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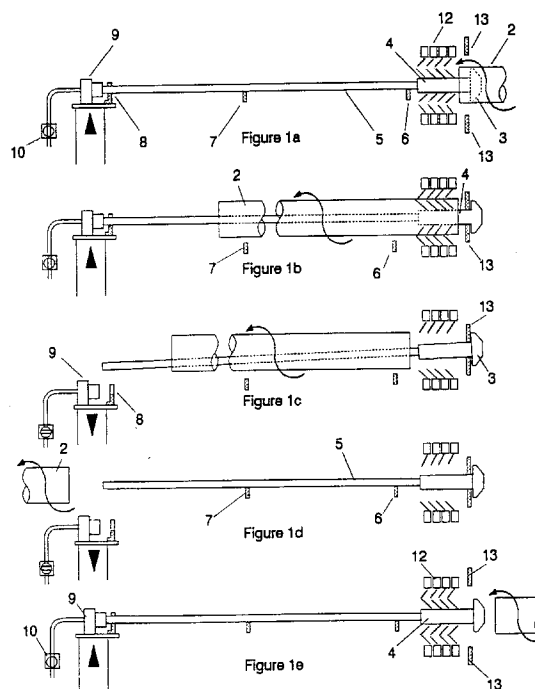
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(54) **Method of and apparatus for applying quench liquids to pipes.**

(57) A method of and apparatus for applying quench liquid to pipes comprises transporting pipes sequentially and longitudinally through a quenching station having a tubular lance, a tail end of which is coupled to a liquid source and the other end of which is provided with a head from which the liquid is projected laterally in a series of jets characterised in that the lance is supported at the tail and at at least one intermediate position along its length whilst the leading end of the pipe passes onto the lance over the head thereof with the quench liquid on ; the lance is then additionally supported at the head when the trailing end of the pipe has cleared the head with the quench liquid on ; the or each intermediate support is displaced to permit passage of the pipe therepast ; the tail coupling is released with the quench liquid off to permit the passage of the pipe therepast ; and the tail coupling and the or each intermediate support is reinstated when the trailing end of the lance has cleared the tail of the lance and the head support is displaced to accommodate the next pipe.



This invention relates to applying quench liquid to pipes, and more particularly to a method of and apparatus for applying quench liquid to pipes including facility for enabling transportation of pipes, e.g. low alloy steel pipes, through a quenching station whereby they may be hardened by cooling them from austenitising temperature (i.e. $> A_3$).

It is known to harden low alloy steel pipes by quenching them from austenitising temperature using internal, or internal and external quenching liquid jets, the internal quench liquid being applied through a stationary lance or feed tube which remains in the bore of the pipe while the entire length of the pipe is passed over the cooling jets with a helical motion. The lance, which extends over a length usually greater than twice the length of the pipe, remains in substantially the same position while the hardened pipe is removed at high speed and another pipe is fed over the quenching jets.

It is an object of this invention to provide an improved method of movement and operation of the quench liquid lance during transportation of pipes thereover such that the pipes may be internally quenched, or internally and externally quenched, with apparatus which occupies little more space than that which is necessary for a conventional "exterior only" quenching unit and which may operate at comparable speeds achieved with such a unit.

This invention provides, according to one aspect, a method of applying quench liquid to pipe comprising transporting pipes sequentially and longitudinally through a quenching station having a tubular lance, a tail end of which is coupled to a liquid source and the other end of which is provided with a head from which the liquid is projected laterally in a series of jets, characterised in that the lance is supported at the tail and at at least one intermediate position along its length whilst the leading end of the pipe passes onto the lance over the head thereof with the quench liquid on; the lance is then additionally supported at the head when the trailing end of the pipe has cleared the head with the quench liquid on; the or each intermediate support is displaced to permit passage of the pipe therepast; the tail coupling is released and displaced with the quench liquid off to permit the passage of the pipe therepast and; the tail coupling and the or each intermediate support is reinstated when the trailing end of the pipe has cleared the tail of the lance and the head support is displaced to accommodate the next pipe.

