May 28, 1935. J. R. McWANE 2,002,701

METHOD OF AND APPARATUS FOR LINING METAL PIPES

Filed May 25, 1933 3 Sheets-Sheet 1

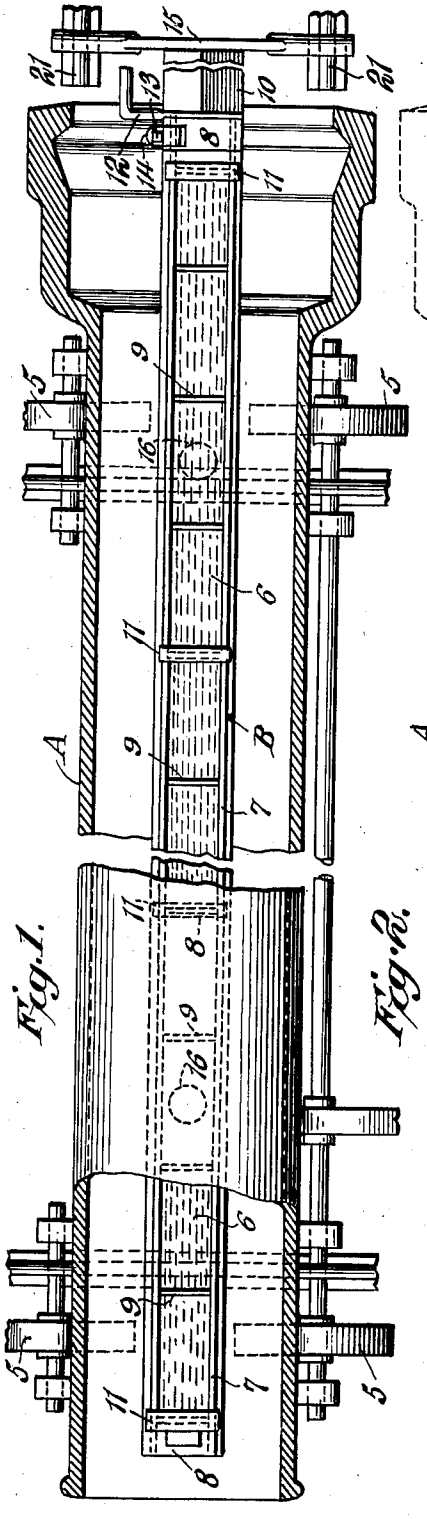


Fig. 1.

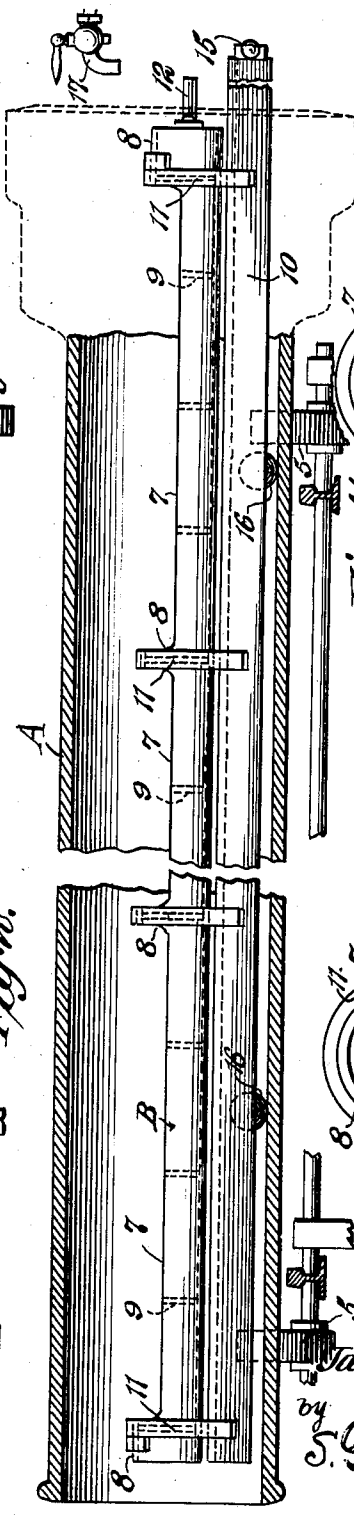


Fig. 2.

