My invention relates to sprocket wheels and more particularly to the construction of sprocket wheels adapted for use in elevators or conveyors.

An object of my invention is to provide an improved thermal compensating sprocket wheel structure particularly adapted to convey hot chain elements of a conveyor apparatus constructed to convey hot materials such as hot clay used in the cracking of petroleum.

Another object of my invention is to provide an improved sprocket wheel structure particularly adapted for use in an elevator or conveyor operating under conditions of heat in combination with a shaft which is cooled.

In carrying out the foregoing object it is a further object of my invention to provide an improved sprocket wheel adapted to be carried upon a shaft which is cooled wherein provision is made providing for expansion of the rim thereof with respect to the hub or central portion thereof.

Another object of my invention is to provide an improved thermal compensating sprocket wheel having removable chain engaging teeth.

Still another object of my invention is to provide an improved removable tooth adapted to be secured upon a conveyor sprocket wheel.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings:

Fig. 1 is a side elevational view of an elevator or conveyor incorporating the features of my invention;

Fig. 2 is a rear view of the head portion of the conveyor shown in Fig. 1, the view being taken on line 2—2 thereof;

Fig. 3 is a transverse, fragmentary sectional view showing one end of the head shaft and head sprocket and associated mechanism of the elevator or conveyor; and

Fig. 4 is a view of a tooth and associated parts of the head sprocket.

This application is a division of my co-pending application, Serial No. 500,799, filed September 1, 1943, entitled "Elevator," now Patent No. 2,401,999, dated December 20, 1946.

The conveyor or elevator illustrated as a whole in Fig. 1 of the drawings comprises a vertical or upwardly extending tower or main frame 20 which is generally rectangular in cross section and at each of the four corners includes a vertical or upright structural member such as a channel 21. Each of the channels 21 in the finally assembled condition of the main frame 20 constitutes a continuous upright member which extends from the foot or bottom of the main frame 20 to the top thereof. At their bottoms, the channels 21 are provided with feet 22 preferably rigidly attached to the base members which may be, for example, mounted on a poured concrete base sufficiently sunk in the ground to provide a firm foundation. At their tops the channel members 21 are rigidly connected together by side I-beams 23 and cross channels 24, all of said structural members 21, 23 and 24 being rigidly connected together. Along the sides, each of the two front and rear channel members 21 are connected by one or more diagonal braces 25 as well as horizontal angle members 26. Spaced moment members 27 connect the front and rear pairs of channels 21.

Mounted upon the I-beams 23 at the top of the main frame 20 is a pair of spaced bearing boxes 29 which support a horizontally extending head shaft 30 of a head assembly 31 that includes a pair of head sprocket wheels 32 which support and drive a pair of endless chain elements 33 of a bucket elevator or conveyor mechanism indicated diagrammatically in Fig. 1. Extending between the two chain elements 33 and carried thereby is a plurality of material receiving buckets, not shown, that are rigidly attached adjacent their sides to the inner side bars of the chains 33 by appropriate brackets.

At the foot or bottom of the tower or main frame 20 there is a foot shaft 37 which is part of a foot shaft assembly 38 which includes a pair of spaced wheels 38 that receive and carry the two endless chain elements 33 of the conveyor apparatus. Foot shaft assembly 38 is mounted for floating guided vertical movement and is carried by a box-like frame 34 with which there is associated a counter-balancing mechanism 35 for counter-balancing weight of the box-like frame and shaft assembly.

Supported by the main frame 20 and generally within the structural members thereof is a totally enclosing casing or housing 40 which includes as its three principal parts a head section 41, a foot section 42 and a plurality of intermediate sections 43. All of these sections are preferably formed at least in part of insulating material so that the enclosing housing or casing is insulated. Also the head section 41 is provided with a discharge chute or spout 44 by which the material is discharged from the conveyor.

The foot part or section 42 of the housing or casing 40 includes a feed chute 43 by which hot clay or other material to be elevated is delivered preferably directly into the buckets at the bottom of the feed run of the conveyor mechanism. The foot section or part 42 also includes structure providing gas tight dust and heat seals for the foot shaft 37 which is mounted for substantially free or floating vertical movement through a limited range so as to compensate for changes in the lengths of the chain elements 33, particularly under the influence of temperature changes.

Attention is now directed to mechanism that
is included in the head section of the conveyer and shown in Figs. 1 and 2 of the drawings. Referring thereto it will be noted that one end of the head shaft 30 is provided with a drive sprocket 48 which is keyed to the shaft 35. At its another end the shaft 30 is provided with a traction wheel 47 with which a mechanically operated brake device 43 (Fig. 1) co-operates. The drive sprocket 45 is driven from an appropriate motor and speed reducer 49 through an appropriate chain and sprocket or equivalent drive 50. The motor and speed reducing mechanism 49 is mounted on a platform formed on rearwardly extending portions of the I-beams 23.

