

SPECIFICATION

Method of and apparatus for supplying binding material

This invention relates to a method of and an apparatus for supplying binding material particularly into cracks and the like in a concrete building or other concrete constructions.

The repair of a concrete building impaired with cracks is usually carried out by filling the cracks with putties or supplying the cracks with binding material.

A method of repairing cracked buildings by supplying binding materials into the cracks has been recently proposed (see Japanese Patent No. 251791) whereby pipes are fixed at spaced intervals to the cracks. The spaces in the cracks between the pipes are sealed with a sealing material and a pump is connected to each pipe. When the sealing material has hardened the pumps are used to supply a binding material into the cracks.

However, the above method suffers from some drawbacks in operation. Increase in the rate at which a building material is supplied into the cracks, for example, will cause an increase in the pressure exerted on the cracks due to the viscosity of the binding material and could result in the sealed portions being ruptured or the cracks widened. Hence, it has been necessary to spend as much as about 3 to 5 minutes in supplying the binding material using a pipe and skilled persons were required for operation.

According to one aspect of the invention, there is provided a method of supplying binder material into binder receiving portions, in which binder supply pressure exerted on the binder receiving portions is buffered by an increase in capacity of a pressure buffering portion located between a supply pipe and a supply hose, and the binder reserved in the pressure buffering portion is supplied to the binder receiving portions by a reduction in capacity of the pressure buffering portion.

According to a further aspect of the invention, there is provided apparatus for supplying binder material into binder receiving portions, comprising a supply pressure buffering portion between a supply pipe and a supply hose, said supply pressure buffering portion being such that it is able to increase its capacity to buffer supply pressure exerted on the binder receiving portions and is able to reduce its capacity to force out binder reserved in itself toward the binder receiving portions.

The invention will now be more particularly described by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a view showing one embodiment of apparatus according to the invention fixed to a crack impaired concrete structure;

Figure 2 is a side view of the apparatus of Figure 1;

Figure 3 is a detailed perspective view of the apparatus of Figures 1 and 2;

Figure 4 is a detailed perspective view of showing a modified version of the apparatus of Figures 1—3;

Figure 5 is a side view of the apparatus of Figures 1—3 at a stage of operation;

Figure 6 is a side view of a further embodiment of apparatus according to the invention fixed in a crack impaired concrete structure; and

Figure 7 is a longitudinal sectional view of yet a further embodiment of apparatus according to the invention.

Referring to the drawings, Figure 1 shows binder supplying apparatuses 8 fixed with a sealing material as shown by Figure 2, to cracks A on the underside, for example, of a floor of a concrete bridge, with spaces of about 20 cm one from another. The spaces between apparatuses 8 in the cracks are sealed with a sealing material.

In the embodiments of the binder supplying apparatus illustrated in Figures 2—5, supply pipes 1 and 2 are connected by a pressure buffering portion 3. A washer 6 is provided at the vicinity of the free end of pipe 1.

In Figures 2 and 3, a rubber tube 5 is provided at the free end of pipe 2 for facilitating the connection of a supply hose (not shown) to pipe 2. Fasteners in the form of clamps 4 (Figure 3) serve to secure the connection of pressure buffering portion 3 with pipes 1 and 2. In the embodiment shown in Figure 3, pipes 1 and 2 are connected to pressure buffering portion 3 such that each end portion of pressure buffering portion 3 surrounds an end portion of a respective pipe 1, 2 while in the embodiment shown in Figure 4, each end portion of pressure buffering portion is surrounded by an end portion of a respective pipe 1, 2. Pipes 1 and 2 are made of the same material, either of metal or plastics material. Pressure buffering portion 3 is a tube made of resilient material, such as a rubber.

Figure 6 illustrates another embodiment of the binder supplying apparatus, in which a pressure buffering portion comprises a housing 13 which is integrally connected to pipe 1 through duct 31 and which has therein a partition plate 32 which is sealingly reciprocable in housing 13, and a spring 34 which is located between partition plate 32 and a wall 3 remote from duct 31. The spring 34 biases the partition plate 32 against the pressure of the binding material supplied. Pipe 1 may be provided with washer 6 and, pipe 2 with a rubber pipe 5 if necessary.