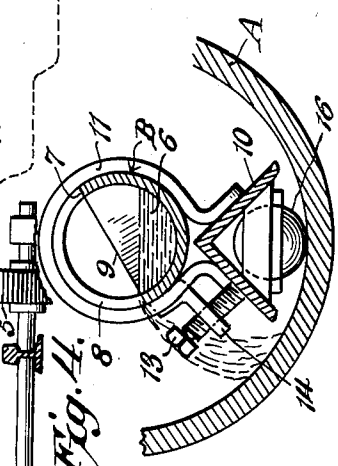


Fig. 4.

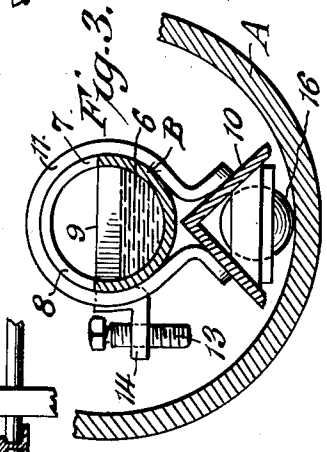


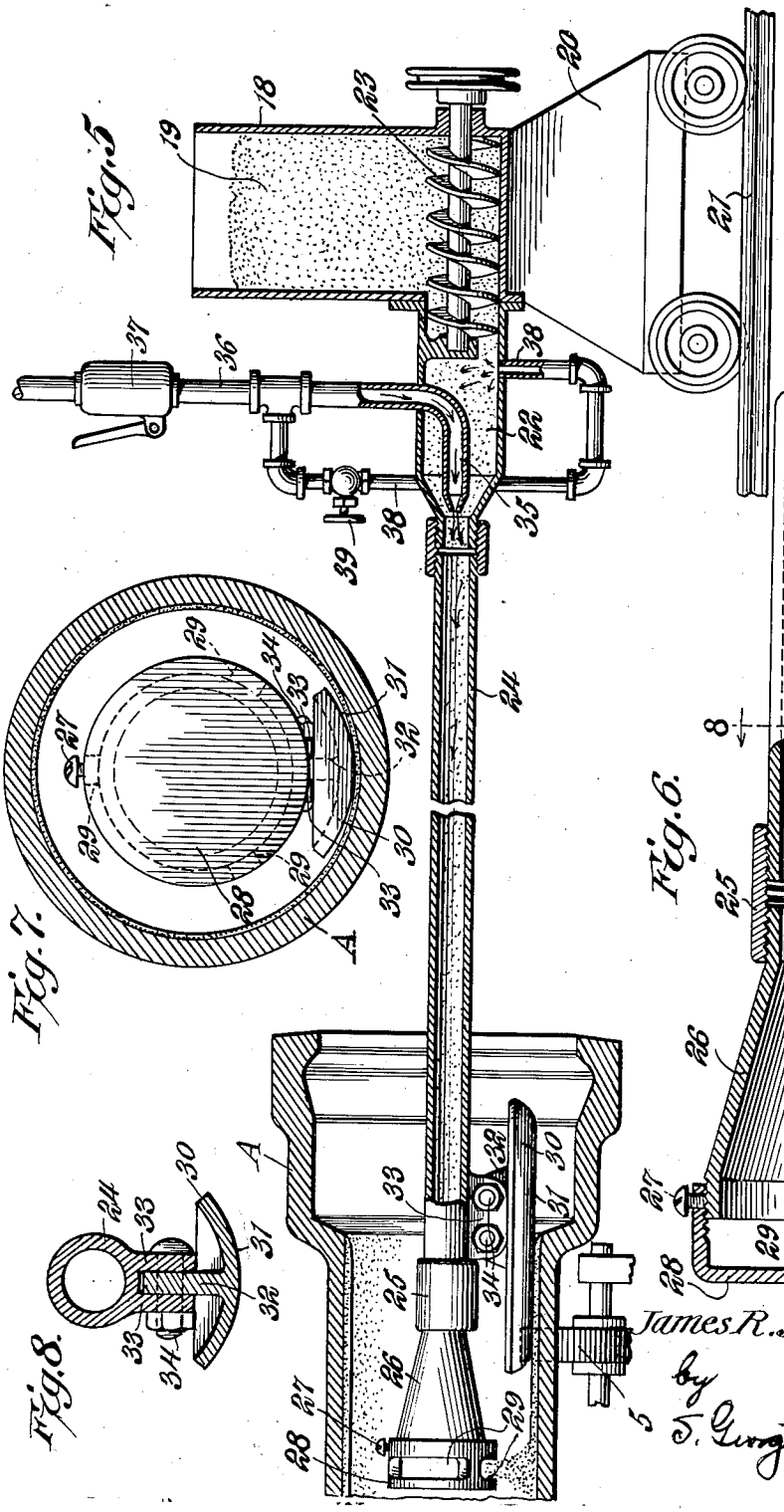
Fig. 3.

