

Improvements relating to remote controlled sealing/welding equipment

This invention relates to equipment which is usable inside pipes and pipelines for effecting circumferential operation on the inside of a pipe or pipeline. Such circumferential operation may comprise for example leak sealing, joint routing, welding, drilling or the like.

Various assemblies are known for operating inside pipes and pipelines for the cleaning, joint repair, welding and like operations, but generally speaking such equipment is for use in larger dimension pipelines, e.g. of the order of 2 metres diameter. There is very little equipment however which is suitable for operation inside pipes or pipelines of smaller diameter, for example of the order of 0.3 of a metre, and this invention provides an assembly which is suitable for such application, although it is to be mentioned that the invention is not to be considered as being limited to this application.

Essentially, the invention comprises a servo controlled unit which has an operating head, and the operating head is adapted to be rotated so that a working tool thereof can operate on the inside circumference of the pipe or pipeline along a circumferential segment thereof.

The servo controlled device preferably is constructed essentially in the manner described in our co-pending European Patent Application No. 85103234.2 which comprises a fixed body portion and a movable body portion. The fixed body portion in use will be anchored to the inside of the pipeline, and the movable body portion which is connected to the fixed body

portion in the nature of a boom is also adapted to be rotated about an axis which lies substantially longitudinally relative to the boom.

05 The end of the movable or boom portion may be provided with suitable slip ring connections for an electrical supply, and/or a sealing compound supply, such as a synthetic resin, whereby the head may serve to form a circumferential weld or insert sealing compound
10 circumferentially into a joint.

A hook portion at the end of the boom portion may serve to couple the actuator to a T.V. camera to enable the train of components to be pulled together along the
15 inside of a passageway.

Pneumatic seals may be provided at the respective ends of the train in order to seal off a space in which the boom portion operates, and to enable that space to be
20 flooded with high pressure air. An outlet for the air if provided on the end of the boom portion will enable the effective removal of debris from the region as any circumferential pipe treatment takes place.

25 An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings, wherein:-

Fig. 1 is a sectional elevation showing the train of
30 components inside a pipe in the region of a joint which is being sealed with sealing compound; and

Fig. 2 is an enlarged part sectional view of part of the equipment shown in Fig. 1.

35 In Fig. 1, the apparatus is shown as being in a pipe 10 in the region of a pipe joint 12 formed by a male end



14 of the pipe engaging a female, belled end 16. It is assumed that this joint is leaking and is being repaired by the apparatus illustrated. Starting from the left hand end, the train of apparatus comprises a servo-operated actuator 18 comprising a fixed body portion 20 which in use is securely held in position and sealed to the inside of the pipe by means of an inflatable annular ring 22. A movable boom portion 24 is pivoted to portion 20 as indicated at pivot 26. In fact this pivot is universal in nature and permits the boom portion 24 to swing horizontally and/or vertically.

At the outer end as shown in greater detail in Fig. 2, the boom portion 24 has an operating head 28 which by virtue of a feed screw 30 can be moved out and in as indicated by the arrow 32. The head 28 is also adapted to be rotated about the axis of the body portion 24, and if desired the whole of the portion 24 can be adapted to be rotated about the axis of the portion 20, even whilst it is in a position as shown in Figure 1 in which it is inclined relative to the portion 20, so that the portion 24 will when so rotated sweep out a cone of revolution.

Beyond the head 28 but attached thereto is an assembly 34 comprising slip rings which are indicated by reference numerals 38 and 40 and which are for enabling the supply of sealing compound and/or electricity to the assembly 34 to drive a pump in the head 28, so as to enable the pumping of resin components through pipes 35, 35A into the joint to seal same. The head 28 has an outlet nozzle 43 from which the mixed resin components are discharged in order to seal the joint as boom 24 is rotated.

The second component of the assembly is a TV camera 42 which also is held in position by an inflatable annular ring 44 so that in fact the space between the rings 22 and 44 can be

filled with high pressure air distorting the rings and sealing them against the wall of the pipe 10 and the portion 20 and camera 42, and this creates an air lock from which the only flow is through an exhaust tube 46 which in fact leads from the tow hook 36 and past the ring 44 to provide a dust outlet. In use, therefore, when high pressure air is inserted into the aforesaid space by means for example of the inlet hose 50, the air is forced to return into and through the pipe 46, and a constant removal of air of the vicinity operation takes place. This provides a vacuum effect for removing the dust from the interior of the pipe whereby the camera 42 will be able to watch the operation of the sealing and/or welding without the lens becoming dirty as a result of airborne dust particles.

The operation continues by manipulating the boom portion 24 of the actuator so that the head 28 continues to insert resin and/or effect welding of the circumferential portion of the pipe, and by viewing the operation at ground level using the T.V. camera 42 to send back a picture of the operation to an above ground T.V. monitor.

When the operation has been completed, the boom portion 24 is manipulated until the hook 36 is engaged in a towing eye 51 in a tow bar 52 connected to the TV camera, mechanically coupling the two portions of the system. When the pressure between the rings 22, 44 is removed, the rings relax and the assembly can be moved along and removed from the pipe. The control of the various operations is effected from a remote location, and specifically the actuator comprising the fixed and movable body portions 20, 24 is desirably constructed in the same manner as is the cutter apparatus described in European Patent Application No. 85103234.2.

It will be understood that the pipes for the resin components

and the electrical cables for the driving of the motors (when provided) pass at least one of the rings 22, 44 and that there is also an exhaust pipe 46 which passes one of the rings. These pipes and/or cables should be such that when the rings 22, 44 are distorted under the air pressure, the pipes and/or cables will continue to perform their functions. Thus the pipes should be sufficiently rigid as not to collapse under the pressure from the distorted ring 22 or 44.

An advantage of having the space between the rings 22, 44 under pressure is that the increased pressure will force the resin (or other grouting and/or sealing material) into the joint with greater force than would be the case when no such pressure exists.



CLAIMS

1. A servo controlled unit for locating in a pipe for the working on the inner surface of the pipe, comprising an operating head, means adapted to turn the operating head whereby the head can be made to work around the pipe inner surface circumferentially, characterised by spaced sealing members to opposite sides of the head so that the head is located between the sealing members, and means for pressurising the space inside the pipe and bounded by the sealing members and the inside of the pipe.
2. A unit according to Claim 1, characterised by a vent hose leading from the vicinity of the head to a location outside said space for venting pressurising medium and airborne particles from said space.
3. A unit according to Claim 1 or 2, characterised in that said unit comprises a servo device, a boom, a universal joint connecting the boom and servo device, said head being carried on the end of the boom, and one of said sealing members being an inflatable ring surrounding said servo device.
4. A unit according to Claim 3, characterised in that said unit includes a T.V. camera whose lens is in said space and is directed to view said head, and said second sealing member is an inflatable ring surrounding the T.V. camera.
5. A unit according to Claim 4, characterised in that the T.V. camera has a coupling bracket in said space and the boom has a coupling hook, said boom being manipulable to bring the hook into coupling engagement with the bracket to couple the camera and servo device so that they can be moved along the pipe as a unit.



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6. A unit according to any preceding claim, characterised in that the head is adapted to inject sealing material into a joint in the pipe, and the unit includes hose means for directing sealing material from
05 outside said space, past one of the sealing members, and into the head for the injection of same from the head into the joint.

7. A servo controlled unit substantially as
10 hereinbefore described with reference to the accompanying drawings.

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