May 30, 1944. G. E. STEUDEL 2,349,889

METHOD OF CUTTING MAINS UNDER PRESSURE

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FIG. 1.

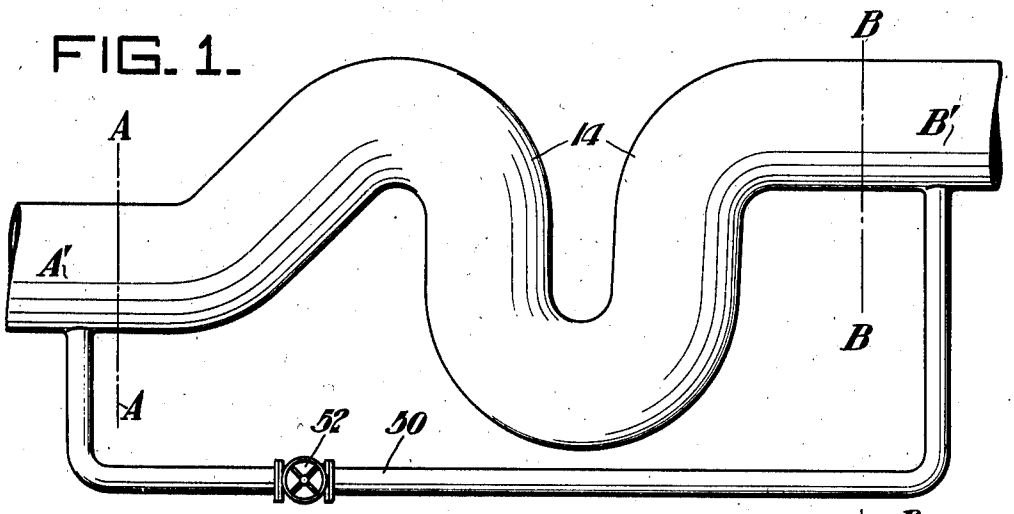
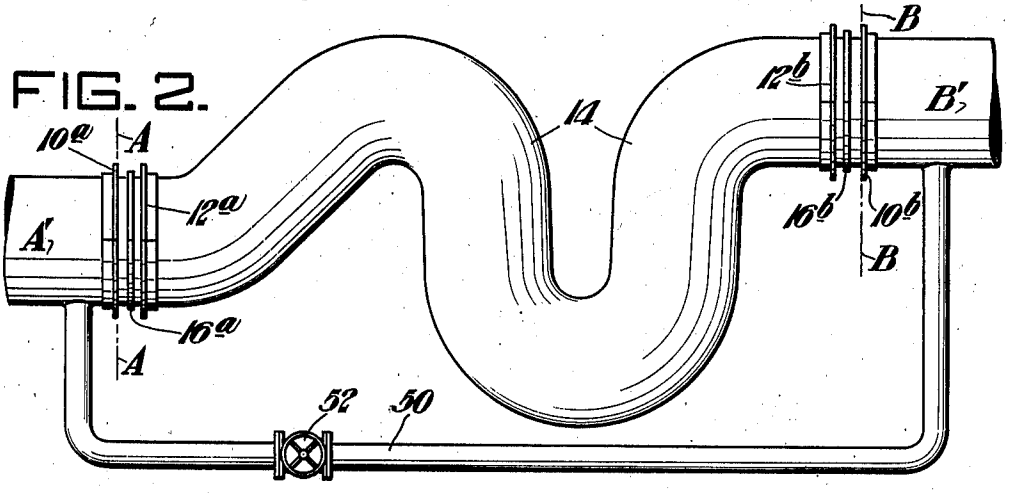


FIG. 2.