This invention provides according to another aspect, apparatus for applying quench liquid to pipes comprising a quenching station and means of transporting pipes therethrough sequentially and longitudinally, the quenching station having a tubular lance, a tail end of which is arranged to be connected to a liquid source coupling and the other end of which carries a head from which the quench liquid is projected

laterally, characterised by the provision of a displaceable support at the tail of the lance, at least one displaceable support at an intermediate position along the lance length, and a displaceable support at the head of the lance, together with a control valve associated with the liquid source coupling, and that the liquid source coupling is displaceable; the arrangement being such that in use the lance is supported at the tail and at at least one intermediate position along its length whilst the leading end of a pipe passes onto the lance over the head thereof with the control valve open, the lance is supported at its head when the trailing end of the pipe has cleared the head with the control valve open, and the or each intermediate support is displaced from the lance to permit passage of the pipe therepast, and the tail support and the liquid source coupling is displaced from the lance and the tail coupling released with the control valve closed to permit passage of the pipe therefrom.

Preferably, the pipe is rotated as it progresses, thus describing a helical path.

The quench liquid may be water and as mentioned above, the interior pipe quenching from the lance may be accompanied by exterior quenching at the same station. In this latter mode, the invention provides a means by which an internal cooling facility may be added to an existing external cooling facility without the need for any additional quench water capacity and without any significant increase in the space required to install and operate the equipment.

Should internal cooling only be adopted the invention may be utilised to produce a controlled hardness profile across the pipe wall thickness, with increasing hardness at the bore; alternatively, when used in conjunction with external quenching the invention can be utilised to achieve uniform through wall hardness.

In order that the invention may be more fully understood, one embodiment thereof will now be described, by way of example, with reference to the accompanying drawing (figures 1a-1e) which schematically illustrates the sequence in which the method of this invention is performed.

Referring now to the drawing, in Figure 1a a pipe 2 heated to austenitising temperature is advanced at constant speed in a helical manner by a pipe-conveying apparatus (not shown) and passes over a guide cone 3 mounted in front of a head 4 of a tubular lance 5. The guide cone may be rotatable on the lance with the oncoming pipe. These items may conveniently be in the same form, and operate in the same manner, as those shown in our United Kingdom Patent application 9106924.5.

Adjacent to the head of the lance, an intermediate retractable support arm 6 holds the lance 5 in a position approximating to the axis of the approaching pipe 2. Also supporting the lance 5 at this time is a second intermediate support arm 7 and a rear or tail end sup-

port bracket 8. The lance rear support bracket positions the lance 5 on the same axis as a sealing coupling 9 through which high pressure water is supplied to the lance 5 via control valve 10.

Water is likewise supplied to external quench rings 12. A head support comprising a pair of arms 13, shown in the retracted mode, is sited adjacent these quench rings and immediately behind the guide cone of the lance.

Referring now to Figure 1b, the pipe is shown to have advanced almost completely through the quench head, the intermediate support arms 6 and 7 having been retracted to permit this whilst the pair of head support arms 13 now close into engagement with the head 4 immediately behind the guide cone 3. The purpose of the upper arm at this site is to prevent any tendency for the lance head to lift off the lower arm as the pipe and guide cone 3 rotate, which might otherwise occur.

As the trailing end of the pipe clears the quench head (Figure 1c), valve 10 is closed and the sealing head 9 is disconnected from the lance 5 and retracted into the position shown. The lance 5, since it is now only supported adjacent the head, inclines into the attitude shown and is brought back into axial alignment by the action of intermediate support arms 6 and 7 which resume their former positions as the pipe trailing end moves clear of them.

Figure 1d shows this situation with the pipe now clear of the whole lance which is supported on support arms 6 and 7 and held by the head support 13.

As soon as the sealing coupling/rear support bracket is retracted, the speed at which the pipe 2 is conveyed may be increased so as to increase the rate of operation of the equipment, the delay between processing successive pipes being minimised.

The equipment may now assume its 'ready' position awaiting the advent of the next pipe and this is shown in Figure 1e. In this Figure, the sealing coupling 9 and support bracket 8 have been elevated into alignment, the valve 10 having been opened whereby the interior spray is brought into its operative mode again and the head support arms 13 having been moved to their retracted position.

