July 15, 1952 LE ROY D. BISHOP 2,603,457

MULTIJET HEAT EXCHANGE ROLL

Filed Nov. 18, 1948

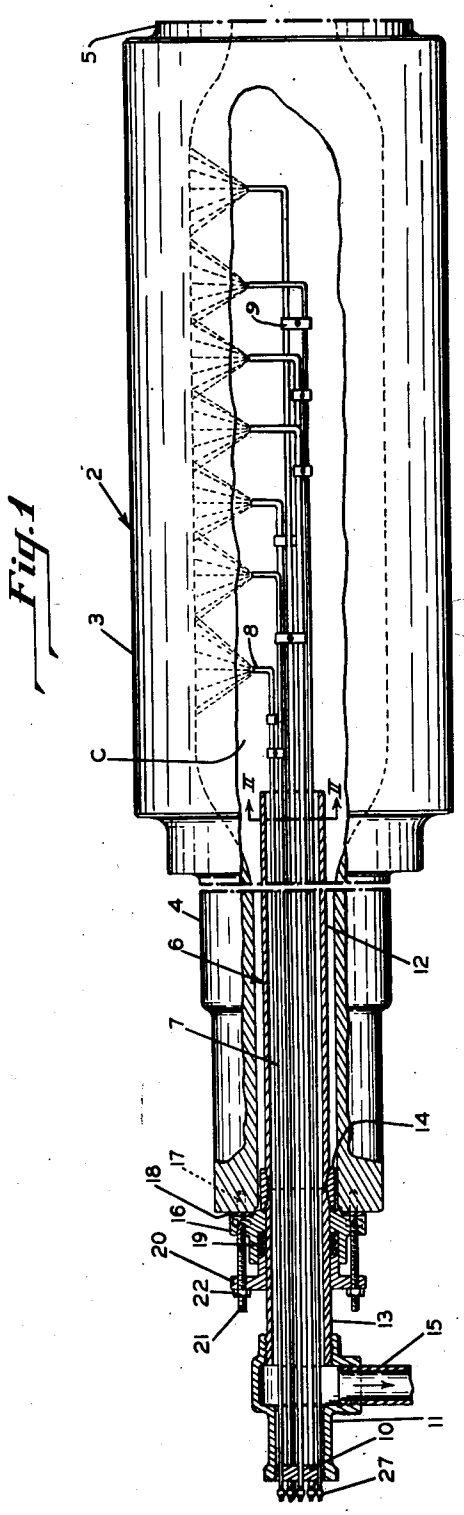


Fig. 1

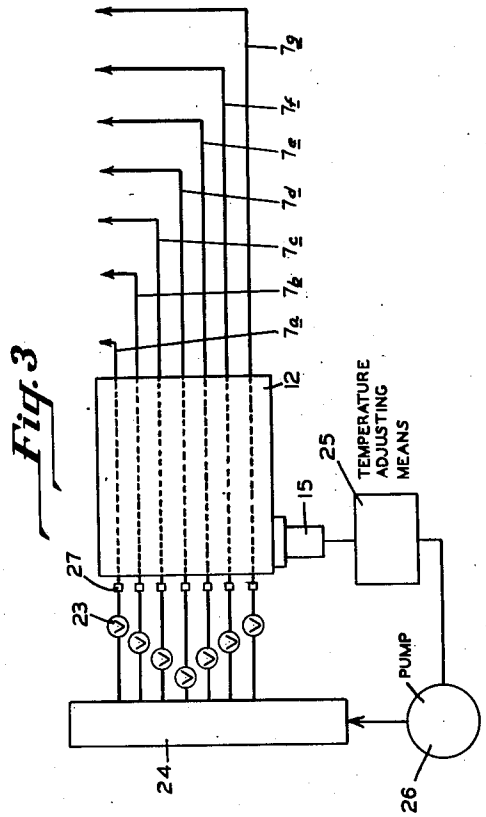


Fig. 3

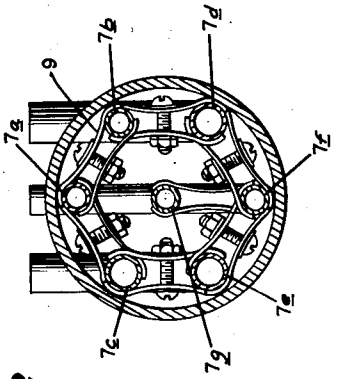


Fig. 2

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Patented July 15, 1952 2,603,457

UNITED STATES PATENT OFFICE

2,603,457

MULTIJET HEAT EXCHANGE ROLL

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Application November 18, 1948, Serial No. 60,716

1 Claim. (Cl. 257—95)

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This invention relates to a heat exchange roll and is concerned particularly with a calender roll for use in the manufacture of so-called asphalt tile, including a controllable jet injector arrangement for directing a plurality of streams of heat transfer fluid at high velocity against the inner surface of the roll, within the heat transfer cavity therein, to extract heat from the roll to bring the working surface to a desired working temperature, preferably substantially uniform throughout the extent of the working surface of the calender roll. In the manufacture of this product, it is desirable to extract heat from the calendar rolls and this is accomplished by circulating refrigerated brine or other heat transfer fluid through a cavity disposed within the roll, below the working surface thereof.

