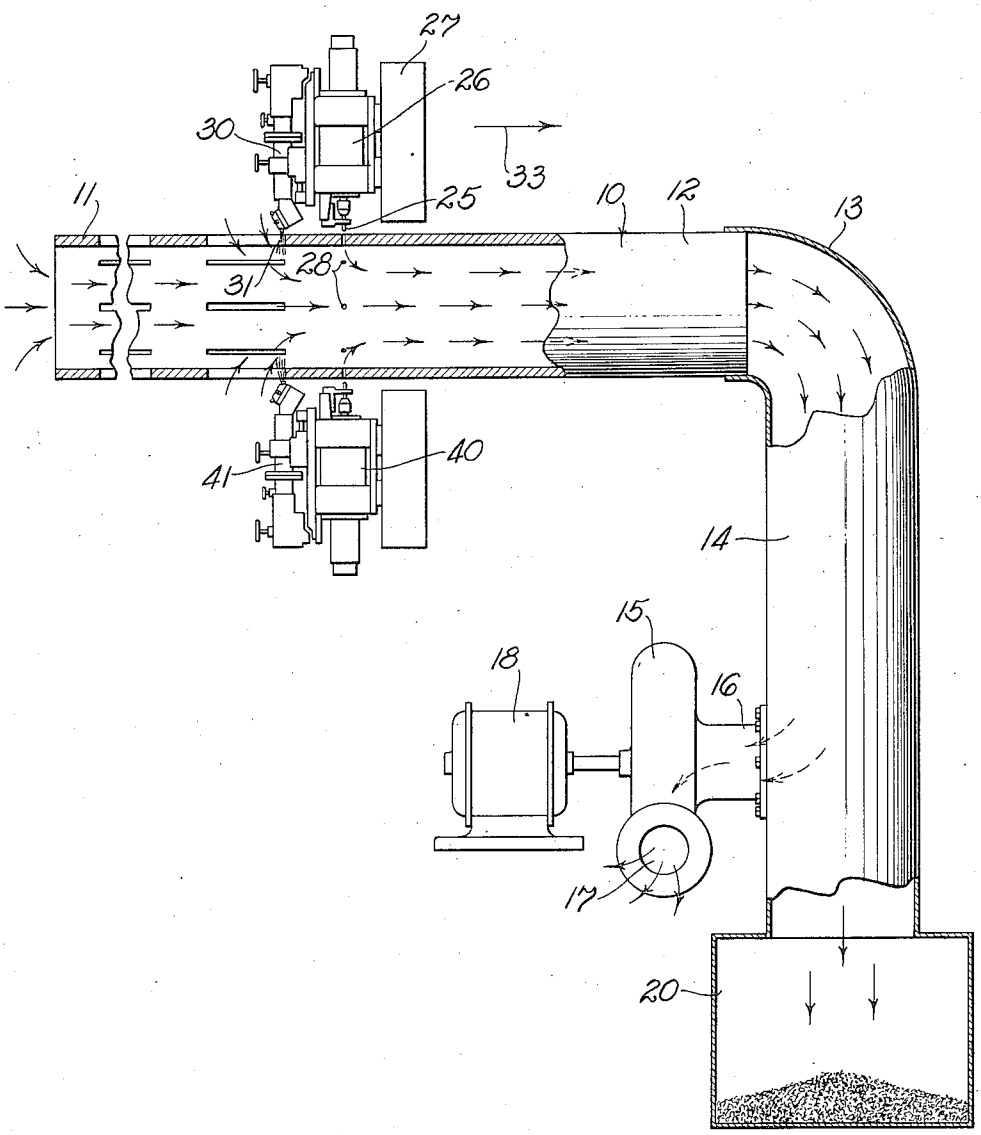
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PROCESS OF CUTTING SLOTS

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PROCESS OF CUTTING SLOTS

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My invention relates to an improvement in the art of cutting slots in objects, and finds particular utility in perforating pipe or other metallic structures. The present application is a continuation in part of my application Serial No. 425,838, filed February 4, 1930, entitled "Method of and apparatus for cutting slots in pipe."

In my Patent No. 1,835,378, issued December 8, 1931, there is disclosed an apparatus for cutting slots in a length of pipe to form a perforated casing finding utility in pumping liquids from wells, for instance. In the structure therein shown a cutting jet is directed through a previously drilled opening in the pipe, after which relative movement between the cutting jet and the pipe is set up to cut an elongated slot through the walls of the pipe. The apparatus in this patent includes an auxiliary pipe inserted into one end of the pipe to be perforated, this auxiliary or inner pipe carrying two heads spaced from each other to form a chamber, these heads being sealed with respect to the inner wall of the pipe being perforated. This chamber is disposed opposite the slot being cut so that the slag is drawn thereinto, this slag being removed by drawing a stream of air through the auxiliary pipe.

The present invention includes among its objects the provision of an improved process for removing slag and chilling the slotted walls to effect a heat-treatment thereof as soon as the slots are formed. No auxiliary pipe is utilized, thus effecting a distinct saving in space as will be apparent when it is considered that this auxiliary pipe must be inserted and withdrawn endwise from the pipe to be processed.