The external cooling water rings 12, the intermediate support arms 6/7 and the head support arms may all be conveniently fixed to a common framework such that they may all be set to accommodate different pipe diameters by a simple height adjustment through an arrangement of interconnected jacks.

Although the invention has been described with reference to the specific embodiment illustrated it is to be understood that various changes and modification may be introduced without departing from the scope of this invention. For example, the dimensional relationships of the various items of equipment shown, and the pipe itself, are illustrated only by way of example.

Claims

1 A method of applying quench liquid to pipes comprising transporting pipes sequentially and longitudinally through a quenching station having a tubular lance, a tail end of which is coupled to a liquid source and the other end of which is provided with a head from which the liquid is projected laterally in a series of jets characterised in that the lance is supported at the tail and at at least one intermediate position along its length whilst the leading end of the pipe passes onto the lance over the head thereof with the quench liquid on; the lance is then additionally supported at the head when the trailing end of the pipe has cleared the head with the quench liquid on; the or each intermediate support is displaced to permit passage of the pipe therepast; the tail coupling is released with the quench liquid off to permit the passage of the pipe therepast; and the tail coupling and the or each intermediate support are reinstated when the trailing end of the pipe has cleared the tail of the lance and the head support is displaced to accommodate the next pipe.

2 A method as claimed in claim 1 wherein each pipe is rotated as it progresses through the quenching station.

3 A method as claimed in claim 1 or 2 wherein each pipe encounters guide means in advance of the head mounted on the lance as the leading end thereof first passes on to the head of the lance.

4 A method as claimed in any one of the preceding claims including two intermediate supports for the lance, the supports moving in unison into and out of supporting engagement with the lance.

5 A method as claimed in any one of the preceding claims wherein, during the step in the method when the lance head is supported, it is supported both above and below.

6 A method as claimed in any one of the preceding claims wherein the or each and intermediate support is displaced prior to releasing the tail coupling.

7 A method as claimed in any one of the preceding claims wherein liquid is additionally applied to the outsides of the pipes at the quenching station.

8 Apparatus for applying quench liquid to pipes comprising a quenching station and means of transporting pipes therethrough sequentially and longitudinally, the quenching station having a tubular lance, a tail end of which is arranged to be connected to a liquid source coupling and the other end of which carries a head from which the quench liquid is projected laterally, characterised by the provision of a displaceable support at the tail of the lance, at least one displaceable support at an intermediate position along the lance length, and a displaceable support at the head of the lance, together with a control valve associated with the liquid source coupling, and that the liquid source coupling is displaceable; the arrange-

ment being such that in use the lance is supported at the tail and at at least one intermediate position along its length whilst the leading end of a pipe passes onto the lance over the head thereof with the control valve open, the lance is supported at its head when the trailing end of the pipe has cleared the head with the control valve open, and the or each intermediate support is displaced from the lance to permit passage of the pipe therepast, and the tail support and the liquid source coupling is displaced from the lance and the tail coupling released with the control valve closed to permit passage of the pipe therefrom.

9 Apparatus as claimed in claim 8 wherein there are provided two intermediate supports.

10 Apparatus as claimed in claim 8 or 9 wherein the lance is provided with a guide member in advance of the head for guidance, in use, of the lance into the oncoming pipes.

11 Apparatus as claimed in any one of the claims 8 to 10 wherein the head supports include members disposed both above and below the head of the lance.

12 Apparatus as claimed in any one of claims 8 to 11 wherein the length of the lance with respect to the maximum length of pipes being quenched is such that in use the head thereof has completely traversed each pipe significantly prior to release of the tail coupling.

13 Apparatus as claimed in any one of Claims 8 to 12 wherein the displaceable supports and the displaceable coupling are mounted on common support means and adjustment means are provided for jointly varying the displacement thereof to accommodate pipes of varying diameters.

14 Apparatus as claimed in any one of Claims 8 to 13 including means for applying quench liquid to the outsides of pipes passing through the quenching station.

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