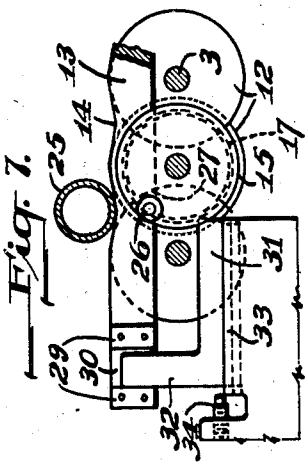


Fig. 6.

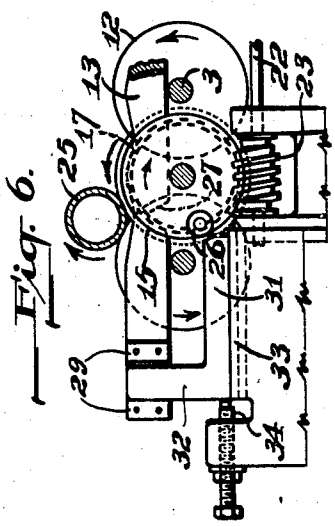


Fig. 11.

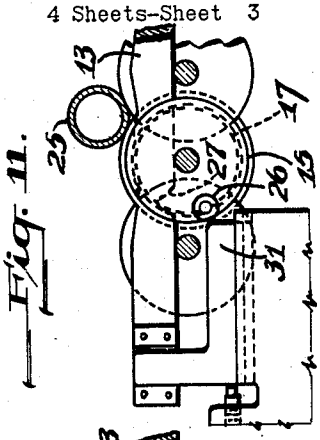


Fig. 10.

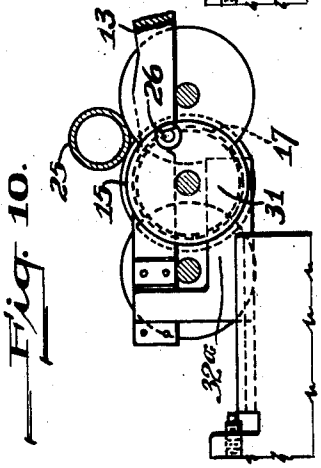
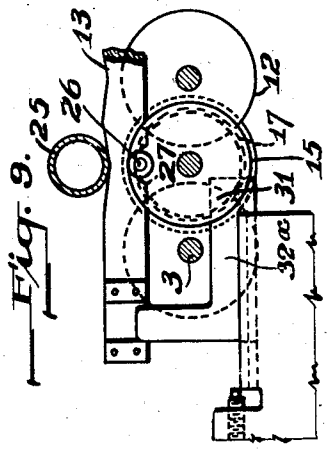


Fig. 9.



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COOLING RACK

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Fig. 14.

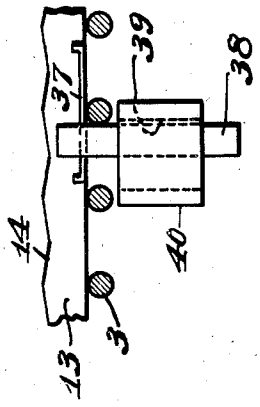


Fig. 13.

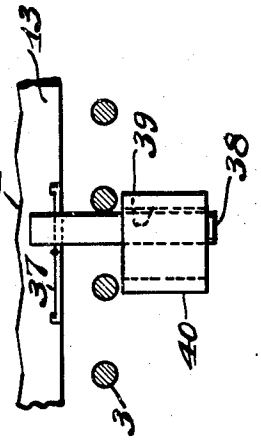


Fig. 12.

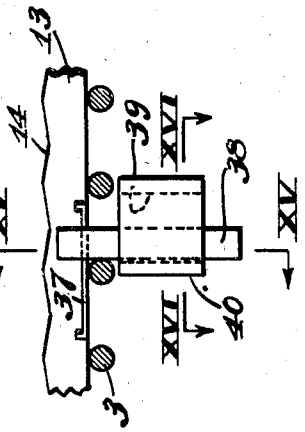


Fig. 16.