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METHOD OF AND APPARATUS FOR LINING METAL PIPES

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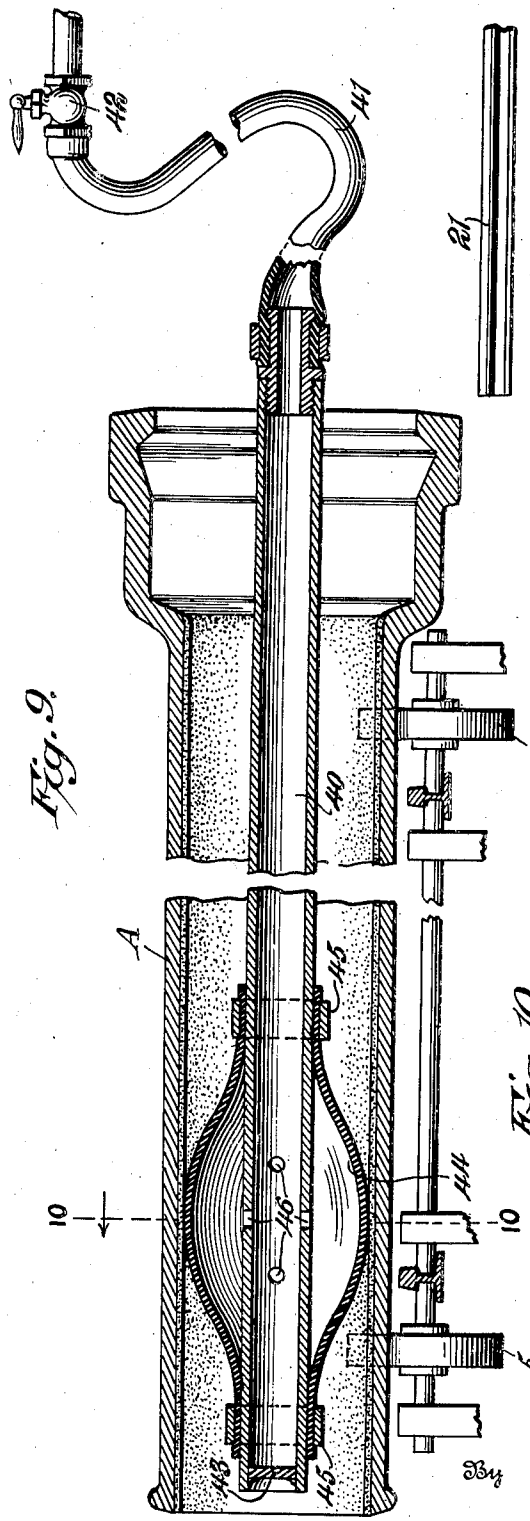


Fig. 9.

