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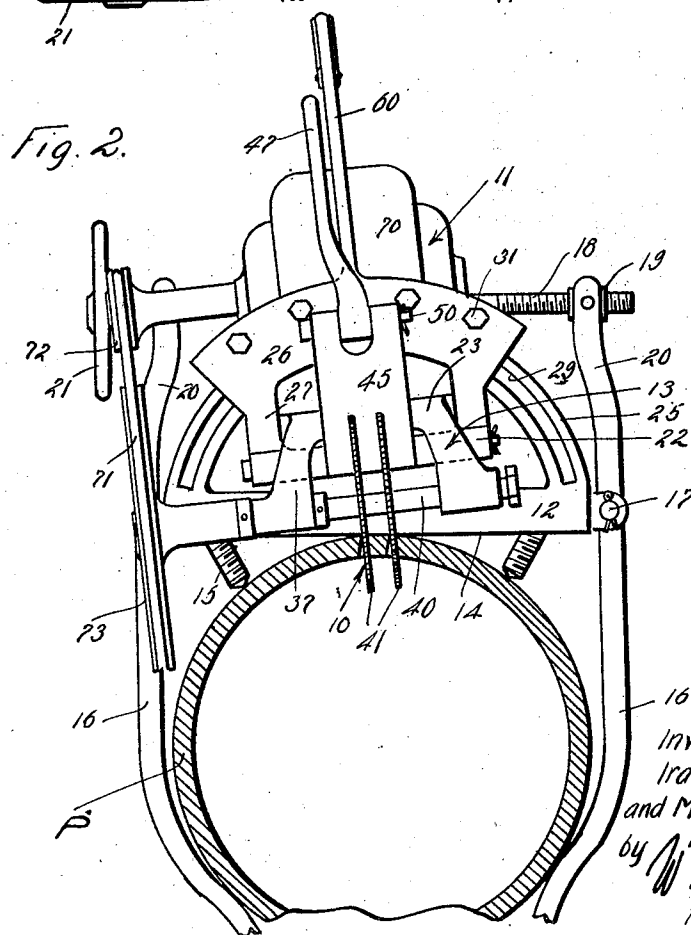
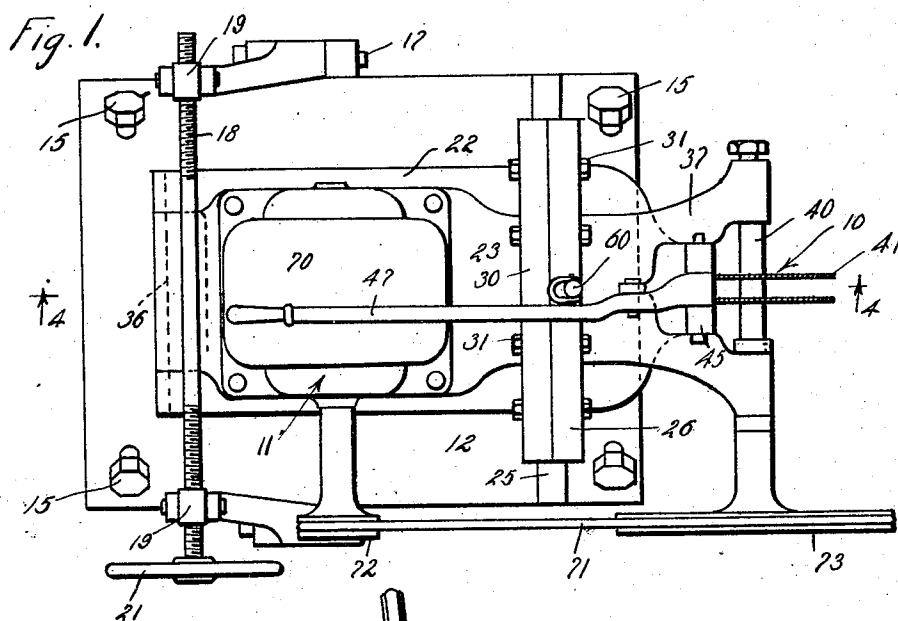
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I. J. McCULLOUGH ET AL

