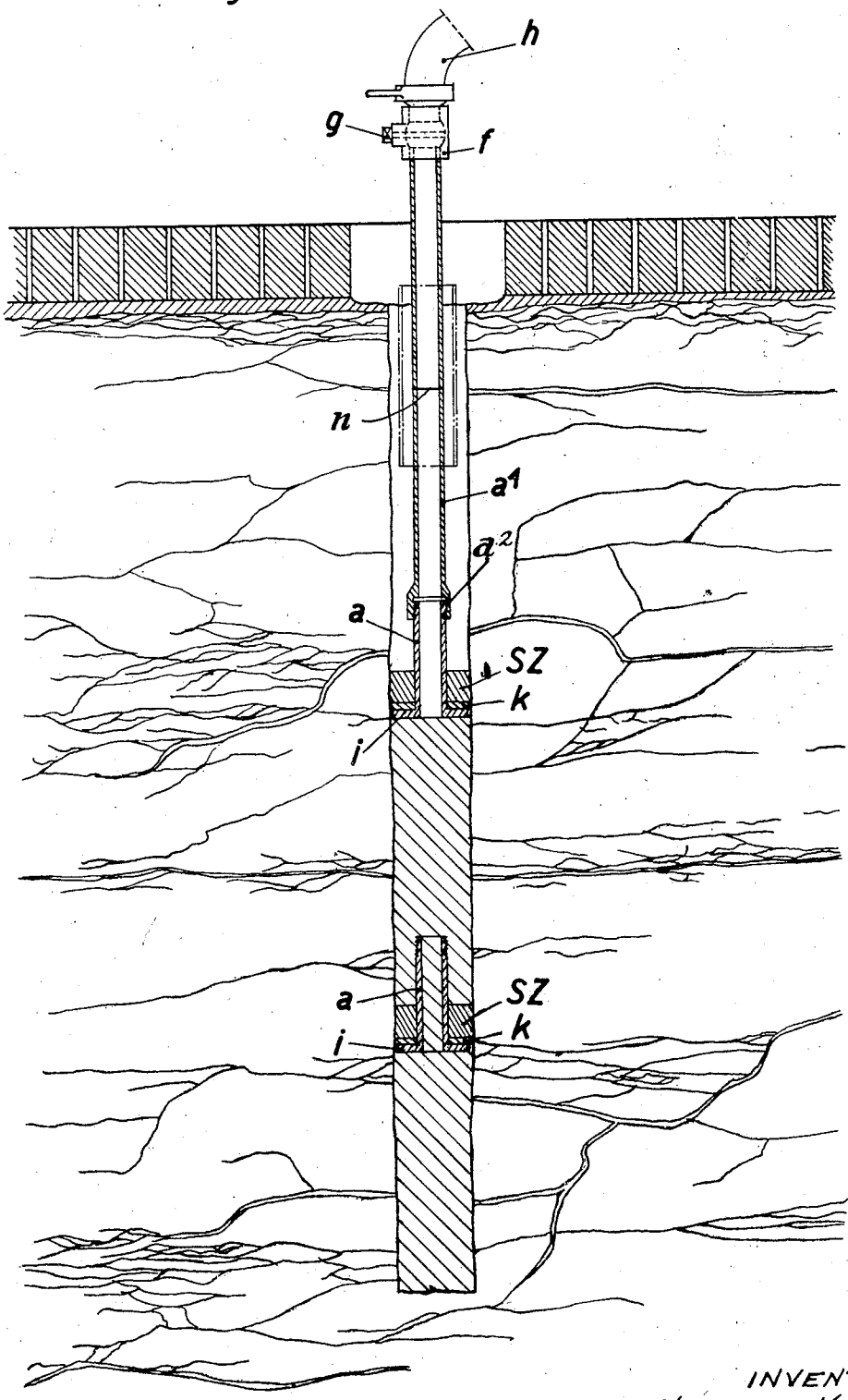
Jan. 15, 1935. W. KLIE 1,987,958

METHOD AND MEANS FOR FILLING IN CONCRETE, ROCKS, AND THE LIKE