In addition, it has been previously necessary to accurately position the chamber with respect to the cutting jet. In the present invention the chamber is entirely dispensed with and this difficulty is completely overcome. In utilizing no auxiliary pipe, the present process overcomes the necessity of moving this auxiliary pipe from time to time to maintain alignment between the chamber and a cutting jet.

In the present process a stream of gas is moved through the unobstructed interior of the pipe. The gas is preferably drawn through that portion of the pipe which is yet unperforated. Such a process not only withdraws all of the slag or cuttings entering the pipe, but in addition chills the walls as the cutting action progresses to heat-treat the material forming the slotted walls.

In addition, such a stream of gas flowing through the unobstructed interior of the pipe deflects the jets, thus making it possible to use a pair of jets disposed opposite each other and directed toward each other, the gas deflecting the jets to prevent the slag from one jet entering the opening formed by the other jet.

In eliminating the chamber inside the pipe, the present invention eliminates the necessity of sealing the heads with respect to the pipe being perforated and provides a method of removing the slag and cuttings without danger of any accumulation in such a chamber as has previously been utilized.

In addition, it is possible with the present process to draw a much larger volume of gas through the pipe and the openings formed therein, thus making it possible to secure a faster cooling action and, in some instances, making it possible to more rapidly cut the slots.

In the present invention one end of the pipe may be left open, so that the gas moves completely through the pipe before the perforating operation is comenced. It is preferable to start the perforating operation at that end of the pipe through which the gas enters, and it has not been found necessary to close this end of the pipe at any time.

It should not be understood that the process is necessarily limited to the use of a vacuum for drawing the gas through the pipe or to the particular direction of flow mentioned above. Nor is the process limited to the cutting of slots by the use of a cutting jet, the process finding utility with other types of cutting operations.

In the drawing I have diagrammatically shown one type of apparatus which may be used in carrying out the process. This type of apparatus is disclosed more in detail in my application supra, and it should be understood that the invention is not limited to this type of apparatus.

In the drawing the pipe to be perforated is indicated by the numeral 10 and is supported by means not shown. One end of the pipe, indicated by the numeral 11, is open to the atmosphere or to any body of gas thereadjacent. The other end of the pipe, indicated by the numeral 12, is in open communication with an elbow 13 communicating with a downward extending pipe 14.

The air or other gas is forced through the pipes 10 and 14 by a pump 15. In the preferred embodiment this pump is in the form of a blower, the intake 16 of which communicates with the pipe 14, the air or other gas being discharged through an outlet 17 of the pump. A motor 18

or other drive means may be used to operate the pump.

Any slag or cuttings carried by this stream of gas may drop downward in the pipe 14 and into a container 20 where they accumulate and can be periodically withdrawn by means not illustrated.

The perforating operation is started at the end 11 at which the gas is drawn into the pipe. This perforating operation may be performed in any one of a number of ways. With the apparatus shown, a preliminary perforation is formed by a drill 25 of a drill structure 26 mounted on a face plate 27 which is movable longitudinally along the pipe 10. This drill structure forms an opening 28 through the wall of the pipe and may be of the form described in detail in my application supra. This opening is elongated through the use of a cutting torch 30 producing a jet 31. After the opening 28 has been drilled, the face plate 27 is moved so that the jet 31 is directed toward the opening. The jet issuing from the torch at this time is a heating jet and acts to heat the walls around the opening previously formed. Such a heating jet may conveniently be composed of an acetylene flame, as mentioned in my application supra. Thereafter a jet of cutting oxygen is directed through the opening 28 and the face plate 27 is moved in a direction indicated by the arrow 33, thus tending to cut a slot in the pipe as the jet is drawn in a rightward direction. This sequence of operations is more particularly set forth in my application supra.

In the present process it is desirable to start the perforating operation at the end of the pipe indicated by the numeral 11 and thereafter work toward the end 12 of the pipe. Thus, the stream of gas is drawn through the unobstructed and unperforated portion of the pipe as the openings are successively formed.

Before the first perforation is formed it will thus be clear that the entire body of gas is drawn through the end 11 of the pipe. As soon as the first perforation is formed, however, a portion of the incoming gas will move through this perforation, and as the perforating operation is continued toward the end 12 of the pipe, a smaller proportion of the incoming gas will move through the end 11 of the pipe and a larger proportion will move through the perforations already formed. As soon as the pipe has been perforated for a length of about two feet substantially all of the incoming gas will be drawn through the slots and substantially none of this gas will move through the end 11. This is a very important feature of the invention in that it permits the gas to be drawn through only those slots which have most recently been formed. At the same time it precludes any necessity of closing the end 11 of the pipe either when the perforating operation is first started or at a later time.