APPARATUS FOR PERFORATING PIPE OR THE LIKE

Filed March 15, 1924

2 Sheets-Sheet 1



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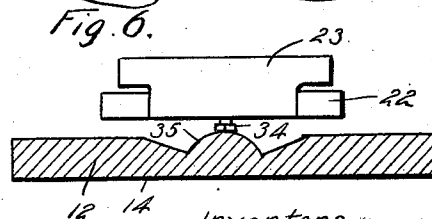
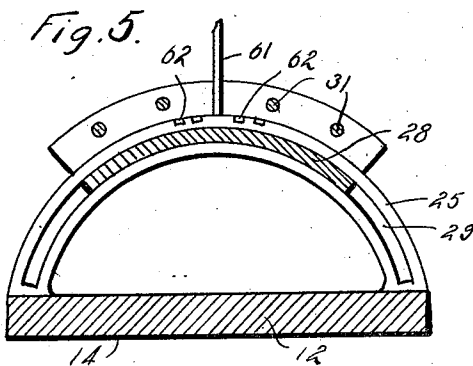
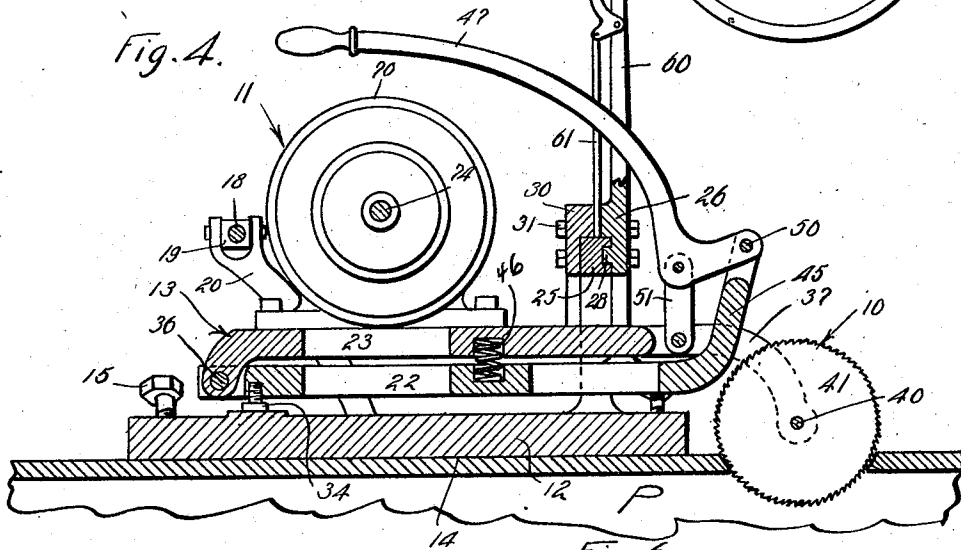
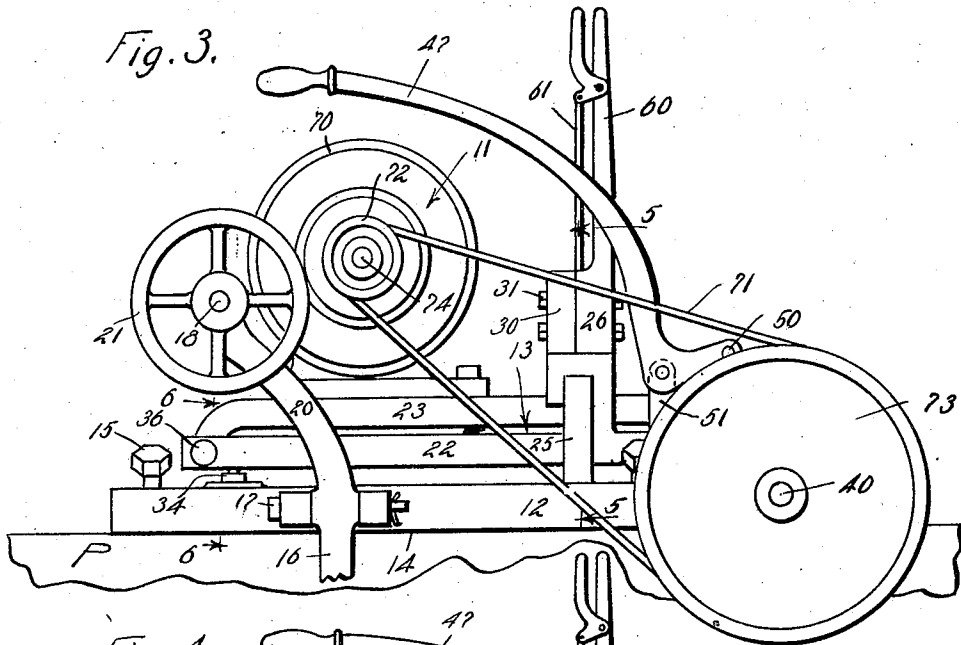
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APPARATUS FOR PERFORATING PIPE OR THE LIKE

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2 Sheets-Sheet 2



14
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR PERFORATING PIPE OR THE LIKE.