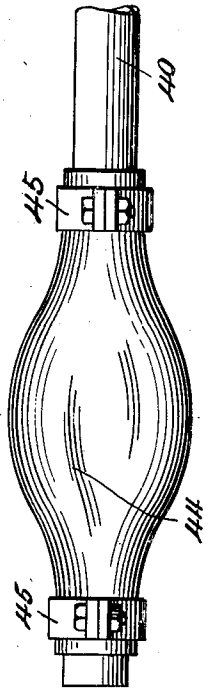


Fig. 11.

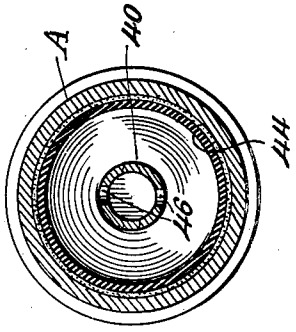


Fig. 10

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UNITED STATES PATENT OFFICE

2,002,701

METHOD OF AND APPARATUS FOR LINING METAL PIPES

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Application May 25, 1933, Serial No. 672,887

17 Claims. (Cl. 25—38)

This invention relates to new and useful improvements in the method of and in the apparatus for lining metal pipes with plastic material, such as for instance, a mixture of sand and cement.

Among the several objects of my invention are to provide a method of applying a cement lining to metal pipes whereby the lining will be easily applied, and to provide novel means for carrying out the several steps of the method.

With these and other objects in view which will more fully appear, the nature of the invention will be more clearly understood by following the description, the appended claims, and the several views illustrated in the accompanying drawings.

In the drawings:—

Figure 1 is a horizontal longitudinal sectional view showing the means for rotating the pipe and simultaneously applying water to the inner surface thereof,

Figure 2 is a vertical longitudinal sectional view thereof,

Figure 3 is an enlarged cross sectional view through the pipe and watering trough, the latter being shown in its normal position,

Figure 4 is an enlarged cross sectional view through the watering trough, the latter being shown tilted to determine the amount of water to be deposited in the pipe,

Figure 5 is a vertical longitudinal sectional view showing the means for blowing a dry mixture of cement and sand against the wet inner surface of the pipe while the latter is being rotated to form a lining for said pipe,

Figure 6 is an enlarged view, partly in section, of the nozzle shown in Figure 5,

Figure 7 is an enlarged cross-sectional view through the pipe and showing the nozzle in end elevation,

Figure 8 is a detail cross-sectional view taken on the line 8—8 of Figure 6,

Figure 9 is a vertical longitudinal sectional view showing the means for smoothing the cementitious lining of the pipe while the latter is being rotated and while the lining is moist,

Figure 10 is a cross-sectional view taken on the line 10—10 of Figure 9, and

Figure 11 is a side elevation of the expansible smoothing head.

Like reference numerals designate corresponding parts throughout the several figures of the drawings.

As previously stated my invention is directed to the method of applying a cementitious lining to the inner surface of a metal pipe, and in the means for carrying out the various steps in this method. The method in its specific aspect consists in constantly rotating the metal pipe about its longitudinal axis, then while the pipe is being rotated applying water or other suitable liquid to the inner surface thereof so as to properly moisten the same, then while the pipe is being rotated blowing a dry mixture of cement and sand or other liquid-absorbent material against the liquid coated inner surface of the pipe to form a resultant lining for the latter, and finally smoothing the surface of the lining while the latter is moist. Referring particularly to Figures 1 to 4, I have shown a metal pipe A which is supported and rotated constantly about its longitudinal axis by means of rolls 5. A water trough B is first manually positioned longitudinally within the pipe, the trough containing water or other suitable liquid 6. This trough is preferably formed from a length of pipe and has its upper portion cut away to form resultant open top portions 7 and intermediate semi-circular bridge portions 8, the ends of the trough B are suitably closed and positioned in the trough at spaced intervals is a series of baffle plates 9. This trough is supported by a carriage 10 of angle iron construction through the medium of loops 11 which surround the bridge portions 8 and have their free ends rigidly connected with the carriage, the loops being of a size to permit the trough to be oscillated about its longitudinal axis and thereby permit the water or other liquid 6 flowing outwardly through the open top 7 when the trough is tilted, as shown in Figure 4. In order to oscillate the trough, a handle 12 is attached to one end thereof. The amount of oscillation which may be imparted to the trough in one direction may be regulated by an adjusting screw 13 which is mounted in a lug 14 fixed to the trough whereby said screw may be adjustably engaged with the carriage 10. The operator may hold the carriage 10 against movement by use of the handle 15. In order to facilitate the insertion and removal of the trough B and also to assist in preventing the trough from being carried around by the pipe during the rotation of the latter, the carriage 10 is provided with two or more anti-friction balls 16 which are spaced apart and have rolling engagement on the inner surface of the pipe. Located in close proximity to the point of work is a spigot 17 which is attached to the free end of a pipe (not shown) leading from a source of water supply whereby the trough B may be replenished with water when desired. In the operation as thus far described, the pipe A is first brought to the working point