In these calenders it has been found that the temperature will vary over the length of the working surface of the roll, generally being hotter at the center than adjacent the roll necks where conduction of heat from the roll to the machine frame, bearings, and the atmosphere is greater than at the center. Frequently, the areas of the working surface adjacent the roll necks will be too cold for proper operation while the center portion will be at a temperature above that desired. In the manufacture of asphalt tile, particularly where a marbleized pattern is produced, it is desirable to maintain a substantially uniform temperature throughout the extent of the working surface of the rolls in order to obtain a uniform surface smoothness and the desired graining effect.

Attempts have been made to provide heat exchange rolls with injectors of different sizes positioned along the length of the roll cavity to thus inject a greater quantity of heat transfer fluid into certain areas of the roll cavity than in others, and to exhaust the heat transfer fluid in zones adjacent the zones of introduction to thus attain a substantially uniform temperature along the length of the working surface of the roll. While these attempts have been successful in a measure, it has not been possible to vary the quantity of transfer fluid injected into the roll cavity at the spaced locations along its length without removing the injector mechanism from the roll and replacing the injector heads. It frequently happens in commercial manufacture that temperature conditions will vary during a production run, or between different runs, and it is desirable to compensate for such variations without the necessity of shutting down the machine and dismantling the injector mechanism.

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It is an object of this invention to provide a heat exchange roll in which a substantially uniform temperature from edge to edge of the working surface of the roll may be obtained regardless of variations in operating conditions.

A further object of the invention is to provide a heat exchange roll in which the heat exchange fluid is injected into the roll cavity against the inner surface thereof at a high velocity and at spaced locations along the length of the cavity and in which independent control of the various injectors is provided to attain a desired temperature relationship in the various locations throughout the length of the working surface of the roll.

Another object of the invention is to provide a heat exchange roll with independent injectors positioned to supply heat transfer fluid to the roll cavity in spaced zones, with external controls provided for regulating the supply of heat transfer fluid to the various injectors, operable without shutting down the operation of the roll and without dismantling of the injector mechanism.

An additional object of the invention is to provide a controllable jet injector arrangement for a heat exchange roll with an exhaust arrangement associated with the injector, the whole being insertable into a heat exchange roll as a unit.

A preferred embodiment of the invention is illustrated in the attached drawing in which:

Figure 1 is a plan view, partly in section and partly broken away, illustrating a heat exchange roll in the nature of an asphalt tile calender, embodying the present invention;

Figure 2 is an enlarged sectional view taken on the line II—II of Figure 1; and

Figure 3 is a diagram illustrating the flow of heat transfer fluid.

Referring to Figure 1, there is shown a heat exchange roll which has been generally designated by the numeral 2. It includes a cylindrical working surface 3 and necks 4 and 5. The roll is provided with a heat transfer fluid cavity C which extends throughout the length of the working surface of the roll.

A controllable jet injector, indicated generally by the numeral 6, is arranged for assembly as a unit with the heat exchange roll 2. The injector includes a plurality of injector tubes 7. In the embodiment illustrated, there are seven injector tubes, each indicated by the numeral 7 followed by one of the letters *a* to *g*. Each of the injector tubes 7*a*–*g* is provided with an up-

wardly directed nozzle 8. The number of the injector tubes employed, their size and their spacing will depend upon the size of the roll, the temperature of the heat transfer fluid as injected, the velocity of flow of the heat transfer fluid, the temperature to be attained at the working surface of the roll, and other variable factors. In a typical asphalt tile calendar roll where the working surface 3 is 48 inches long and the heat transfer fluid is brine at a temperature of 0° F., supplied at 60 pounds pressure at the manifold, and a temperature of 100° F. is desired at the working surface, the tubes 7c, 7d, and 7e may have an inside diameter of ½ inch, and the tubes 7a, 7b, 7f, and 7g an inside diameter of ⅜ of an inch. The tubes may be positioned in the locations shown in Figure 1. The nozzles 8 may be merely copper tube sections or may be conventional nozzles. The preferred arrangement is to have the nozzles so shaped and so positioned that they direct jets of heat transfer fluid upwardly against the wall of the chamber in overlapping zones, as diagrammatically illustrated in Figure 1. The tubes 7 are suitably fastened together as by clips 9 so as to properly support one another in proper spaced relationship. The tubes 7 are fitted through openings in a supporting disk 10, and the disk 10 is threaded into an end fitting 11. An exhaust conduit 12 is provided for the discharge of spent heat transfer fluid from the cavity C. The conduit 12 is connected to the end fitting 11 by a conduit 13 and connecting coupling 14. A discharge pipe 15 is also attached to the end fitting 11 for conveying the heat transfer fluid from the roll.