Application filed March 15, 1924. Serial No. 699,460.

This invention has to do with apparatus for perforating pipe, or the like, and it is an object of the invention to provide a simple, effective and practical apparatus for producing perforated pipe useful in wells, and the like.

The apparatus provided by this invention is particularly suited for the production or formation of perforations such as are set forth and claimed in our copending application entitled Perforated casing, filed February 26, 1924, Serial No. 695,235.

Another object of this invention is to provide a simple, effective and convenient apparatus or machine of the character referred to.

Another object of this invention is to provide a perforating machine such as will simultaneously cut a plurality of elongate perforations in a pipe, or the like.

Another object of this invention is to provide a simple, compact and inexpensive machine of the character specified.

Another object of this invention is to provide a perforating machine which is portable, and which is extremely simple and convenient to handle and operate.

The various objects and features of our invention will be best and more fully understood from the following detailed description of a typical preferred form and carrying out of the invention, throughout which description reference is had to the accompanying drawings, in which:

Fig. 1 is a plan view of a machine embodying our invention;

Fig. 2 is a front elevation of the machine;

Fig. 3 is a side elevation of the machine;

Fig. 4 is a longitudinal detailed sectional view of the machine, taken substantially as indicated by line 4—4 on Fig. 1;

Fig. 5 is a detailed sectional view, taken as indicated by the line 5—5 on Fig. 3; and,

Fig. 6 is a detailed sectional view, taken as indicated by the line 6—6 on Fig. 3.

The present invention, as before stated, has reference to apparatus for perforating pipe, or the like, to produce perforated pipe such as is employed in wells. Perforated pipe is employed in wells, particularly oil wells, for the purpose of admitting fluid into the well without admitting sand, or the like. In our above identified copending application we set forth and claim an improved form of perforation which is particularly effective, simple and practical. This improved per-

foration has inwardly divergent side walls and inwardly convergent end walls, it being preferred that the side walls be flat and the end walls somewhat concave. The apparatus herein set forth is particularly suited for the formation of our improved perforations. There are various features of our present invention, however, which are not necessarily related to or associated in any way with, our improved form of perforation, and which we wish understood as being applicable to the formation of various types or forms of perforations.

The apparatus provided by our invention embodies a disk cutter, the diameter of which is somewhat longer than the perforation to be formed, and the periphery of which is provided with suitable cutting parts or teeth. The cutter is rotated and is moved into engagement with the pipe to cut a straight elongate slot in it. The slot thus formed is, of course, very slightly greater in width than the cutter, has flat smooth sides, and somewhat concave inwardly convergent ends. With the first cut thus made the cutter is withdrawn from the pipe and the plane of the cutter varied or changed with relation to the pipe about an axis at or close to the outer surface of the pipe at the first made opening, preferably by moving or tilting the cutter with relation to the pipe. The cutter is then again moved into engagement with the pipe so that it enters the first made cut and operates to remove or cut away one side of the first made cut and thereby enlarge the inner portion of the cut or opening made in the pipe so that the opening has inwardly divergent side walls, the entrance to the outer part of the opening remaining the same or substantially the same in width as made by the first cut. The cutter on the second cut is preferably fed into the pipe an amount equivalent to the amount that it was fed into the pipe upon the first cut. To remove any burrs or rough edges that there may be in the opening or perforation the cutter, while in the pipe at the end of the second cut, may be swung back to its original angular position with relation to the pipe, and, if necessary, between its two angular positions, whereupon it can be removed from the pipe leaving the slot or perforation completely finished. By our present method an inwardly divergent slot is formed with the use of a simple disk cutter by two simple operations

of the cutter and entirely from the exterior of the pipe. The first cut having been made the inward divergence is given to the opening or perforation by cutting away one wall of the first cut through the first made opening at the exterior of the pipe.