Attention is now directed particularly to Fig. 3 of the drawings which illustrates one end of the housing assembly 31, one of the bearing boxes 33 and certain associated apparatus, it being understood that the structure is duplicated on the other side of the elevator.

Mounted in spaced relation on the head shaft 30 are the head or drive sprockets 31, there being one for each of the chains 33, as previously pointed out, said sprockets 32 preferably being of similar construction. Each sprocket 32 includes a plate steel center ring 32 preferably keyed and welded to the shaft 30 and forming a hub. The additional diameter of the wheel 32 is formed by a pair of concentric rings 39 and 60, the former being shrunk onto the center ring or hub 38 and the second being in turn shrunk onto the ring 99. In building up this wheel, the ring 38 is heated to a high temperature so that it can be forced or slipped onto the ring 38 and when it cools to atmospheric temperature it will be under tension. Thereafter, the edges of the rings 39 and 99 are preferably welded together by welds 101 which may be either continuous or spaced intervals along the periphery thereof. In a similar manner the ring 100 is shrunk onto the ring 99 and attached thereto by welds 102 similar to the welds 101. The ring 100 is also under tension at atmospheric temperature.

As a consequence of the above structure, the wheel 32 can expand or contract with variations in temperature without thereby damaging the same, and at the same time the structure is such that the parts are held together both by friction and by welded connections. Because shaft 30 is cooled, as hereinafter described, the temperature of the wheel rim, which frequently reaches 1000 degrees F., will be much higher than the shaft temperature during operation of the conveyer.

Mounted on the outer periphery of the ring 100 is a plurality of removable sprocket teeth 163 and the bottom or root of each tooth 163 is provided with an arcuate groove which receives the periphery of the ring 100, said root of tooth 163 being bifurcated so that a portion or part thereof extends on each side of the ring 100. The final attachment between each tooth 163 and the ring 100 is by virtue of a pair of pins 104 which have a preferential seating in the ring 100 and the root parts of tooth 103, the pins 104 preferably being welded at one or two spots to the root of tooth 103 after the parts are assembled. To remove a tooth 103 the welded spot is burned off.

To protect the major portion of the two wheels 32 from the high temperature within the casing 49 and also to reduce the transfer of heat therefrom through the shaft 30 and to its supporting bearings, the principal portion of said sprocket 32, including the rings 99 and 98 and part of the ring 100 as well as the major portion of the shaft 30 within the housing 40, is embedded in a heavy drum 105 of insulating material which is preferably made up of sections which are split along a plane passing through the axis of the shaft 30, transversely of itself. The drum 105 is also made in sections, there being at least one transverse section between the two sprockets 32 and two sections, one outside each of said sprockets, these transverse sections being connected together with tie rods 106. Similar tie rods 106 or tie bolts not illustrated, may interconnect the sections of drum 105 along their plane of severance parallel the axis of shaft 30.

As clearly illustrated in Fig. 3 of the drawings, the end of drum 105 is closely positioned with respect to the insulating material lining 107 of the head section 41 of casing 40. The opposite ends of head shaft 30 extend through close-fitting openings in the side walls of the head section 41 and a stuffing box 108 is provided between each of said side walls and said shaft 30 which acts as a dirt and heat seal. A support for opposite ends of the shaft 30 is provided by a pair of self aligning bearings, one of which is seen at 109. Said bearings 109 is preferably babbitt or bronze lined and is only semi-cylindrical in shape and supports the bottom portion of the shaft 30, since the load on the shaft 30 is always in a downward direction. The shaft 30 is enclosed and protected by the bearing box 29 which provides a lubrication well. Oil drip rings 110 are provided on shaft 30.

It is important in elevators or conveyors of the type illustrated that the temperature of the wheel shaft be controlled because in spite of all of the insulation provided on the shaft assemblies the shafts will become quite hot unless they are properly cooled. It is because of the cooling of the shaft 30 and the consequent large temperature differential between it and the rim of sprocket wheel 32 that the above described special construction of said sprocket wheel 32 is required. To control its temperature the shaft is provided with an axial bore 121 whereby it is formed as a hollow shaft. It will be understood that this outer exterior of the shaft 30 and the consequent large temperature differential between it and the sprocket wheel 32 which acts in the nature of a bearing. The fitting 123 is so constructed that a feed water elbow 124 connected thereto, will be effectively connected to the interior of the pipe 122 and a water discharge elbow 125 is effectively connected to a passageway formed between the exterior of the pipe 122 and the cylindrical surface provided by the bore 121. The packing between the fitting 123 which is stationary and the rotating shaft 30 is provided by packing ring 126 and associated packing gland 127 which is attached by screws to the end of the shaft 30 and the fitting 125 is mounted on a stationary bracket 128 which may be connected to any desired closely associated portion of the main frame 20.