Original Filed Feb. 16, 1932 2 Sheets-Sheet 1

Fig. 1



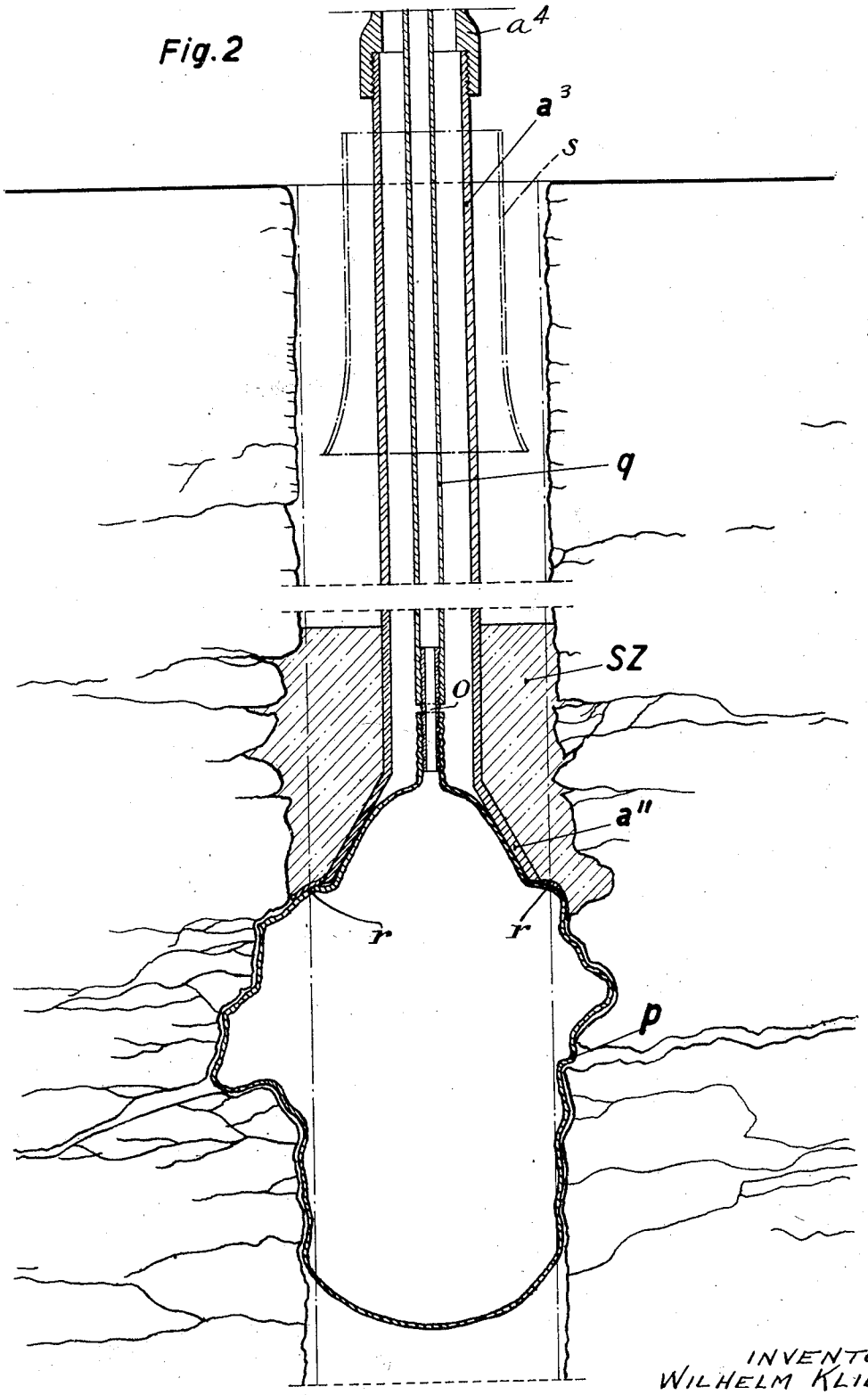
INVENTOR
WILHELM KLIE
BY Richards & Geier
ATTORNEYS