The machine provided by our present invention for perforating pipe, and which is particularly suited for forming perforations of the character above mentioned, and for carrying out the method just described, includes, generally, a cutter 10, power means 11 for operating the cutter, and a support for the cutter. The support, in accordance with the preferred form of construction, includes a base 12 adapted to be mounted on the pipe P, and a carrier 13 supporting the cutter 10 so that the cutter can be tilted or adjusted about an axis longitudinal of the pipe and can be moved or fed into and out of engagement with the pipe. The base 12 may be in the form of a plate having a straight bottom 14 adapted to engage or seat on the pipe P. The base is provided with means for bracing it on the pipe P, which means may, when the base is in the form of a flat plate, include a plurality of set screws 15 which project downwardly through the plate to engage the pipe, in the manner clearly illustrated in Fig. 2 of the drawings. This particular means of bracing the base is extremely simple, and is readily adjustable to accommodate pipe of various sizes, and is adjustable to adjust or vary the angularity between the base and pipe if such becomes necessary.

It is desirable to equip the machine with means for releasably connecting the base 12 with the pipe P so that the base will not shift or move on or with relation to the pipe during operation of the machine. In accordance with the broader aspects of our invention various means may be provided for connecting or securing the base on the pipe. In the drawings we have disclosed a clamping device for this purpose. The clamping device includes jaws 16, pivotally connected with the base and adapted to clamp onto the pipe. The jaws may be connected with opposite sides of the base 12 by suitable pivot pins 17, and may be shaped and proportioned to accommodate and properly grip the pipes or casings on which the machine is to be used. Suitable means may be provided for operating or actuating the jaws. The actuating means illustrated in the drawings is a screw means, including a screw 18 oppositely screw threaded at its two ends. The ends of the screw are threaded through blocks 19 pivotally connected with arms 20 which extend upwardly from the jaws 16. A suitable hand wheel 21 is provided on the screw for operating it. Rotation of the screw in one direction moves or forces the arms 20 apart and thereby forces the jaws 16 together and into clamping engagement with the pipe, while rotation of the

screw in the opposite direction draws the arms together and thereby releases the jaws 16. The particular mechanism just described is, of course, one particular form of mechanism that may be employed in carrying out our invention, and has been herein set forth simply because it is simple, effective and convenient.

In the particular form of the invention illustrated in the drawings, the carrier 13 includes, generally, a body 22 which is connected with the base 12, and an arm 23 connected with the body 22. The body 22 is spaced somewhat above the base 12, and is in the form of an elongate frame. The body 22 is pivotally connected with the base 12 so that it is movable or can be tilted relative to the base about an axis longitudinal of the machine, or the pipe to which the machine is applied, and located at or close to the outer surface of the pipe. Although the desired pivotal connection between the base and body may be obtained in various manners we have found it desirable to provide an arcuate segment 25 at the upper side of the base, and an arcuate segment 26 in connection with the body to cooperate with the segment 25. The segment 25 is rigidly connected by its ends to the base 12 so that it is concentric with the pivotal axis of the body, or, in other words, so that its axis or center is at or close to the plane of the pipe to which the machine is applied. The segment 26 is rigidly connected with the body by suitable legs 27, and is shaped and curved to fit or correspond to the front of the segment 25. A concentric rib 28 may be provided on the face of one of the segments to slidably fit a concentric groove 29 in the face of the other segment to guide the segments in proper cooperating relation. The segment 26 may be held in proper engagement with the segment 25 by a retaining plate 30 which engages over or back of the segment 25, and is connected to the segment 26 by suitable bolts 31. In the particular form of machine shown in the drawings the pivotal connection just described is located at one end of the machine, which we will term the forward end, and the parts are arranged and proportioned so that the body extends freely through or between the segment 25 and base 12. The body 22 extends to the other or rear end of the base where it may be suitably supported, for instance, by a projection 34 resting on a curved bearing surface 35 provided on the base, the bearing surface 35 being concentric with the segment 25.

As a means for controlling the movement of the body with relation to the base we have provided an operating lever 60 in connection with the segment 26, and have provided a locking pin 61 in connection with the lever to cooperate with notches 62 in the segment 25 to lock the segments against relative movement. The notches may be located in the segment 25 so that the segments may be

locked in various predetermined relative positions.