The injector mechanism 6, including the injector tubes 7, the discharge conduit 12, and the associated end fitting and coupling are joined together into a unitary structure. In order to mount this structure on the roll, a flanged sleeve 16 is provided which encircles the member 13 and is affixed to the roll 2 at the neck 4 by a plurality of machine bolts 17. Since the roll 2 and the sleeve 16 rotate with respect to the injector mechanism 6, suitable sealing arrangements are provided to prevent the leakage of heat transfer fluid. A gasket 18 is used to seal the joint between the sleeve 16 and the roll 2, and a rotating joint arrangement including packing 19, a packing gland 20, and adjusting bolts 21 which are fixed within the flange of the sleeve 16 and are provided with adjusting nuts 22 is provided. The conduit 13 is turned on its outer surface to a proper finish to permit sealing by the packing 19.

In the assembly of the injector with the roll, it is merely necessary to slide the injector into position and draw up the attaching bolts 17.

As diagrammatically shown in Figure 3, each of the injector tubes 7 is provided with a valve 23 for independently controlling the supply of heat transfer fluid to each of the nozzles 8. This makes it possible to control the volume and velocity of heat transfer fluid directed into the roll cavity C at the individual spaced locations and thus obtain minute temperature control at the working surface 3. A manifold 24 is preferably provided into which the various tubes 7 are connected.

The discharge conduit 12 is preferably connected by the pipe 15 to a temperature adjusting means 25, such as a refrigerating unit adapted to lower the temperature of the heat transfer fluid to the desired degree, and the heat transfer fluid so adjusted in temperature is delivered by a pump 26 into the manifold 24 for injection into the roll cavity through the various injector tubes. This provides a closed, circulating system for the heat transfer fluid. Other inlet and discharge arrangements may be provided, if desired. For example, where water is used as a cooling fluid, it may be unnecessary to circulate the water, merely supplying water to the manifold from a suitable supply and discharging the water from the roll into a sewer.

In order to facilitate the removal of the injector from the roll, a coupling 27 is provided on each tube 7 adjacent the disk 10, and the valves 23 are preferably so positioned that they need not be disconnected to permit removal of the injector mechanism.

In the operation of the device, heat transfer fluid is supplied to the manifold 24 and the valves 23 are adjusted while the calender roll is in operation, heat transfer fluid being projected through the tubes 7 and nozzles 8 against the rotating wall of the roll cavity. Temperature measurements may be made at the roll surface. If it is desired to maintain a substantially uniform temperature throughout the working surface of the roll, adjustment of the valves 23 will be made to establish such condition. Should the temperature of the mix fed to the rolls vary during production, or should other variable factors be encountered which tend to alter the temperature condition at the working surface of the roll, adjustments of the valves 23 may be effected while the calender is in operation and the proper control thus established. Since the manufacture of asphalt tile is effected very rapidly, it is essential to be in a position to very quickly compensate for any changes in temperature which may occur across the working surface of the roll in order to permit sustained quality production.

The system works on the principle of directing controllable jets of heat transfer fluid at a high velocity to obtain heat transfer from the roll to the heat transfer fluid. This necessitates that the exhaust conduit 12 be of sufficient capacity to prevent the filling of cavity C with heat transfer fluid. In the typical embodiment illustrated and described using an exhaust conduit 2½ inches in diameter, the cavity C will not be more than half filled at any time even though each of the injector tubes 7 be wide open and supplying heat transfer fluid at 60 pounds per square inch pressure.

While I have illustrated and described a preferred embodiment of my invention, it will be understood that the same is not limited thereto but may be otherwise embodied and practiced within the scope of the following claim.

I claim:

A heat exchange roll comprising a roll body having a peripheral working surface the temperature of which is to be controlled and having a heat transfer fluid chamber within the body thereof and extending substantially throughout the length of the working surface; a plurality of upwardly directed jet injectors disposed within said chamber, opening directly into said chamber above the axis of the roll, and spaced along the length thereof, a plurality of said injectors disposed at the central portion of the working surface of the roll being larger than a plurality of said injectors disposed at the end portions of the working surface of the roll; a manifold externally of the roll connecting said injectors to a common source of heat transfer fluid under

pressure; a central conduit having a capacity greater than the combined capacities of the injectors leading from the chamber adjacent to one end thereof and through which said injectors are disposed, said conduit discharging spent heat transfer fluid from the roll cavity below the axis of the roll, whereby the injectors are unrestricted in their upward projection of jets of heat transfer fluid under pressure against the inner surface of the roll cavity; and valves disposed externally of the roll and interposed between said manifold and said injectors for independently controlling the supply of heat transfer fluid to said individual injectors.

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