The gas forced through the newly formed openings or slots chills the walls of the slots in a manner to very effectively increase the hardness thereof, thus resulting in a pipe having perforations which are very resistant to any abrasive action. In addition, the gas forced through the unperforated portion of the pipe 10 deflects the cutting jet as it moves through the walls of the pipe. This is of especial advantage when a pair of cutting jets are used on opposite sides of the pipe. Thus, in the drawing I have illustrated an auxiliary drill structure 40 and an auxiliary cutting torch 41 disposed substantially opposite the drill structure 26 and the cutting torch 30 respectively. Other drill structures and cutting torches may also be mounted on the face plate 27 so that a large number of slots may be simultaneously cut. When a plurality of cutting operations are performed there is the danger of the slag from one cutting jet entering the opening formed by the jet substantially opposite. In practice it has been found that this slag will often tend to clog the tip of the cutting torch which is positioned substantially opposite. The difficulty is entirely overcome by moving a stream of gas through the pipe 10 as hereinbefore set forth, for this stream of gas deflects the jets so as to prevent the slag from one jet coming in contact with the other jet or the opening formed thereby. However, it is very desirable that the velocity of the stream of gas be maintained relatively high so that sufficient deflection will take place. The desirable velocities cannot be set up if an auxiliary pipe is used for conducting the gases as set forth in my patent supra. The velocity of the cutting jets is of necessity extremely high and the amount of deflection depends upon the relative jet velocity and the velocity of the gas being drawn through the pipe 10. Because the present process draws gas through the unobstructed interior of the pipe it becomes possible to secure sufficiently high velocities to deflect the cutting jets to the extent necessary in preventing slag from reaching the opposite jet. So also, in the present structure there is no chamber or pocket inside of the pipe being perforated in which the slag or cuttings tend to accumulate.

Various modifications may be made without departing from the spirit of the invention. Thus, various types of cutting means can be utilized, it being clear that the present process will withdraw the cuttings from the interior of the pipe through the unperforated portion thereof so as not to clog the perforations previously formed. However, the use of a cutting jet has been found to be the most advantageous method of forming such slots, especially in view of the desirable heat-treatment effected. It is also possible to reverse the direction of flow of the gas when certain types of cutting operations are being performed. It is, however, very desirable when utilizing the cutting jets to draw the gas into the pipe rather than forcing it therefrom.

I claim as my invention:

1. A method of cutting openings in a length of pipe the interior of which is unobstructed, which method includes the steps of: successively cutting openings in said pipe by successively directing a cutting flame through the walls of said pipe; and moving a stream of gas through the yet unperforated and unobstructed portion of said pipe and through the openings as they are successively cut.

2. A method of cutting openings in a length of pipe the interior of which is unobstructed and one end thereof being open, which method includes the steps of: successively cutting openings in said pipe starting adjacent said open end thereof and progressing toward the other end thereof; and moving a stream of gas through the yet unperforated and unobstructed portion of said pipe and through the openings as they are successively formed.

3. A method of cutting slots in a length of pipe the interior of which is unobstructed, which method includes the steps of: moving a stream of gas through the unobstructed interior of said

pipe from end to end whereby the gas enters one end of said pipe and leaves the other end thereof; first cutting openings through said pipe adjacent that end thereof at which said gas enters whereby said gas is thereafter moved into said pipe through said one end of said pipe and also through said openings; and thereafter successively cutting additional openings through said walls of said pipe between the openings already cut and that end of said pipe from which said gas moves whereby an increasing proportion of the gas enters said pipe through the openings successively cut therein and a decreasing proportion of said gas enters said pipe through said one of said ends thereof.

4. A method of cutting openings in a length of pipe the interior of which is unobstructed, which method includes the steps of: directing a pair of cutting jets through oppositely disposed walls of said pipe; and moving a stream of gas through the unobstructed interior of said pipe to deflect said jets after they pass through said walls whereby the slag carried by one of said jets is deflected in a longitudinal direction and thus does not move through the opening cut by the other of said jets.

5. A method of cutting openings in a length of pipe the interior of which is unobstructed, which method includes the steps of: simultaneously directing a pair of cutting jets through oppositely disposed walls of said pipe, said jets being substantially in axial alignment with each other; and drawing a stream of gas through the unobstructed interior of the yet unperforated portion of said pipe to deflect said jets after they pass through said walls whereby the slag carried by one of said jets is deflected in a longitudinal direction and thus does not move through the opening cut by the other of said jets.

6. A method of cutting openings in a length of pipe, which method includes the steps of: successively cutting openings in said pipe; and continuously exhausting a stream of gas through the yet solid and internally unobstructed portion of said pipe during the cutting of said openings, said gas entering said pipe through said openings as they are successively formed, said stream of gas removing through said solid and internally unobstructed portion of said pipe the material formed by the cutting operation.

7. A method of cutting openings in a length of pipe, which method includes the steps of: cutting openings in said pipe, starting at one end and working toward the other end, by directing a cutting flame against said pipe; and exhausting a stream of gas through the yet solid and internally unobstructed portion of said pipe to draw said gas through the recently formed openings.

8. A method of cutting openings in a length of pipe providing an open end, the interior of said pipe being unobstructed, which method includes the steps of: drawing a stream of gas through the unobstructed interior of said pipe, said gas entering said open end of said pipe and leaving the other end thereof; cutting openings in said pipe whereby at least a portion of said gas is drawn into said unobstructed interior of said pipe through the recently formed openings, said stream of gas moving at sufficient velocity to carry the material formed by said cutting operation through said unobstructed passage and from said other end of said pipe.

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