The arm 23 is pivotally connected to the rear end of the body, extends forward over the body, and projects beyond the forward end of the body to carry the cutter 10. The arm is pivotally connected with the body by a suitable pivot pin 36 so that it is movable about an axis transverse of the machine and the pipe to which the machine may be applied. The forward projecting portion of the arm is in the form of a yoke 37 which carries an arbor or shaft 40. The cutter 10 is mounted on or carried by the arbor 40, and is in the form of one or more disks 41 provided at their peripheries with teeth or cutting parts so that they are in the form of milling cutters. The axis of the arbor is parallel with the pivotal axis of the arm and is, therefore, transverse of the arm and is at right angles to the longitudinal axis of the machine. The arm extends freely through or between the legs 27 and between the segment 26 and body 22 so that it is free to be moved or swung the desired amount about its axis of pivotal connection with the body. The body has an upwardly extending part 45 which extends upwardly through the yoked part 37 of the arm and operates to brace and guide the forward end of the arm. The part 45 slidably fits the yoke, and, therefore, braces the arm close to the cutter. The arm 23 is normally held up or in a raised position by means of a suitable spring 46 interposed between the body and arm, and is adapted to be moved downwardly to feed the cutter into engagement with the pipe by means of an operating lever 47. The lever 47 is connected to the upper end of the projecting part 45 by a pivot pin 50, and is connected with the arm by a link 51. The arrangement of the lever and link is clearly illustrated in Fig. 4 of the drawings.

The power means 11 for operating the cutter may comprise an electric motor 70 mounted on a suitable part, for instance, the arm 23, and a drive between the motor and arbor 40 which carries the cutter. The drive between the motor and arbor may be in various forms; we have shown a belt 71 running over pulleys 72 and 73 mounted on the motor shaft 74 and arbor 40, respectively.

In operation the machine is applied to a pipe by placing the base 12 on the pipe and securing it in position by means of the clamping jaws 16. The base is, of course, braced on the pipe by the set screws 15, and if so desired is supported by the set screw so that it does not actually touch the pipe. The clamping jaws are tightened onto the pipe through operation of the hand wheel 21. With the base in position the carrier, in the case of the particular machine above described the body 22, is adjusted to the desired tilted position with relation to the base,

for instance, to a position such as is shown in Fig. 2 of the drawings, so that the cutters are likewise tilted or are in position to engage the pipe somewhat diagonally. With the body adjusted and locked by the pin 61 and the cutter driven by the motor the operating lever 47 is moved downwardly causing the arm to swing or move downwardly and carry the cutter into engagement with the pipe. The operator continues to move the lever 47 down until the cutter has cut the desired distance into or through the pipe, whereupon the lever is released or moved to the up position to remove the cutter from the pipe. The body is then moved to another position with relation to the base, preferably to an opposite tilted position, and is set or locked in the desired position by means of a locking pin 61. The cutter is then again fed into engagement with the pipe by means of the lever 47, and will, upon engaging the pipe, enter the opening or openings made by the operation just described. However, as the cutters are fed through the pipe they will, due to their different angular position with relation to the pipe, cut away one side of the opening or openings in the pipe so that the finished opening or openings have inwardly divergent side walls. If necessary the cutter can be rocked or swung between its two positions to clean the opening or openings. When the second cut is completed the lever 47 may be released, whereupon the base 12 may be released and moved to another position on the pipe where the operation just described may be repeated. In Fig. 2 of the drawings we illustrate the machine in position where it is has just completed the second cut. This figure of the drawings clearly illustrates the manner in which the cutter or blades enter or operate through the outer part of the opening first cut to cut away one side or wall of the cut to make the opening inwardly divergent without enlarging the outer end of the opening.

Having described only a typical preferred form of our invention we do not wish to limit ourselves to the specific details hereinabove set forth but wish to reserve to ourselves any changes or variations that may appear to those skilled in the art or fall within the scope of the followings claims.

Having described our invention, we claim:

1. A pipe perforating machine including, a cutter, and a mounting for the cutter adapted to be arranged on a pipe and including a cutter supporting part adjustable about an axis close to the outer surface of the pipe and operable to feed the cutter laterally into engagement with the pipe.

2. A pipe perforating machine including, a cutter, and a mounting for the cutter adapted to be arranged on a pipe and including a cutter supporting part having a longitudinal pivotal axis substantially in line with the cut-

ter and close to the outer surface of the pipe and a transverse pivotal axis.

3. A pipe perforating machine including, a cutter, and a mounting for the cutter adapted to be arranged on a pipe and including a cutter supporting part having two independently operable pivotal axes one substantially in line with the cutter and close to the outer surface of the pipe and the other transverse of the first mentioned axis.