Adjacent its inner or right hand end, as viewed in Fig. 3, the pipe 122 is provided with radial holes 129 so as to provide communication between the feed and return paths for the cooling water or other temperature controlling fluid or medium. The inner end of the pipe 122 is provided with a rigidly attached plug 130 which is supported in the end of a filler and connecting cylindrical rod 131 which extends through the
central portion of the shaft 30 and supports the inner ends of the pipes 122 associated with opposite ends of said shaft 30. It may be mentioned that axial movement of the pipes 122 is prevented since the fittings 123 to which said pipes in opposite ends of the shaft 30 are screwed-threaded, are held by the above mentioned stationary bracket 120. Fuller is preferably rigidly attached to the exterior surface of the pipe 122 and is closely adjacent to the cylindrical surface of the bore 121, though slightly spaced from said surface, since the shaft 30 rotates while the wire helix 122 is stationary. It is evident that cooling water introduced by way of the feed elbow 122 will flow through the fitting 123 into the pipe 122 and out of the radial openings or holes 125 and thence will return by a greatly elongated and helical path of reduced cross-sectional area to provide what is known as "turbulent flow," during which it will scour the internal surface of the elongated portion of the shaft 30 provided by the bore 121, ultimately flowing through the fitting 123 and the discharge elbow 125. This elongated helical path together with the swirling action will insure proper cooling of the shaft 30 and through it the bearing 109 so as to prevent burning out of said bearings and undue heating of the lubricating oil for it, which is within the bearing box 29.

In the operation of the conveyor or elevator hot material such as clay or fuller's earth is fed to the feed chute 43 and by it directed into the buckets of the conveyor mechanism as they travel upwardly from the foot shaft assembly 36 along their working or elevating run. As the buckets travel over the head shaft 31 they discharge into the discharge chute 44 and the material flows therefrom and is discharged from the elevator at the top thereof. Provision has been made for free vertical movement of the foot shaft, movement which may be caused by differences in temperature within the casing or housing 36. Furthermore, the head sprocket wheels for the two strands of chain 33 have been especially constructed to take care of differences in temperature adjacent the outer rims thereof as compared with the hubs or portions thereof attached to the shaft 30.

From the foregoing description it will be obvious that I have provided an improved thermal compensating sprocket assembly and wheel therefor wherein provision is made for an extreme temperature differential between the outer rim of the wheel and the cooled hub portion thereof which may be cooled, for example, through an internally cooled supporting shaft. It will also be obvious that I have provided an improved conveyor wheel having removable sprocket teeth thereon and that the sprocket teeth are secured to the outer rim of the wheel through root members that form an accurate slot between them for receiving the rim of the wheel and through which there are aligned openings for receiving a fastening or securing pin that may be pressed therethrough and permanently fixed therein by welding to one or both root members of the tooth. It will be seen that the separate teeth of each sprocket wheel 32 co-operate to form a segmented outer or toothed peripheral portion or rim that will not interfere with the thermostaticating features of the wheel and should the teeth become worn they may be replaced readily by removing the pins 104.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended and I wish therefore not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. A driving member for a conveyor adapted to convey hot material including a shaft adapted to operate at a relatively low temperature, a thermal compensating sprocket wheel rigidly supported upon said shaft adapted to drive hot chain elements of the conveyor, said thermal compensating sprocket wheel including a hub member rigidly secured to said shaft and a plurality of concentric ring members carried by said hub, said concentric ring members being under tension at atmospheric temperature, sprocket teeth carried by the outer of said concentric rings each tooth having in its bottom a groove which receives said outer ring, the teeth thereby having root parts on opposite sides of said outer ring, means including pins extending tightly through aligned openings in said root parts and outer ring tightly attaching said teeth to said outer ring, and insulating material on said shaft embedding said wheels except for said outer concentric rings.

2. A driving member for a conveyor adapted to convey hot material including a shaft adapted to operate at a relatively low temperature, a thermal compensating sprocket wheel rigidly supported upon said shaft adapted to drive hot chain elements of the conveyor, said thermal compensating sprocket wheel including a hub member rigidly secured to said shaft and a plurality of concentric ring members carried by said hub, all of said concentric ring members being under tension at atmospheric temperature, sprocket teeth carried by the outer of said concentric rings each tooth having in its bottom a groove which receives said outer ring, the teeth thereby having root parts on opposite sides of said outer ring, and means including pins extending tightly through aligned openings in said root parts and outer ring tightly attaching said teeth to said outer ring.

STANLEY M. MERCER.

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