Jan. 15, 1935. W. KLIE 1,987,958

METHOD AND MEANS FOR FILLING IN CONCRETE, ROCKS, AND THE LIKE

Original Filed Feb. 16, 1932 2 Sheets-Sheet 2

Fig. 2



INVENTOR
WILHELM KLIE
BY Richards & Geier
ATTORNEYS

Patented Jan. 15, 1935 1,987,958

UNITED STATES PATENT OFFICE

1,987,958

METHOD AND MEANS FOR FILLING IN CONCRETE, ROCKS, AND THE LIKE

Wilhelm Klie, Kiel, Germany, assignor to Deutsche Werke Kiel Aktiengesellschaft, Kiel, Germany, a corporation of Germany

Original application February 16, 1932, Serial No. 593,257. Divided and this application March 6, 1934, Serial No. 714,260. In Germany January 21, 1930

4 Claims. (Cl. 61—36)

This invention relates to a method and means for filling cracks in concrete, rocks and the like and is a division of my co-pending application, Ser. No. 593,257, filed February 16, 1932.

The present invention is more particularly concerned with a method and means for inserting a filling material or a plugging material into cracks and cavities, which have been formed in concrete, rocks and the like.

Experience has shown that structures made of concrete often crack after a certain time, so that cavities are formed in the concrete. It has been observed that those portions of the concrete, which are nearest to the surface, usually have more cracks than the lower portions. In some cases a part of the concrete may disintegrate completely and form loosely interconnected layers.

If a structure has been erected on top of a concrete foundation, the concrete underneath the structure may become soft and rotten while the structure is still preserved in a good condition.

In mines, tunnels and similar underground structures which contain a concrete foundation, underground water, such as sea water, may come in contact with the concrete and cause the formation of cracks and cavities therein.

In all the above-mentioned and similar cases it is necessary to insert under pressure a so-called filling or plugging material such as cement, certain chemicals and the like, into the cracks or cavities to prevent a disaster which might occur if the disintegration is allowed to develop any further. The same procedure is used to prevent water from overflowing a mine, when this water is found in the rock or coal and ore strata in the course of the construction of a mine or tunnel.

In prior art, it was customary to drive an iron pipe or an iron tube through a conical wood stopper and then to drive this pipe together with the stopper into a bore hole, which was drilled in the concrete as far as the cavities and cracks, which were to be filled in, the stopper acting as a closing member at the outer end of the bore hole.

Due to the fact that the pipe does not fit the bore hole tightly, the filling material often penetrates into the space between the bore hole and the pipe and raises the upper layers of the concrete structure with respect to its lower layers, before the cavities or cracks formed in these lower layers are filled in.

Attempts were made to prevent this deformation of the upper layers of a concrete structure by placing heavy weights around the bore hole. This procedure is ineffective in most cases and it is always very expensive and inconvenient.

It should be noted that chemical fillers must be inserted into the bore hole under a very high pressure and the damaging effects of this high pressure cannot be offset by placing weights around the bore hole.

An object of the present invention is the provision of a new and effective method of inserting a filling or plugging material into the cavities and cracks of a concrete structure or rock.

Another object is the provision of a method of filling cracks which is particularly applicable to bore holes having very irregular walls.

The above and other objects of this invention may be realized through the use of a pressure pipe which is sealed with respect to the bore hole by means of a liquid sealing material introduced, from the top of the bore hole, into the space between the pressure pipe and the bore hole, means being provided adapted to serve as a support for the sealing material during its introduction.

In accordance with a modified form of the process an inflatable bag or balloon made of an air-tight material is used as a support for the sealing material, which support adheres closely to the irregular side walls of a bore hole.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying, drawings showing preferred embodiments of the inventive idea.

In the drawings:

Figure 1 is a vertical section through a bore hole provided with a device for filling cracks and cavities of a concrete structure.

Figure 2 shows in vertical section a bore hole having irregular side walls and provided with means for filling the cracks.