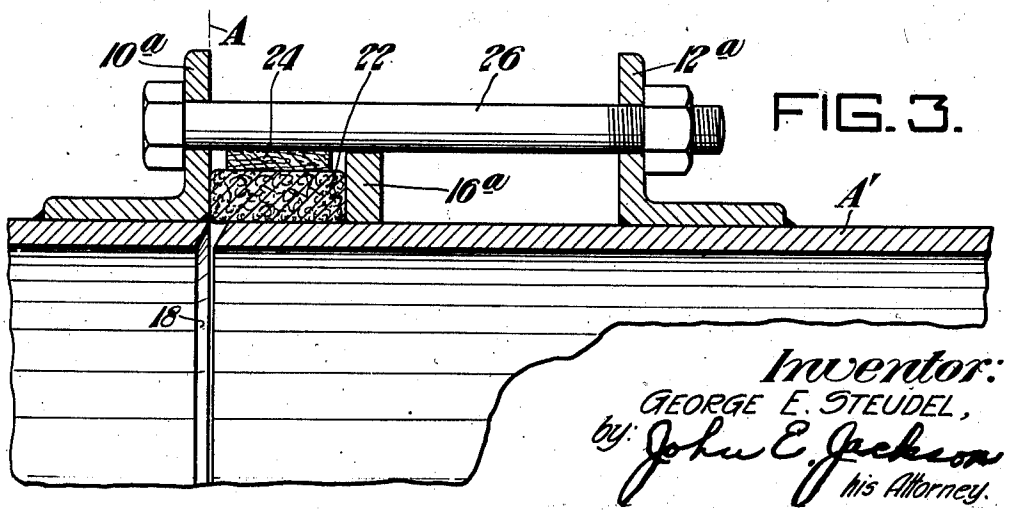


FIG. 3.

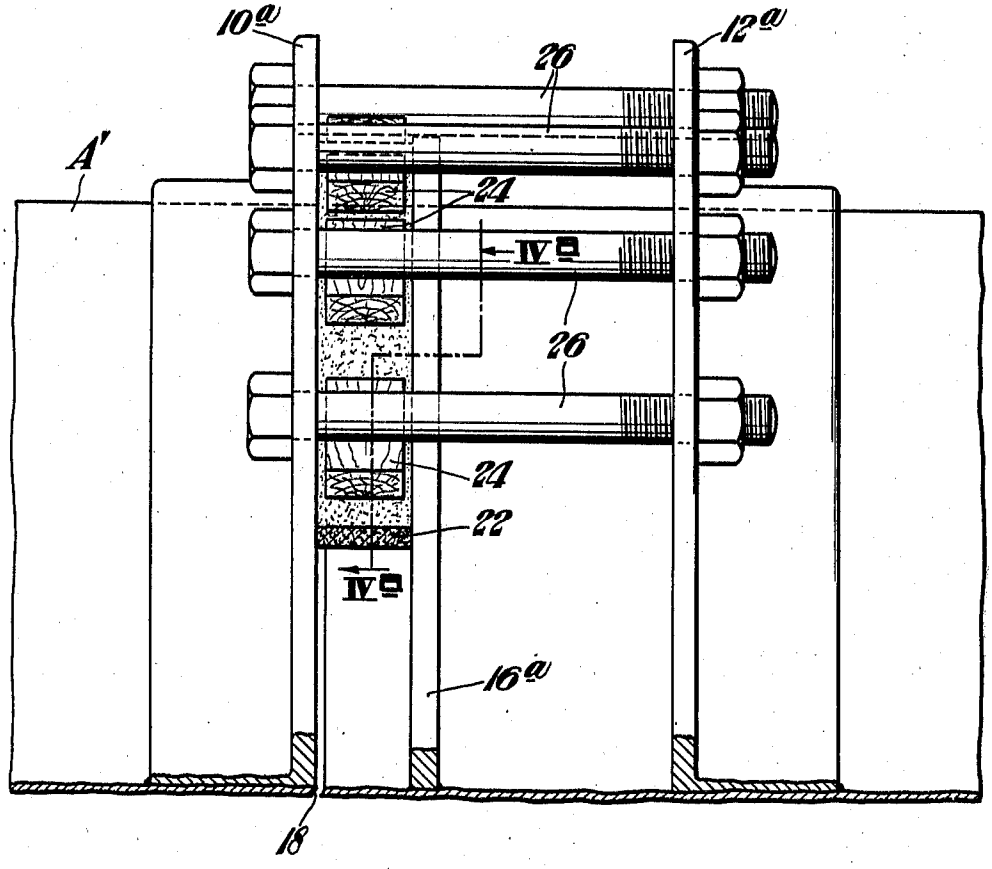
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METHOD OF CUTTING MAINS UNDER PRESSURE

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FIG. 4.