Figure 7 shows another embodiment of the binder supplying apparatus, in which, washer 6 is integrally formed at an end of pipe 1. The other end of pipe 1 is provided with a thread 1'. A hollow coupler 12 provided with an internal thread 12' and an external thread 12" connects pipe 1 and pressure buffering portion 3 such that coupler 12 is screwed onto pipe 1, engaging thread 12' of coupler 12 with thread 1' of pipe 1 while the free end of coupler 12 is inserted into an end portion of pressure buffering portion 3. The fastening of pipe 1 to pressure buffering portion 3 is secured by screwing a hollow fixing member 11 having an

internal thread 11' onto coupler 12, engaging thread 11' of fixing member 11 with thread 12" of connecting means 12. Pressure buffering portion 3 and pipe 2 are connected by a hollow coupler

- 5 23 provided with an external thread 23'. The coupler 23 is inserted into the other end portion of pressure buffering portion 3 while an adaptor 21 having an internal thread 21' and integrally formed at an end of pipe 2 is screwed onto
- 10 coupler 23, engaging thread 21' of adaptor 21 with thread 23' of coupler 23. The fastening of pressure buffering portion 3 to pipe 2 is secured by screwing a hollow fixing member 22 provided with an internal thread 22' onto coupler 23,
- 15 engaging thread 22' of fixing member 22 with thread 23' of coupler 23. A check valve 7 is provided to prevent the binding material supplied from flowing backwards.

- 20 The binder supplying apparatus may be fixed at cracks and the like with the aid of a washer but alternatively may be fixed without a washer.

- With the binder supplying apparatus as shown in Figures 3 or 4 applied to cracks A of a concrete building or construction in a manner as shown by
- 25 Figure 1, and rubber tube 5 is connected to a binder supply pump (not shown) through a supply hose and a binding material such as *inter alia*, epoxy resin, unsaturated polyester resin, is supplied into cracks A. The binding material, while
- 30 being pressed into cracks A, also fills rubber tube 3. When the pressure in cracks A rises to a certain level, rubber tube 3 increases in volume to buffer the pressure in cracks A. Upon supplying an adequate amount of binding material either tube 3
- 35 or tube 5 is closed at its end portion nearer the pump (see Figure 6), and the supply hose is detached from the apparatus to be connected to another binder supplying apparatus and thus the operation proceeds. Even after the pump has been
- 40 disconnected from the binder supplying apparatus, the binder supplying operation is continued as rubber tube 3 presses the binding material deep into cracks A by its continuous contraction until the binding material gels to finally lose its fluidity.

- 45 Thus, the time required for binder supplying operation using binder supplying apparatus as described is greatly reduced owing to rubber tube 3 which buffers the supply pressure and also continues the binder supplying operation by its
- 50 contraction.

- The embodiment of the binder supplying apparatus shown in Figure 6 has, as previously described, the housing 13 as the pressure buffering portion. A binder material, while being
- 55 pressed into cracks A, fills housing 13, causing it to increase its capacity, i.e. when the pressure exerted to cracks A rises to a certain level, the binding material pushes partition plate 32 against the spring 34. The pressure in cracks A is thereby
- 60 buffered. When an adequate amount of the building material has been supplied through a binder supplying apparatus, rubber tube 5, for example, is closed as in the case of the embodiments previously mentioned, by its end
- 65 portion nearer the pump and the binder supplying

operation is continued succeeded by partition plate 32 which, urged by spring 34, forces the binding material deep into cracks A.

- It is thus possible to supply a binding material
- 70 into cracks and the like of buildings or constructions made of concrete without rupturing the sealed portions or widening the cracks by increasing the supply rate, owing to the supply pressure buffering function performed by the
- 75 pressure buffering portion.

- It is also thus possible to fully supply the cracks with a binding material as the binding material reserved in the pressure buffering portion is continuously forced into the cracks by the
- 80 reduction in capacity of the pressure buffering portion.

Hence, the time required for a binder supplying operation is considerably reduced.

- Further, the supply pump can be selected from
- 85 a wide variation of pumps such as, *inter alia*, plunger pumps, gear pumps. The pulsations of the binding material supplied from a pump of plunger type can be buffered.

- The present invention, in addition to its
- 90 application to reparation of concrete buildings or other concrete constructions impaired with cracks, may be used in various ways such as *inter alia*, for sticking a steel plate onto a construction for reinforcement or filling openings of a building with
- 95 fillers so long as the buildings or constructions are made of concrete.