4. A pipe perforating machine including a cutter, a mounting for the cutter adapted to be arranged on a pipe embodying a part adjustable about an axis substantially coincident with the outer surface of the pipe and operable to move the cutter laterally into engagement with the pipe, and power means for actuating the cutter mounted on said part.

5. A pipe perforating machine including, a disk cutter, a mounting for the cutter adapted to be arranged on a pipe embodying a cutter carrying part adjustable about an axis substantially in line with the cutter and close to the outer surface of the pipe and operable to move the cutter laterally into engagement with the pipe, and power means carried by said part to drive the cutter.

6. A pipe perforating machine including, a cutter, and a mounting for the cutter adapted to be arranged on a pipe embodying a base stationary with the pipe, and a cutter carrying part carried by the base and adjustable about an axis substantially in line with the cutter and close to the outer surface of the pipe and operable to move the cutter into engagement with the pipe, and means whereby the said part is normally in position so that the cutter is out of engagement with the pipe.

7. A pipe perforating machine including, a disk cutter, and a mounting for the cutter adapted to be arranged on a pipe embodying a base adapted to be mounted stationary on the pipe and a cutter carrying part pivotally connected with the base about an axis substantially in line with the plane of the cutter and close to the outer surface of the pipe and about an axis transverse of the plane of the cutter.

8. A pipe perforating machine including a cutter, and a mounting for the cutter adapted to be arranged on a pipe embodying a base adapted to be mounted stationary on the pipe, a cutter carrying arm carried by the base adjustable with relation to the base about an axis substantially in line with the cutter and operable to move the cutter into engagement with the pipe, and means for setting said arm against movement about said axis.

9. A pipe perforating machine including, a cutter, and a mounting for the cutter adapted to be arranged on a pipe embodying a base to be mounted stationary on the pipe, an arm carrying the cutter at one end and operable to move the cutter into engagement with the

pipe, and a pivotal connection between the base and arm located near the cutter carrying end of the arm.

10. A pipe perforating machine including, a cutter, and a mounting for the cutter adapted to be arranged on a pipe embodying, a base adapted to be mounted stationary on the pipe, a body connected with the base about an axis longitudinal of the pipe and lying close to the outer surface of the pipe, and a cutter carrying arm pivotally connected with the body about an axis transverse of the pipe.

11. A pipe perforating machine including, a cutter, a mounting for the cutter adapted to be arranged on a pipe embodying, a base adapted to be applied to the pipe, a body, a pivotal connection between the body and base the axis of said connection being longitudinal of the pipe, an arm having one end connected to one end of the body and the other end extending beyond the other end of the body and carrying the cutter, and a part extending from the last mentioned end of the body to guide the cutter carrying end of the arm, the pivotal connection between the body and base being located at the end of the body closest the cutter.

12. A pipe perforating machine including, a cutter embodying a plurality of spaced disks, a base adapted to be applied to a pipe, means for adjusting the base with relation to the pipe, means for releasably securing the base on the pipe, a body pivotally connected with the base about an axis longitudinal of the pipe and lying close to the outer surface of the pipe, releasable means for setting the body against movement with relation to the base, an arm pivotally connected with the body about an axis transverse of the pipe and supporting the cutter with the planes of the disks substantially parallel to the longitudinal axis of the pipe, means for operating the arm to move the cutter into engagement with the pipe, means whereby the arm is normally in position with the cutter out of engagement with the pipe, and power means for operating the cutter mounted on the arm.

13. A machine for perforating a pipe including a cutter, and a mechanism connecting the pipe and cutter operable to vary the angular relation between the pipe and cutter and to bring the pipe and cutter into engagement, the cutter including a plurality of spaced disk blades.

14. A machine for perforating a pipe comprising a cutter, a stationary base and a mounting carried by the base for feeding the cutter and said mounting being operable relative to the base to position the cutter in different angular positions transversely of the pipe.

15. A machine for perforating pipe including a cutter, a stationary base and a mechanism on the base for supporting the cutter and operable to vary the angular cut-

ting plane of the cutter and to bring the pipe moving the cutter into engagement with the
and cutter into engagement. pipe.

16. A machine for perforating a pipe in- In witness that we claim the foregoing we
cluding a cutter, a stationary base and a have hereunto subscribed our names this 8th
5 mechanism on the base for supporting the day of March, 1924.

M. SUMTER BLACK.
IRA J. McCULLOUGH.