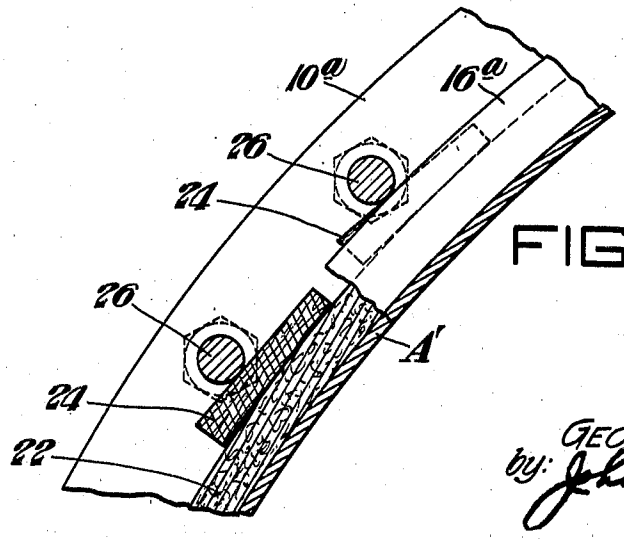


FIG. 4a

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FIG. 5.

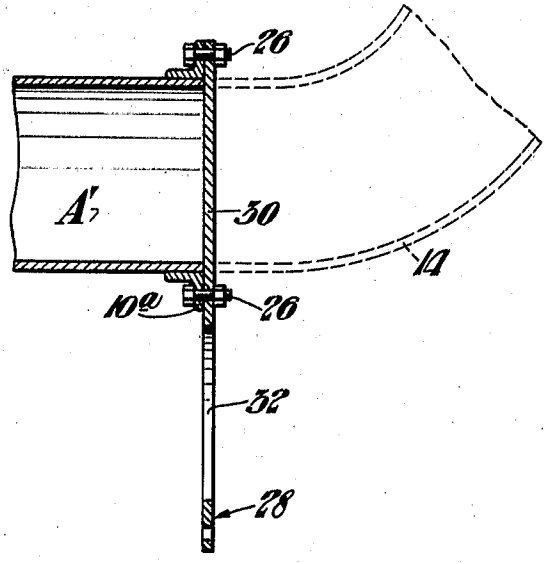


FIG. 6.

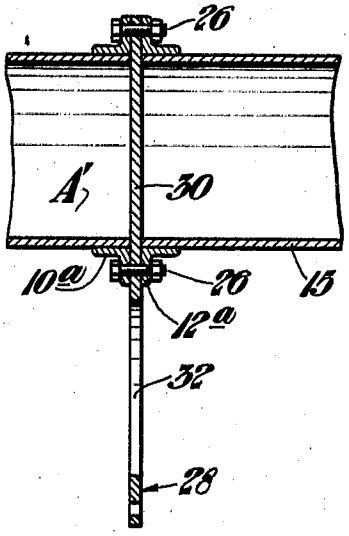


FIG. 7.

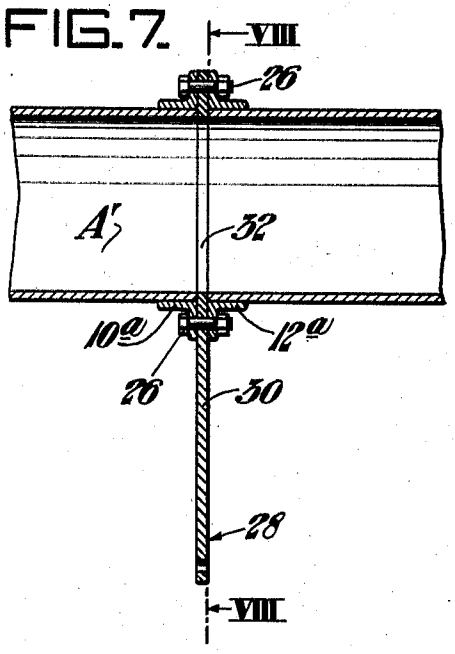
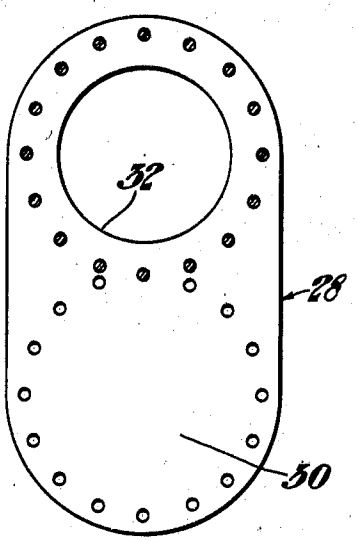


FIG. 8.