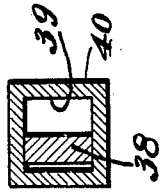
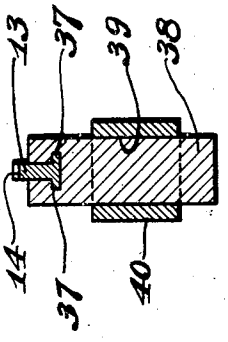


Fig. 15.



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Patented Feb. 26, 1935 1,992,361

UNITED STATES PATENT OFFICE

1,992,361

COOLING RACK

August P. Diescher, Pittsburgh, Pa., assignor to Diescher Tube Mills, Inc., Pittsburgh, Pa., a corporation of Delaware

Application March 15, 1933, Serial No. 660,854

16 Claims. (Cl. 80—42)

My invention relates to apparatus for cooling cylindrical articles, and particularly to cooling racks that are especially adapted for use in cooling tubes, pipes, rods, bars and the like.

Cooling racks for the purpose of cooling tubes, rods or other cylindrical articles that have been used heretofore have generally comprised a series of parallel endless chains that pass over sprockets at each end of the rack and are supported upon tracks consisting of bars or channels, each chain being in the form of a loop, the upper part resting upon the tracks on the framework while the lower or return part of the chain sags between the sprockets at the ends of the rack. In case the rack is relatively long and the chain sags to such extent that it will not clear the floor beneath the rack, a suitable pit beneath the rack provides clearance space for the lower portion of the chains. The chains are provided with lugs projecting above the links thereof and spaced to provide pockets that will accommodate tubes of the largest diameter which the cooling rack is intended to receive.

Between each pair of chains there are provided rails, bars, or other form of skids that extend for the full length of the cooling rack and upon which the tubes roll as they are moved slowly forward by the chains. These supporting bars are slightly higher than the links of the chains in order that the pipes may roll along the bars without engagement with the chain links. In other words, the lugs of the chain cause the tubes to roll along their supports.

In order to insure that the forward movement of the pipes or tubes will not exceed that of the lugs that actuate them, the cooling rack is usually inclined and the tubes are generally moved from the lower end to the higher end of the rack. This arrangement insures that the tubes will bear against the chain lugs and will normally move forward at a relatively steady rate and will not move faster than the lugs on the chain, a condition under which they would be stationary at periods and would remain so until overtaken by the lugs of the chains. Such irregular movement would occur if the tubes were moved on level supports.

If the hot tubes were to remain stationary for any considerable period of time, such as that referred to above, in case the progress was not uniform, one side of the tube would be exposed to cooling drafts from which the opposite side would be more or less protected and the tube would become bowed or curved because of the unequal cooling.

It will be appreciated that in racks of the character described above the length of time available for cooling is dependent upon the speed of the chains along the rack. It will be understood also that the rate at which the tubes revolve is dependent entirely upon chain speed. In order that the tubes may have ample time to become cooled to the desired temperature in their passage across the rack, it is necessary to maintain a relatively low speed for the chains, and there is therefore no opportunity to increase the speed of rotation of the tubes in order to insure more nearly uniform cooling without shortening their period of cooling on the rack.

It has been found in practice that it is substantially impossible to maintain the transverse alignment of the corresponding lugs of the several chains, and the result is to cause some of the tubes to become bent or warped and in some cases to roll in directions out of parallelism with the direction of travel of the chain. Furthermore, the chains are subjected to considerable wear, and it sometimes occurs that one or more of the chains will be broken and the tubes may be bent because of the excessive space between actuating lugs.