The device shown in Figure 1 comprises a pressure tube h, only one end of which is shown in the drawings. The tube h is attached to a connecting member f which is provided with a valve g. An extension pipe a^1 is screwed to the lower end of the connecting member f and is provided at its lower end with a flange a^2 having inner screw threads. A pressure pipe a is screwed into the flange a^2 of the pipe a^1.

The lower end of the pipe a is connected or forms a single piece with an end disc i, the diameter of which is approximately equal to the diameter of the bore hole. A packing ring k which may be made of leather, felt or the like,

is placed on top of the disc *i* and surrounds the lower end of the pipe *a*. The disc *i* and the ring *k* operate as a closing device for closing the pipe *a* with respect to the walls of the bore hole.

In operation, the pipe *a* is first screwed into the flange a^2 of the pipe a^1 and then the two pipes are lowered into the bore hole until the pipe *a* is situated just above the cavities or cracks which are to be filled. The pipe a^1 must be of such length that after the insertion of the two pipes the connecting member *f* remains above the upper surface of the concrete. At this stage, the tube *h* is not connected with the connection member *f*.

Then a liquid sealing material SZ, such as quick setting cement, i. e. cement mixed with a setting accelerator or cement fondu, or the like, is introduced into the space between the pipe *a* and the bore hole until it reaches the packing ring *k* and solidifies over this ring and around the pipe *a*.

After the sealing material has solidified, one end of the pressure tube *h* is attached to the upper end of the connecting member *f*. The opposite end of the tube *h* connected with an air-compressor and a container for the filling material. These are not shown in the drawings.

The filling or plugging material is forced under pressure through the pipe *h*, the connecting member *f*, the pipe a^1 and the pipe *a*. The filling or plugging material flows into the lower part of the bore hole and fills up or plugs the cracks formed therein. Due to the sealing of the pipe *a* with respect to the bore hole, the pressure exerted upon the filling or plugging material cannot be transmitted to the outer layers of the structure so that these layers cannot be raised or otherwise injured.

Then the pressure tube *h* is removed and the pipe a^1 is screwed off and taken out of the bore hole, so that merely the pipe *a* remains therein.

The filling operation may be repeated at another part of the bore hole. For that purpose a second pipe *a* is screwed into the flange a^2 of the pipe a^1 and the pipes a^1 and *a* are again introduced into the bore hole to a smaller depth. Then the sealing substance SZ is again poured on top of the felt ring *k* and the filling material is again introduced into the bore hole through the tube *h* and the pipes a^1 and *a*. This stage of the process is illustrated in Figure 1 of the drawings.

After the completion of the second filling operation, the tube *h* and the pipe a^1 are removed leaving the second pipe *a* within the bore hole.

Obviously, the filling may be repeated several times and any suitable number of pipes *a* may be left in a bore hole.

The second filling operation may take place immediately after the first filling operation has been completed.

If a large amount of water pouring into the bore hole, the valve *g* must be closed as soon as the filling material, such as the cement, has passed through the connecting member *f*. In that case the pipe a^1 along with the connecting member *f* should not be withdrawn from the bore hole until the cement has set properly.

In the case of very deep bore holes, for instance, in mines, tunnels, or shafts, the extension pipe a^1 may consist of two or more interconnected pipes as shown at *n* in Figure 1.

The method illustrated in Figure 2 of the drawings may be applied when the side walls of bore holes are very uneven and irregular. A bore hole with very uneven walls is often formed when the hole is bored through brittle concrete, since in that case large parts of the walls break off during the boring. In that case it is often impossible to use the method illustrated in Figure 1, since the pressure pipe cannot be closed off properly with respect to the walls of the bore hole by means of the disc *i* and the ring *k*, so that the liquid sealing substance would penetrate into the space between the edges of the ring *k* and the irregularly shaped walls of the bore hole and would flow to the bottom of the bore hole.

In accordance with the process shown in Figure 2, a bag or balloon made of a suitable air-tight material, for instance rubber, is introduced into the bore hole and is inflated by compressed air, so that it is pressed tightly against the walls of the bore hole, thus closing off said bore hole and forming a secure support for the liquid sealing substance.

As shown in Figure 2, a bag or rubber balloon *p* is attached to an air-supply pipe *q*, preferably, by means of an intermediate pipe *o*.