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UNITED STATES PATENT OFFICE

2,349,889

METHOD OF CUTTING MAINS UNDER PRESSURE

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Application December 11, 1941, Serial No. 422,600

5 Claims. (Cl. 29—157)

The present invention relates to an improved method for cutting out sections of gas mains and replacing new sections while gas pressure is maintained in the mains.

While not limited thereto, the method is well suited for removing weakened or dangerous sections from gas mains of enormous size, such as those used in connection with blast furnace equipment for conveying blast furnace gas to soaking pits, boiler house plants, stoves or other related blast furnace or steel mill equipment.

Such blast furnace equipment frequently includes in the gas line a water seal in the nature of a huge S-shaped trap which at intervals requires replacement. In a typical blast furnace installation, the gas main for conveying blast furnace gas is built up of steel plate and is of exceedingly large diameter, for example, in the neighborhood of 6 to 8 feet. To remove a damaged or weakened water seal involves the removal of a length of about 46 feet of such large diameter main. Since many auxiliary pieces of equipment, such as boilers, stoves, soaking pits and the like are fired by blast furnace gas, it is important that at the time of removal of a trap or other weakened section of the main that gas pressure be not entirely cut off from the main, or if the pressure is reduced or cut off, that the same be interrupted for only a very short length of time. The method to be presently described solves the problem very effectively.

The invention will be fully apparent from the following detailed disclosure when read in connection with the accompanying drawings and will be defined with particularity in the appended claims.

In the drawings:

Figure 1 represents a length of a blast furnace gas main approximately 8 feet in diameter, showing a trap or water seal section between the lines A—A and B—B which is to be severed from the main and replaced by a new section;

Figure 2 is a view similar to Figure 1 showing subsequent steps in the method;

Figure 3 is an enlarged longitudinal section illustrative of the steps of cutting the main along the face of the permanent flange, preferably in increments of 2 feet, at line A—A or B—B of Figure 1;

Figure 4 is a view similar to Figure 3, illustrating the next cutting step after the previous cutting increment has been packed, bolts installed in the flanges over the packing, and packing wedged in place;

Figure 4a is a detail section taken on line IVa—IVa of Figure 4;

Figures 5, 6 and 7 are sectional views illustrating further steps in the method; and

Figure 8 is a section on line VIII—VIII of Figure 7 showing a goggle valve or sealing plate in open position and which may be moved to a closed position illustrated in section in Figure 6.

Referring in detail to Figure 1 of the drawings, the first step in the method comprises welding permanent flanges 10a and 10b to the portions A' and B' of the main adjacent the lines A—A and B—B which are to remain in place. These flanges 10a and 10b are of sectional form, being split along a diametric line so as to facilitate engagement with an existing main. After the flanges 10a and 10b have been firmly secured, as by welding, to the sections A' and B', temporary flanges 12a and 12b, also of split or sectional form, are welded near the ends of the section of the main to be removed. In the drawings illustrating the invention, this section of the main to be removed includes the S-shaped trap, designated by the numeral 14. This trap is part of conventional blast furnace equipment and normally contains water to form a seal between different sections of the main. It is clear, however, that the method is equally applicable to removing straight lengths of a main. The permanent flanges 10a and 10b and temporary flanges 12a and 12b, after being welded in place, are substantially parallel.

The next step in the method is to weld respective sectional rings 16a and 16b to the section of main to be removed at locations intermediate the flanges 10a and 12a and 10b and 12b. These rings are of split or sectional form to facilitate ready attachment, as by welding, to the exterior of the portion of the main to be removed. It will be understood that the flanges 10a and rings 16a, as well as the flanges 10b and rings 16b, define annular spaces in the zone where the main is to be severed. Thus the flanges and the rings serve to define the cutting zone or region of cleavage.