Any bending of the hot tubes is apt to become more or less permanent, and any such bending or curving of the tubes may cause them to slide instead of rolling along the skids or bars, in which case the unequal cooling will cause them to be permanently bent. The cost of straightening tubes that are defective from causes of this nature may at times equal that of producing the hot tubes initially. In accordance with the present invention, I provide a cooling rack for tubes, pipes, rods, bars, or other cylindrical articles in which the speed of rotation of each article is entirely independent of its rate of progression from one end of the cooling rack to the other. While tubes are referred to specifically hereinafter, such use is by way of example only. The tubes are supported upon a series of suitably spaced parallel rows of continuously rotating discs which remain in their axial positions while the tubes are periodically transferred from a position between two rows of discs to a succeeding and similar position. The discs of each row most desirably overlap those of adjacent rows.

The means for transferring the tubes comprises a series of movable bars which periodically lift all of the tubes that may be at that time upon the rack and transfer each of them over one row of discs. The operation of transferring the tubes from one position to another may be initiated,

for example, by a flag switch or other suitable device operated by a new tube before it is received by the cooling rack.

Accordingly, the cooling rack of my invention operates to rotate the tubes at a peripheral speed that may be considerably higher than would be necessary to roll them between succeeding positions at their normal rate of progression, whereby the tubes may be rotated at such high speeds as to cause them to be cooled uniformly and more quickly and independently of the rate at which they progress across the rack. Furthermore, the rate of progression across the rack may be varied automatically in accordance with the rate at which hot tubes are produced, since it is only necessary to move the tubes on the rack to anticipate the receipt of a new tube for which space must be provided.

The details of my invention will be described in connection with the accompanying drawings illustrating an approved embodiment of the invention, and in which Fig. 1 is a plan view of a cooling rack constructed in accordance with my invention, parts being broken away; Fig. 2 an enlarged plan view of a portion of the cooling rack of Fig. 1; Figs. 3, 4 and 5 side elevational views of portions of the cooling rack of Fig. 1; Figs. 6, 7, 8, 9, 10 and 11 views showing progressive positions of portions of the transfer mechanism during a cycle of its operation; Figs. 12, 13 and 14 views in side elevation of guide mechanism for the transfer bars; and Figs. 15 and 16 sections taken respectively on lines XV—XV and XVI—XVI of Fig. 12.

Referring to the drawings, the cooling rack 1 comprises a framework 2, portions of which are shown in Figs. 2 to 5, inclusive, and which supports a series of parallel horizontal shafts 3 extending transversely of the rack, and the shafts having bearings 4 at each end and at suitable intermediate points thereof. As best shown in Fig. 1, these shafts are connected at adjacent ends thereof by means of two series of gears 5 and 6 that are so arranged that all of the shafts 3 operate in the same direction.

Each shaft 3 is provided with a gear 5 and a gear 6, the relative positions of which are reversed on adjacent shafts. Each gear 5 is connected to its shaft while each gear 6 is an idler gear for connecting two gears 5 on adjacent shafts. Gears of sufficient diameter that alternate shafts may be connected thereby would interfere with the progress of tubes on the rack. It is not desirable to provide idler gears between adjacent shafts. The shafts 3 are driven in unison by means of a motor 7 which is connected thereto by means of suitable reduction gear mechanisms 8 and 9 that are in turn connected by gear mechanism 10 to each of the series of gears 5 and 6 that are mounted upon the shafts 3 in the manner described above.

Upon each shaft 3 is a series of discs 12 that are spaced therealong at suitable intervals that may correspond approximately to the distances between the chains of cooling racks of the prior art. The shafts are so spaced and the discs 12 are of such diameter that the discs of adjacent shafts overlap, whereby a notch or pocket is formed by each pair of discs of two adjacent shafts, and tubes or rods may be supported in these series of notches or pockets that extend transversely across the table.

The discs 12 of adjacent shafts 3 are staggered as shown in Figs. 1 and 2, the staggered arrangement being progressive alternately in one direction for a series of shafts 3 and then in the opposite direction for a similar series of shafts, whereby not only may the discs overlap each other, but a tube is supported by discs at different locations along its length as the tube is successively transferred. Such operation prevents continuous engagement of any portion of the tube with supporting means of a lower temperature, and the cooling of the tube it therefore more nearly uniform through its length.