and is then rotated. The operator fills the trough B with water from the spigot 17, then rotates the trough counter clockwise the limited distance permitted by the adjustment of the screw stop 13 in order to limit the amount of water to be later deposited in the pipe, and then manually inserts the trough longitudinally within the pipe, the insertion being assisted by the anti-friction balls 16 riding along the inner surface of the pipe. The operator then holds the handle 15 of the carriage 10 and by means of the handle 12 oscillates the trough B in a clockwise direction whereby the water or other liquid 6 is caused to flow outwardly from the trough and onto the inner surface of the pipe which is being constantly rotated. By this means the entire inner surface of the pipe is coated with water or other liquid, and the amount of water thus deposited may be readily governed by adjusting the stop screw 13 as will be understood.

The trough B is then withdrawn properly to enable carrying out the next step in my invention. The next step of my invention consists in blowing a dry mixture of cement and sand or other cementitious material radially against the moist inner surface of the pipe. To this end, I have provided a hopper 18 for containing a supply of mixed sand and cement 19 or the like and have mounted this hopper on a truck 20 which in turn is movable along rails 21 toward and from the pipe A and in a path in alinement with the longitudinal axis of said pipe. Projecting laterally from the bottom of the hopper 18 is a mixing chamber 22 and a power operated conveyor screw 23, which is located in the bottom of the hopper 18, functions to feed the material 19 into the mixing chamber 22. A conveyor pipe 24 extends from the end of the mixing chamber 22 opposite the feed screw 23 and is adapted to be projected axially within the pipe A. Attached to the projecting end of the pipe 24 by a coupling 25 is a flared discharge nozzle 26. Threaded onto the outer end of the nozzle 26 and retained against relative movements therewith by a set screw 27 is a head 28 having a plurality of radially extending openings 29. In order to support the nozzle in spaced relation to the inner surface of the pipe A, I have provided a shoe 30 having its lower surface 31 transversely curved as shown in Figures 7 and 8 particularly. This shoe is provided with an integral upstanding wing 32 which fits between depending ears 33, 33 and is secured thereto by bolts 34. Disposed within the mixing chamber 22 is an ejector nozzle 35 which is connected by a pipe 36 to a source of compressed air. Located in the pipe 36 for controlling the passage of air to the nozzle 35 is a hand valve 37. A by-pass 38 has one end connected to the pipe 36 at a point between the nozzle 35 and the valve 37 and has its other end connected to the mixing chamber 22. The end of the by-pass 38 is connected to the mixing chamber 22 between the discharge end of the nozzle 35 and the feed screw 23. Disposed in the by-pass 38 is a hand controlled valve 39 for regulating the amount of air which passes through this by-pass into the mixing chamber in rear of the nozzle 35.