The next step in the method is to cut the main along the face and slightly under the heel of the permanent flange 10a, preferably in increments of 2 feet, such as indicated at 18 in Figure 3. After the main is cut (one increment), wire braided asbestos rope is packed over the top of the cut, so as to fill the space between the flange 10a and the ring 16a, Figure 3. Over the packed portion of the cut, bolts 26 are inserted in the flanges 10a and 12a and tightened

up, as illustrated in Figure 4. Wooden wedges 24 are placed between the bolts 26 and packing 22 to hold the packing in place and to prevent the escape of gas. This procedure is continued until the entire circumference of the main is cut, packed, and bolted tight. Similarly, the gas main between flanges 10b and 16b is cut, packed, and bolted. By the above procedure, the main is circumferentially cut at lines A—A and B—B in Figure 1, which severs section of gas main 14 from main A' and B' in Figure 1.

It is apparent that the severed section of the main to be ultimately removed is nevertheless so sealed by the packing as to prevent the escape of gas. The bolts 26 serve to hold the severed section in place until its removal is to be effected.

The problem at this stage is to remove the section of main between the lines A—A and B—B and to install a new section with a minimum amount of interference with normal operation of the apparatus connected on the parts of the main beyond the section lines A—A and B—B, and with a minimum loss of gas from the main of enormous diameter.

To accomplish this desirable end I next attach sealing plates or goggle valves 28, such as indicated in Figure 8, to the permanent flanges 10a and 10b. Each sealing plate or goggle valve has a blanking off or closure portion 30 and an aperture or port 32. Each goggle valve or sealing plate is connected by bolts 26 to the adjacent permanent flange. It will be understood that when in one position the solid portion 30 will serve as a barrier to prevent flow of gas through the main. This position is shown in Figure 5. When the sealing plate is secured in its other position, shown in Figure 7, the gas may flow through the port 32 thereof. These goggle valves or sealing plates are assembled in relation to the flanges 10a and 10b prior to the removal of all the bolts 26 which couple the permanent flanges 10a with the temporary flanges 12a secured to the section of main to be removed. After the sealing plates or goggle valves are assembled in readiness to be quickly moved to closed position, the pressure on the gas main is reduced. Thereupon all of the bolts 26 are removed and the section of the main between the points A—A and B—B of Figure 1 is bodily removed and the goggle valves or sealing plates are moved to such position that the closure portions 30 thereof serve as barriers to prevent the escape of gas from the sections A' and B' of the main. Thereafter, a new section of main is installed between the lines A—A and B—B of Figure 1. This new section, designated at 15 in Figure 6, has at its ends flanges 12a and 12b adapted to be bolted to the permanent flanges 10a and 10b.

In order to maintain a substantially uniform and controlled pressure in the part of the main severed from the source of gas during the course of constructing the new main, an eight inch bypass pipe line 50, with a gate valve 52 therein, is preferably installed. This procedure insures controlled gas pressure in the isolated part of the main and thereby eliminates the possibility of air infiltration into this part of the system.

While the new section of main is being installed between the permanent flanges 10a and 10b, air is introduced into the said new section of main through a suitable hole therein under superatmospheric pressure, the hole being later closed by a plug. This step of introducing a positive current of air eliminates the possibility of any gas accumulation in the newly constructed main and therefore makes safe the conventional welding method. During the cutting of the main, high pressure air is also directed over the point of cut to remove gas accumulations that may interfere with operations. The cutting is done by the use of an oxyacetylene or similar metal burning torch, or may also be accomplished with an electric arc type of cutting tool.

After the new section of main has been bolted in place, the goggle valve or sealing plate 28 is shifted so as to bring the port 32 into alignment with the contiguous sections of the main so as to thus open communication between the sections A' and B', thus restoring communication between them.

All of the above steps, it will be understood, are carried out without materially interfering with the normal gas pressure in the main and without loss of a large quantity of gas such as would be contained in a main having a diameter in the neighborhood of 8 feet.

The invention has been specifically described with reference to removing a damaged section of a gas main and inserting a new section therein. It will be understood, however, that the same procedure may be followed in renewing weakened or damaged sections of steam mains, water mains or the like. Thus the invention is applicable to cutting and replacing sections of any main adapted to carry any type of fluid under pressure.

While I have described quite precisely a certain preferred sequence of operations, it is to be understood that the drawings and descriptive matter are to be interpreted in an illustrative rather than a limiting sense, since various modifications may be made without departure from the invention as defined in the appended claims.