The means for transferring the tubes from a position in which they are rotated between adjacent rows of discs 12 comprise a series of transfer bars 13 that extend lengthwise of the cooling rack and are spaced at suitable intervals such that they may support the tubes without danger of the latter bending or sagging between transfer bars. The number of bars may in general correspond to the number of discs on each shaft for supporting the tubes.

Each transfer bar is provided with recesses or notches 14 along its upper edge that are spaced to correspond to the distances between the tubes upon the cooling rack. The transfer bars are guided and held in upright position and caused to be moved through a cyclic path by means of a plurality of series of pairs of mechanically-connected crank discs 15 of smaller diameter than the discs 12, and that are mounted upon certain of the shafts 3 for rotation independently of their supporting shafts and in directions opposite thereto. The members of each pair of crank discs are on opposite sides of the transfer bars 13. One crank disc of each pair is carried by a sleeve 16 that also carries a worm wheel 17. The transfer bars 13 are maintained in their upright positions by the crank discs 15 on opposite sides thereof.

The several worm gears 17 for operating the series of crank discs 15 for each of the bars 13 are driven by means of a motor 18, gear mechanism 19, a shaft 20 extending transversely of the cooling rack, and bevel gear mechanisms 21 for connecting the shaft 20 to a series of shafts 22 extending longitudinally of the cooling rack, the shafts 22 being provided with a series of worms 23 for operating the several worm gears 17. By means of this arrangement, all of the crank discs for all of the transfer bars 13 are operated in synchronism to cause the bars to operate through the same cycle simultaneously. Such operation insures that all of the tubes on the cooling rack are lifted at the several points along their lengths simultaneously and in equal amounts, and that there will be no bending or misalignment of the tubes during their transfer.

In the operations of the cooling rack of my invention, it may be assumed that hot tubes are supplied thereto at intervals such as those at which seamless tubes may be delivered from a cross-roll mill. A transfer or "throw-out" mechanism will ordinarily remove the completed tubes from a conveying table or receiving table and place them successively on transporting means such as the skids 24, portions of which are illustrated in Fig. 3.

A hot tube descending the skids 24 will come to rest in the first notch or pocket between the first and second rows of rotating discs 12. A tube 25 is illustrated in this position in Fig. 6. The discs 12 rotate in a counterclockwise direction and the tube is accordingly rotated in a clockwise direction, as indicated by arrows. The transfer mechanism is normally stationary, and in the usual practice its operation will be initiated by

a flag switch or similar device in the path of the tubes as they are moving toward the cooling rack.

It may be assumed further that while a tube 25 occupies the position shown in Fig. 6, a succeeding tube has been supplied to the skids 24 and that a flag switch, not shown, has been operated to start the motor 18 which drives the transfer mechanism. The transfer bars 13 are at this time in positions corresponding to that of the bar 13 of Fig. 6, being supported upon the shafts 3. The crank pin 26 of each pair of crank discs 15, which when stationary occupies the relative position shown in Fig. 6, now moves upwardly in a clockwise direction to engage a notch 27 in the lower edge of the corresponding bar 13 and the bar is then lifted by the series of crank pins 26.

A notch 14 of the bar 13 then engages the tube 25 which is being rotated by the first and second rows of discs 12. The bar 13 continues its movement upward and to the right to lift the tube thereon out of engagement with the continuously rotating discs 12, the various parts successively passing through the positions illustrated in Figs. 7, 8 and 9, and the bar 13 being at its extreme position to the right, as shown in Fig. 10, when it has again descended into engagement with the shafts 3, and the crank pins 26 being in position to be disengaged from the notch 27 as the crank discs 15 continue to rotate. The tube 24 has now been positively transferred over the second row of discs 12 and is placed in the succeeding notch or pocket and is being rotated by the supporting discs.