As thus far described, it will be apparent that after the inner surface of the pipe A has been thoroughly moistened by coating the entire surface with water, the watering trough B is withdrawn. The truck 20 is then moved along the rail 21 and the nozzle 26 is projected longitudinally within the pipe A, the shoe 30 supporting the nozzle in spaced relation to the inner surface of the pipe. The dry material 19 which consists preferably of a mixture of cement and sand, is then fed by the screw 23 into the mixing chamber 22. The material within this mixing chamber is then agitated and will be mixed by air entering said chamber through the by-pass 38. This dry material is then fed into the pipe 24 by means of the air blast issuing from the ejector nozzle 35. The mixture is then conducted along the pipe 24 and ejected radially from the nozzle 26 against the inner moist surface of the pipe A. This dry mixture absorbs the moisture and in this manner adheres to the inner surface of the pipe. The shoe 30 which supports the nozzle rides on the moist lining as shown particularly in Figure 5, and after the lining has thus been applied to the pipe the nozzle is withdrawn therefrom.

After the lining has been applied to the inner surface of the pipe as immediately above described, I then smooth the surface of the lining while the latter is moist and while the pipe is being rotated. To this end, I provide a smoothing device as shown in Figures 9, 10 and 11 and which is adapted to be inserted longitudinally within the pipe. This device comprises a tube 40 which is connected at one end by a flexible hose 41 to a source of compressed air, a valve 42 being positioned in the line to control the amount of air passing therethrough. The opposite end of the tube 40 is sealed by a plug 43 and an expansible and contractible tubular head 44 surrounds the tube 40 and has its spaced ends sealed around the tube by means of clamps 45, 45. The tube 40 between the clamps 45, 45 is formed with a plurality of openings 46 by means of which air may pass outwardly from the tube 40 into the flexible head 44 and thereby expand the latter. In operation the headed end of the tube 40 is inserted longitudinally within the rotating pipe A and the valve 42 is then opened. This permits compressed air to expand the head 44 against the surface of the moist lining. Then while the tube is being rotated the smoothing device is moved back and forth longitudinally of the pipe and as a result the surface of the lining is smoothed throughout the length of the pipe. The valve 42 is then closed and the device is withdrawn from the pipe.

From the foregoing, it will be observed that I have provided a method of lining the inner surfaces of pipes with a cementitionus material and that this method consists in first moistening the entire inner surface of the pipe by applying water thereto while the pipe is being rotated about its longitudinal axis; secondly, in blowing a dry cementitious material against the moistened surface of the pipe while the latter is being rotated; and thirdly, to smooth the lining of the pipe while the former is still moist and while the latter is being rotated about its longitudinal axis. It will also be observed that I have provided devices for carrying out the various steps of the method herein described.

I claim:—

1. The method of lining pipes, consisting in rotating the pipe about its longitudinal axis, then while the pipe is being rotated coating the whole of the interior surface of the pipe with a liquid, and then while the pipe is being thus rotated applying a liquid-absorbent material to said liquid coated interior surface to form a resultant lining to said pipe.

2. The method of lining pipes, consisting in rotating the pipe about its longitudinal axis, then while the pipe is being rotated coating the whole

of the interior surface of the pipe with a liquid, and then while the pipe is being thus rotated applying a liquid-absorbent material to said liquid coated interior surface to form a resultant lining to said pipe, and finally smoothing the lining material while the latter is moist and while the pipe is being rotated.

3. The combination with a metal pipe; of means for supporting and rotating the pipe about its longitudinal axis; and means operable during the rotation of the pipe for coating the inner surface of said pipe with a liquid, said coating means comprising a carriage movable longitudinally within the pipe, a liquid-containing trough having an open top and mounted on the carriage for oscillatory movements, and anti-friction balls mounted on the bottom of the carriage for rolling contact with the pipe.

4. The combination with a metal pipe; of means for supporting and rotating the pipe about its longitudinal axis; and means operable during the rotation of the pipe for coating the inner surface of said pipe with a liquid, said coating means comprising a carriage movable longitudinally within the pipe, a liquid-containing trough having an open top and mounted on the carriage for oscillatory movements, and means cooperating between the trough and the carriage to adjustably limit the oscillatory movement of the trough.