In operation, a pressure pipe a^3, which may be of the same or different shape as the pipe *a* shown in Figure 1, is introduced into the bore hole. The pipe a^3 may be connected with a pipe a^4.

In the modification shown in Figure 2, the pipe a^3 is provided with conical edges a'', although, obviously, it may have the same shape as the pipe *a* shown in Figure 1. The pipe a^3 is introduced along with the inflating pipe *q* and as soon as the pipe has reached the desired depth of the bore hole, the balloon *p* is inflated by air blown through the pipe *q* by a device not shown in the drawings.

The balloon *p* will come in contact with the irregular walls of the bore hole and will close the pipe a^3 with respect to the walls of this bore hole. Then the sealing material SZ is introduced into the space between the pipe a^3 and the bore hole and is allowed to set. The bag *p* is deflated and may be removed from the bore hole along with the inflating pipe *q*.

In some cases the inflated bag *p* is left in the bore hole not only until the sealing material is set, but until it is completely hardened. In that case those surfaces of the bag *p* which come in contact with the sealing substance should be provided with a coating of fat *r* to prevent the bag from being torn while it is being withdrawn from the bore hole.

After the bag *p* has been withdrawn, a filling or plugging material, such as cement, chemical and the like is introduced into the bore hole through the pipe a^3.

The pipe a^3 may consist of two or more portions in such case, the lower portion may be left in the bore hole and the filling or plugging operation may be repeated by using another upper pipe—portion in the same manner as illustrated in Figure 1 of the drawings.

The use of an inflated bag or balloon has the further advantage that it greatly facilitates the introduction of the sealing material into the bore hole if the hole is filled with water. An inflated balloon prevents the water from rising within the bore hole much more effectively than a felt ring.

If there is a danger that water may pour into the bore hole through a crack situated above the inflated ball *p*, a second pipe *s* shown by broken lines in Figure 2 may be placed around the pipe a^3. The pipe *s* is, preferably, provided with out-

wardly bent edges. Then the water which flows into the bore hole, passes between the walls of the bore hole and the walls of the pipe *s*, while the sealing substance is introduced through the space between the walls of the pipe a^3 and the walls of the pipe *s*.

In case several adjacent bore holes have been drilled, the filling material may penetrate through cracks and cavities from one bore hole to the other. This may be prevented through the use of inflated bags or balloons *p*, which close off those bore holes which have not been filled in yet and prevents the filling material from passing from one bore hole into another.

What is claimed is:

1. In a process of pressing a filling or plugging material into concrete, rock or the like, the steps of inserting a pressure pipe into a bore hole, said pipe comprising an upper and a lower portion, sealing off said lower portion with respect to the wall of the bore hole, passing a filling or plugging material through said pipe, separating the upper portion of said pressure pipe from its lower portion, removing said upper portion from the bore hole, connecting another lower portion with said upper portion, inserting the pressure pipe into the bore hole, sealing the new lower portion with respect to the bore hole wall at a point nearer to the mouth of the bore hole than the first sealing, and passing the filling or plugging material through the pressure pipe.

2. In a process of pressing filling or plugging material into concrete, rock and the like, the steps of inserting a pressure pipe into a bore hole, closing the bore hole at the lower end of the pressure pipe by inflating a bag or balloon, and introducing a sealing material between the pressure pipe and the bore hole wall, said inflated bag or balloon forming a support for said sealing material.

3. In a process of pressing filling or plugging material into holes bored in concrete, rock and the like, the steps of closing one of the bore holes by introducing a bag or balloon into said bore hole and then inflating said bag or balloon, and forcing filling or plugging material into an adjacent bore hole.

4. In a process of pressing a filling or plugging material into concrete, rock and the like, the steps of inserting a pressure pipe into a bore hole, closing the bore hole at the lower end of the pressure pipe by inflating a bag or balloon, placing an auxiliary pipe around the pressure pipe, and introducing a sealing substance through the space between the pressure pipe and the auxiliary pipe, said inflated bag or balloon forming a support for said sealing substance.

WILHELM KLIE.