The left-hand end of each bar 13 as viewed in the drawings is provided on each side thereof with two spaced vertical plates 29 to form a guideway 30. A slidable member or shoe 31 extending in a vertical plane has a vertical arm 32 that is bifurcated to provide a slot for receiving the end of the bar 13, the two arm portions extending into the guideways 30. The shoe 31 has a horizontal member 32*a* that is of such thickness as to be movable between the crank discs 15 of the adjacent pair. The member 32*a* is provided on its lower edge with a relatively short horizontal guide flange 32*b* which cooperates with a grooved guide 33.

The shoe 31 moves with the bar 13, and in Fig. 10 the shoe has been moved by the bar 13 to the right along the guide 33. The continued rotation of the crank discs 15 beyond their positions illustrated in Fig. 10 causes the crank pin 26 of the crank discs at the left-hand end of the rack to engage the projecting end of the shoe 31 to operate in the manner of a cam to actuate the shoe 31 to the left toward its initial position.

The actuation of the shoe 31 by the crank pin 26 occurs simultaneously with the movement of the bar 13 to the left by the action of the shafts 3 on which it rests, and which tend to carry the bar 13 in this direction. If, however, the bar 13 should for any reason fail to be moved by the shafts 3, it will be positively moved to the left toward its initial position by means of the shoe 31. Return movement of the bar 13 is limited by an adjustable stop 34 which is engaged by the shoe 31.

When the crank discs 15 occupy the position shown in Figs. 6 and 11, the motor 18 is brought to rest by a limit switch 35 and a brake 36. The various parts of the transfer mechanism after each operation come to rest when they are in the positions illustrated in Fig. 11, which corresponds to the positions of the parts in Fig. 6, with the exception that the tube 25, shown in the pocket between the first and second rows of discs in Fig. 6, is now in the pocket between the second and third rows of discs for rotation thereby.

The limit switch 35, which is conventionally shown in Fig. 1, may be of any usual type which opens the circuit of the motor 18 at the end of each cycle of operation of the transfer mechanism. As is customary in installations of a similar character, the circuit of the motor is closed by the flag switch to initiate each cycle and is opened by the limit switch at the end of each cycle. Both operations are entirely automatic and are such as are commonly employed in connection with motor-operated devices.

The operation described above is continued for each succeeding hot tube that is supplied to the cooling rack, each actuation of the transfer mechanism operating to positively shift each tube on the rack laterally from one pocket to the succeeding pocket.

If for any reason it is considered desirable to employ additional means for maintaining the vertical or upright positions of the several transfer bars, the mechanism shown in Figs. 12 to 16 may be provided for this purpose. At suitable intervals each bar 13 may be provide with a flange 37 upon each side thereof, and upon which there is slidably suspended a guide block 38. The latter extends vertically downward between two adjacent shafts 3 and into a slot 39 in a stationary guide frame 40.

When the transfer bars 13 are moved by the crank discs 15, each of the guide blocks 38 moves therewith from the position shown in Fig. 12 and through its uppermost position shown in Fig. 13, in which it engages a shaft 3 in its forward movement. Further movement of the bar 13 causes the block 38 to slide upon the slide 37, and its vertical position depends upon that of the bar 13 to which it is connected. When the bar reaches its lowermost position in engagement with the shafts 3, the parts are in the positions shown in Fig. 14.

The bar 13 is now transferred to its initial or stationary position by the shafts 3, and guide block 38 returns with it to such extent as is permitted by the shaft 3 to the left of the guide block, and which it engages before the bar 13 has completed its return movement.

However, throughout the entire movement of each of the bars 13 the guide blocks 38 retain them in their vertical or upright positions by reason of their being held in vertical alignment by their guide frames 40. The form of such retaining mechanism must be such as to permit relatively free movement of the bars 13 without being projected into the paths of tubes on the cooling rack, and it must be operative in the relatively narrow spaces between adjacent shafts.

It will be appreciated that while the tubes are in position in their respective pockets between rows of discs 12, the latter rotate continuously to rotate the tubes thereon at any desired speed, which may be entirely independent of the speed of the transfer mechanism or the frequency with which it operates. This arrangement, which is extremely flexible, permits the discs 12 to be operated at such relatively high speed that the tubes thereon may be cooled uniformly on all sides thereof, whereby substantially any danger of warping or bowing of the tubes is eliminated. The relatively rapid rotation of the tube also reduces the time required for cooling.