CLAIMS

1. A method of supplying binder material into binder receiving portions, in which binder supply
- 100 pressure exerted on the binder receiving portions is buffered by an increase in capacity of a pressure buffering portion located between a supply pipe and a supply hose, and binder reserved in the pressure buffering portion is supplied to the binder
- 105 receiving portions by a reduction in capacity of the pressure buffering portion.

2. The method set forth in claim 1, wherein the pressure buffering portion is a resilient tube.

3. The method set forth in claim 1 or claim 2,
- 110 wherein the supply pipe and the pressure buffering portion are connected together such that an end portion of the supply pipe is inserted into an end portion of the pressure buffering portion.

4. The method set forth in claim 1 or claim 2,
- 115 wherein the supply pipe and the pressure buffering portion are connected together such that an end portion of the pressure buffering portion is inserted into an end portion of the supply pipe.

5. The method set forth in claim 1, wherein the pressure buffering portion comprises a housing
- 120 having a spring to adjust its capacity.

6. The method set forth in claim 2, wherein the resilient tube and the supply pipe are connected together by a connecting member.

7. The method set forth in any one of the preceding claims, wherein a check valve is
- 125 provided to prevent the binder supplied from flowing backwards.

8. Apparatus for supplying binder material into



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- 30 or tube 5 is closed at its end portion nearer the pump (see Figure 6), and the supply hose is detached from the apparatus to be connected to another binder supplying apparatus and thus the operation proceeds. Even after the pump has been disconnected from the binder supplying apparatus,
- 40 the binder supplying operation is continued as rubber tube 3 presses the binding material deep into cracks A by its continuous contraction until the binding material gels to finally lose its fluidity.

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Hence, the time required for a binder supplying operation is considerably reduced.

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- 85 a wide variation of pumps such as, *inter alia*, plunger pumps, gear pumps. The pulsations of the binding material supplied from a pump of plunger type can be buffered.

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- 90 application to reparation of concrete buildings or other concrete constructions impaired with cracks, may be used in various ways such as *inter alia*, for sticking a steel plate onto a construction for reinforcement or filling openings of a building with fillers so long as the buildings or constructions are made of concrete.

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2. The method set forth in claim 1, wherein the pressure buffering portion is a resilient tube.

3. The method set forth in claim 1 or claim 2,
- 110 wherein the supply pipe and the pressure buffering portion are connected together such that an end portion of the supply pipe is inserted into an end portion of the pressure buffering portion.

4. The method set forth in claim 1 or claim 2,
- 115 wherein the supply pipe and the pressure buffering portion are connected together such that an end portion of the pressure buffering portion is inserted into an end portion of the supply pipe.

5. The method set forth in claim 1, wherein the pressure buffering portion comprises a housing having a spring to adjust its capacity.

6. The method set forth in claim 2, wherein the resilient tube and the supply pipe are connected together by a connecting member.

7. The method set forth in any one of the preceding claims, wherein a check valve is provided to prevent the binder supplied from flowing backwards.

8. Apparatus for supplying binder material into

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binder receiving portions, comprising a supply pressure buffering portion between a supply pipe and a supply hose, said supply pressure buffering portion being such that it is able to increase its capacity to buffer supply pressure exerted on the binder receiving portions and is able to reduce its capacity to force out binder reserved in itself toward the binder receiving portions.

9. The apparatus set forth in claim 8, wherein the supply pressure buffering portion is a resilient tube.

10. The apparatus set forth in claim 8 or claim 9, wherein the supply pipe and the pressure buffering portion are connected together such that an end portion of the supply pipe is inserted into an end portion of the pressure buffering portion.

11. The apparatus set forth in claim 8 or claim 9, wherein the supply pipe and the pressure buffering portion are connected together such that an end portion of the pressure buffering portion is

inserted into an end portion of the supply pipe.

12. The apparatus set forth in claim 8, wherein the supply pressure buffering portion comprises a housing having a spring to adjust its capacity.

13. The apparatus set forth in claim 9, wherein the resilient tube and the supply pipe are connected together by a connecting member.

14. The apparatus set forth in any one of claims 8—13, wherein a check valve is provided to prevent the binder supplied from flowing backwards.

15. A method of supplying binder material into binder receiving portions, as set forth in claim 1 and substantially as hereinbefore described.

16. Apparatus for supplying binder material into binder receiving portions, substantially as hereinbefore described with reference to any one of the embodiments shown in the accompanying drawings.

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