I claim:

1. The method of cutting a section from a main containing a fluid under pressure and inserting a new section therein, which includes the steps of cutting through the wall of the main in separate peripheral increments to form one zone of cleavage, applying a packing after each increment is cut to prevent the escape of fluid from the main, then at a second zone of cleavage spaced from the first mentioned zone, repeating the aforesaid steps to thus completely sever from the main the section thereof between said zones, removing the packings at both zones of cleavage, applying a respective temporary sealing member to the main at each of said zones of cleavage, removing the severed section, inserting a new section of main, connecting the ends of said new section to the main, and removing the said temporary sealing members, to thus establish communication through said new section.

2. The method of cutting a section from a main containing a fluid under pressure and inserting a substitute section therein, which comprises securing permanent members in juxtaposition to the zones where the main is to be severed, securing temporary members to the section of the main to be removed at points spaced from said permanent members, securing respective ring sectors to the section of the main to be removed intermediate said permanent members and said temporary members, making a respective series of cuts in separate increments in the main in the region immediately adjacent each of said permanent members, closing the resulting void after each increment is cut away so as to prevent the fluid from escaping therethrough, the extent of and number of said cuts made being sufficient to completely sever the main adjacent each of

said permanent members, sealing the ends of the sections of the main which are to remain in place, removing the severed section of the main, inserting a new section of main and securing it to said permanent members, and finally unsealing said ends, thus restoring communication between the permanent sections of the main through the said newly inserted section.

3. The method of cutting a section from a main containing fluid under pressure and inserting a new section therein, which comprises securing permanent flanges in juxtaposition to the zones where the main is to be severed, securing temporary flanges to the section of the main to be removed at points spaced from said permanent flanges, securing respective rings to the section of the main to be removed intermediate said permanent flanges and said temporary flanges, coupling said permanent flanges to said temporary flanges, cutting in separate increments a series of openings in the periphery of the main in the region adjacent each of said permanent flanges, inserting packing between the permanent flanges and said rings so as to prevent the fluid from escaping through said openings, thus severing the main adjacent each of said permanent flanges, securing respective apertured sealing plates to the permanent flanges in positions to close the sections of the main which are to remain in place, uncoupling said permanent flanges from said temporary flanges, removing the severed section of the main between said sealing plates, inserting a new section of main and securing the ends thereof to said permanent flanges, and moving each sealing plate to a position where the aperture therein will establish communication between the permanent sections of the main and the said newly inserted section.

4. The method of cutting a section from a main containing fluid under pressure and inserting a new section therein, which comprises securing permanent flanges in juxtaposition to the zones where the main is to be severed, securing temporary flanges to the section of the main to be removed at points spaced from said permanent flanges, securing respective rings to the section of the main to be removed intermediate said permanent flanges and said temporary flanges, cutting in separate increments a series of openings in the periphery of the main in the region adjacent each of said permanent flanges, inserting bolts to couple the permanent flanges to the temporary flanges, inserting packing between the permanent flanges and said rings so as to prevent the fluid from escaping through said perforations and inserting wedges between said bolts and packing to compressively confine the latter in the annular space between the permanent flanges and said rings to thus effectively seal the series of perforations, the cuts being of a number sufficient to sever the main adjacent each of said permanent flanges, sealing the ends of the main at the respective zones of cleavage, removing said bolts to uncouple said permanent flanges from said temporary flanges, removing the section of main between said permanent flanges, and inserting a new section of main and securing it to said permanent flanges.

5. The method of cutting a section from a main containing a fluid under pressure and inserting a new section therein, which includes the steps of cutting through the wall of the main in separate increments to form one zone of cleavage, applying a closure after each increment is cut away to prevent the escape of fluid from the main, then at a second zone of cleavage spaced from the first named zone, repeating the aforesaid steps to thus completely sever from the main the section thereof between said zones, removing the said closures at both zones of cleavage, applying a respective temporary sealing member to the main at said zones of cleavage, removing the severed section between said zones, inserting a new section of main, introducing air under superatmospheric pressure into the new section so as to exclude the flow of fluid thereinto, removing the said temporary sealing members, and connecting the ends of said new section to the main, to thus establish communication through said new section.

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