In view of the fact that the tubes are sup-

ported upon parallel rows of discs that are mounted upon fairly rigid parallel shafts, the notches or pockets between the respective pairs of rows of discs are always in alignment, and there is no tendency for tubes thereon to become bent or distorted by reason of misalignment of the various parts in engagement with the tubes.

The arrangement whereby the discs on successive shafts are staggered with respect to those on the preceding shaft insures that no part of the relatively hot tube is unduly cooled by contact with its metallic supports for an undue length of time. The arrangement whereby the tubes are rotated regardless of their progressive forward movement enables the tubes to remain on the cooling rack for any desired time, or for such time as is permitted by the rate at which tubes are delivered to the rack. In the cooling racks of the prior art it has been necessary to advance the tubes on the rack in order to rotate them, regardless of whether or not additional tubes were being received.

Tubes that are cooled on the cooling rack of my invention are uniformly free from such defects as have been caused heretofore by the cooling of certain portions at a higher rate than others, and accordingly the percentage of defective tubes because of lack of uniform cooling is reduced to a minimum. A cooling rack constructed in accordance with my invention is economical in manufacture and operation.

Furthermore, the rack may be adjusted to conditions in the mill in which it is located in that it may be operated horizontally, or it may be inclined either upwardly or downwardly within certain limits, as desired. A pit or other excavation, which has been necessary in connection with chains, is entirely unnecessary, and this comparatively large item of expense in connection with prior installations is thereby avoided.

I claim:

1. A cooling rack for cylindrical articles, comprising a series of sets of continuously rotating members for engaging and supporting said articles thereon, and intermittently operable means for disengaging said articles from one set of said supporting members therefor and positively transferring them to another position in engagement with another set of supporting members.

2. A cooling rack for cylindrical articles, comprising a plurality of parallel rows of rotatable discs arranged side-by-side with the discs of each row staggered with respect to and overlapping those of adjacent rows whereby articles may be supported and rotated in the series of aligned pockets thus formed, and means for periodically lifting articles in said pockets and positively transferring them to other of said pockets.

3. A cooling rack for cylindrical articles, comprising a plurality of rows of rotatable discs, said rows being parallel and side-by-side, and the discs of adjacent rows being staggered and overlapping each other whereby a series of aligned notches are formed for supporting articles for rotation therein, and means comprising a recessed member for periodically lifting said articles from the notches occupied by them and positively transferring each of them to another notch for rotation therein.

4. A cooling rack for cylindrical articles, comprising a plurality of rows of rotatable discs, said rows being parallel and side-by-side, and the discs of adjacent rows being staggered and overlapping each other whereby a series of aligned notches are formed for supporting articles for rotation therein, and means comprising a plurality of simultaneously operable members that have recesses therein for receiving said articles, said members being operable to lift said articles from the notches occupied by them and positively transfer them to other of said notches.

5. A cooling rack for cylindrical articles, comprising a plurality of rows of rotatable discs, said rows being parallel and side-by-side, and the discs of adjacent rows being staggered and overlapping each other whereby a series of aligned notches are formed for supporting articles for rotation therein, and means comprising a plurality of intermittently movable lifting bars for positively transferring each article in the respective notches to a succeeding notch whereby said articles advance progressively and successively on the cooling rack.

6. A cooling rack for tubes or the like, comprising a plurality of parallel rows of discs of equal diameter in axial alignment, said rows being side-by-side and so spaced that a tube may be supported between adjacent rows, means for rotating the discs of the several rows in the same direction to rotate the tubes thereon, and means for advancing a tube progressively on said rack, said means comprising a plurality of bars for periodically lifting the tube and positively placing it between succeeding rows of discs.