5. Means for lining metal pipes including a carriage movable longitudinally within the pipe, a liquid-containing trough having an open top and mounted on the carriage for oscillatory movements, and anti-friction balls mounted on the bottom of the carriage for rolling contact with the pipe.

6. The combination with a metal pipe; of means for supporting and rotating the pipe about its longitudinal axis; and means operable during the rotation of the pipe for coating the inner surface of said pipe with a liquid, said coating means comprising a carriage movable longitudinally within the pipe, a liquid-containing trough having an open top and mounted on the carriage for oscillatory movements, and handles respectively secured to the operating ends of the carriage and trough whereby the operator may hold the carriage with one hand and oscillate the trough with the other.

7. The combination with a metal pipe; of means for rotating the pipe about its longitudinal axis; means for coating the whole of the inner surface of the rotating pipe with a liquid; and means operable while the latter is being rotated for blowing a dry cementitious material against the liquid coated inner surface of the pipe to form a lining for the latter.

8. The combination with a metal pipe; of means for rotating the pipe about its longitudinal axis; means for coating the whole of the inner surface of the rotating pipe with a liquid; and means operable while the latter is being rotated for blowing a dry cementitious material against the liquid coated inner surface of the pipe to form a lining for the latter, said material blowing means including a discharge nozzle movable longitudinally within the pipe, and a supporting shoe connected to the nozzle and having a transversely curved lower bearing surface.

9. Means for lining metal pipes including a nozzle movable longitudinally within the pipe and connected to a supply of dry cementitious material, pneumatic means for blowing the material outwardly through the nozzle, and a supporting shoe connected to the nozzle and having a transversely curved lower bearing surface.

10. In apparatus for applying and smoothing moist cementitious linings in pipes, means movable longitudinally within the pipe for smoothing said lining and comprising a device having an expansible and contractible head.

11. Means for smoothing the moist cementitious lining of metal pipes comprising a tube having one end adapted to be connected at one end to a source of fluid under pressure and having its other end closed, said tube having perforations adjacent its closed end, and a tubular smoothing head formed of expansible material disposed around the tube and having its ends clamped to the tube on opposite sides of the perforations.

12. In apparatus for applying and smoothing moist cementitious linings in pipes, means for rotating the pipe about its longitudinal axis, and means movable longitudinally within the pipe while the latter is being rotated for smoothing said lining and comprising a device having an expansible and contractible head.

13. The combination with a metal pipe, of means for rotating the pipe about its longitudinal axis, means for applying a liquid to the whole of the inner surface of the pipe while the latter is being rotated, and means for applying a dry cementitious material to the liquid coated surface of the pipe to form a lining therefor while the pipe is being rotated.

14. The combination with a metal pipe, of means for rotating the pipe about its longitudinal axis, means for applying a liquid to the inner surface of the pipe while the latter is being rotated, means for applying a dry cementitious material to the liquid coated surface of the pipe to form a lining therefor while the pipe is being rotated, and means for smoothing the moistened lining while the pipe is being rotated.

15. The method of lining pipes, consisting in rotating the pipe about its longitudinal axis, depositing in the pipe while rotating a predetermined amount of liquid sufficient to wet the entire interior of the pipe, and applying to the wet pipe interior a coating of dry cementitious material.

16. The method of lining pipes, consisting in rotating the pipe about its longitudinal axis, depositing in the pipe while rotating and simultaneously throughout the length of the pipe a predetermined amount of liquid sufficient to wet the entire interior of the pipe, and applying to the wet pipe interior a coating of dry cementitious material.

17. The method of lining pipes, consisting in rotating the pipe about its longitudinal axis, depositing in the pipe while rotating a predetermined amount of liquid sufficient to wet the entire interior of the pipe, and applying to the wet pipe interior a coating of dry cementitious material thereby forming a temporarily plastic lining, and finally smoothing the lining by pressure contact during continued rotation of the pipe.

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