7. A cooling rack for cylindrical articles, comprising a series of parallel shafts having discs thereon of such diameter that the discs on each shaft overlap those of an adjacent shaft with which they are staggered, means for driving all of said shafts in the same direction, transfer mechanism for articles supported on said discs between pairs of adjacent shafts, said mechanism comprising notched members for lifting said articles over at least one row of discs to another position, and means for actuating said notched members at intervals and at a rate of movement that are independent of the speed of said shafts and said discs.

8. A cooling rack for cylindrical articles, comprising a series of parallel shafts having discs thereon of such diameter that the discs on each shaft overlap those of an adjacent shaft with which they are staggered, means for driving all of said shafts in the same direction, transfer mechanism for articles supported on said discs between pairs of adjacent shafts, said mechanism comprising notched members for lifting said articles over at least one row of discs to another position, and means for actuating said notched members at intervals and at a rate of movement that are independent of the speed of said shafts and said discs, said actuating means comprising crank members rotatably mounted on certain of said shafts.

9. A cooling rack for cylindrical articles, comprising a series of parallel shafts having discs thereon of such diameter that the discs on each shaft overlap those of an adjacent shaft with which they are staggered, means for driving all of said shafts in the same direction, transfer mechanism for articles supported on said discs between pairs of adjacent shafts, said mechanism comprising notched members for lifting said articles over at least one row of discs to another position, crank members rotatably mounted on said shafts for lifting said notched members and actuating them to move articles transversely, and means for actuating said crank members periodically and independent of the speed of the shafts or the discs thereon.

10. A cooling rack for cylindrical articles, comprising a series of parallel shafts having discs thereon of such diameter that the discs on each shaft overlap those of an adjacent shaft with which they are staggered, means for driving all of said shafts in the same direction, transfer mechanism for articles supported on said discs between pairs of adjacent shafts, said mechanism comprising notched members extending lengthwise of said rack and transversely of said shafts, spaced crank discs on each side of said members and rotatably mounted on certain of said shafts for lifting said members and actuating them endwise until they are lowered into engagement with said shafts for return thereby toward their initial positions, means actuated by at least one of said crank discs for each notched member for insuring the return movement of said member, and means operable independently of the speed of said shafts for intermittently actuating said crank discs.

11. A cooling rack for cylindrical articles, comprising a series of rotatable shafts having means thereon for supporting said articles, and transfer mechanism for said articles comprising bars transverse to said shafts, means for moving said bars from one longitudinal position to another in engagement with said shafts to be returned by the latter to their initial positions, and means for controlling the operation of the actuating means.

12. A cooling rack for cylindrical articles, comprising a series of rotatable shafts having means thereon for supporting said articles, and transfer mechanism for said articles comprising bars transverse to said shafts, means for actuating said bars from one longitudinal position to another in engagement with said shafts to be returned by the later to their initial positions, and means comprising a limit switch for limiting each operation of the actuating means to a complete cycle.

13. A rack for cooling cylindrical articles, comprising means for supporting said articles individually at successive parallel stations, means for continuously rotating the articles on their axes while they are being supported at their several said stations, and means in addition to said supporting means for intermittently moving said articles transversely from station to station.

14. A rack for cooling cylindrical articles, comprising discs arranged in cooperating pairs to form a series of successive parallel stations for supporting said articles individually, means for rotating said discs to continuously rotate the articles on their axes while they are being supported at their several stations, and means in addition to said discs for intermittently moving said articles transversely from station to station.

15. A rack for cooling cylindrical articles, comprising discs arranged in cooperating pairs to form a series of successive parallel stations for supporting said articles individually, means for rotating said discs to continuously rotate the articles on their axes while they are being supported at their several stations, and means for intermittently elevating said articles above said discs and moving them transversely from station to station.

16. A rack for cooling cylindrical articles, comprising discs arranged in cooperating pairs to form a series of successive parallel stations for supporting said articles individually, means for rotating said discs to continuously rotate the articles on their axes while they are being supported at their several stations, and a plurality of bars for intermittently engaging and moving said articles transversely from station to station.

AUGUST P. DIESCHER.