Dec. 15, 1953 F. H. MUELLER 2,662,428

LINE STOPPER SHELL CUTTER

Filed July 31, 1951

Fig 1.

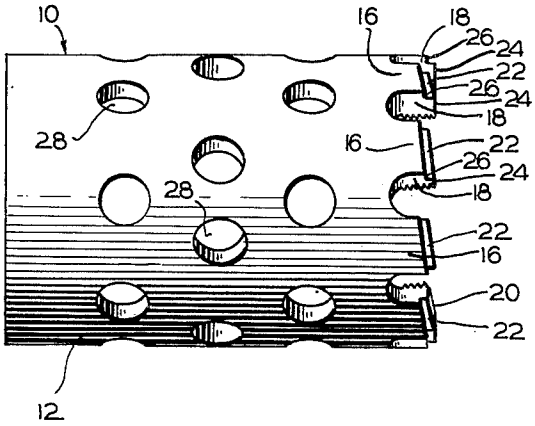


Fig 2.

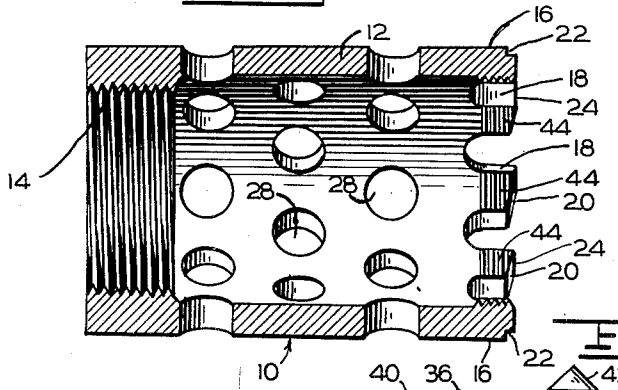


Fig 3.

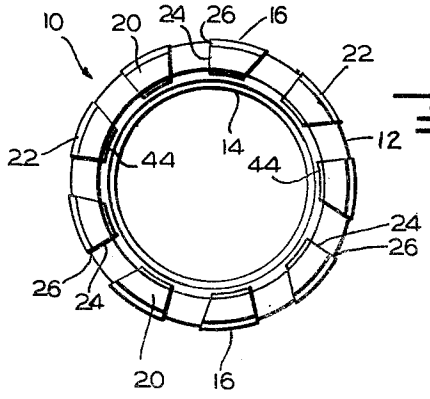


Fig 5.

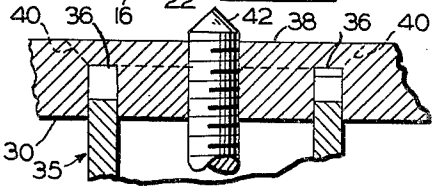
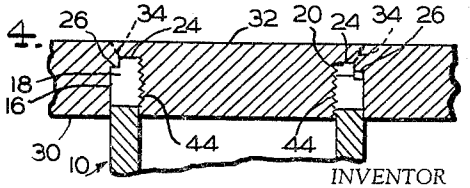


Fig 4.



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Patented Dec. 15, 1953

2,662,428

UNITED STATES PATENT OFFICE

2,662,428

LINE STOPPER SHELL CUTTER

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Application July 31, 1951, Serial No. 239,595

2 Claims. (Cl. 77—69)

1

This invention relates to shell cutters and more particularly to an improved shell cutter especially adapted for cutting pipe lines and for retaining, and removing with the cutter, the coupon cut out from the pipe line by the cutter.

Shell cutters are boring tools of an annular construction in the form of a hollow cylindrical shell having an annular cutting edge which cuts away only an outer concentric ring portion of the material. The disc-like central or intermediate portion thus cut out is conventionally termed a coupon. Conventional shell cutters are usually provided with a central threaded pilot bit or drill, the function of which is to both center the cutter and retain the coupon cut out thereby so that such coupon may be withdrawn from the hole. This latter function is particularly important in pipe lines. With the conventional pilot bit type of cutter, however, difficulty is frequently had in removing coupons from the pipe. The ordinary cutter, when emerging through the inner wall of the pipe, usually will fracture the coupon off along forwardly flaring lines, thus giving the coupon a ragged rim, slightly larger than the hole which is cut. Hence, when the shell cutter is withdrawn, the coupon is often pulled off the pilot bit and falls into the main or pipe being cut. The disadvantages attendant with such loss of the coupon are obvious, particularly when the main is in service.

Hence, it is an object of this invention to provide an improved shell cutter which will positively retain and withdraw the coupon with the cutter.

It is another object of this invention to provide an improved shell cutter in which the coupon formed thereby has a diameter at least small enough to pass through the hole ultimately made by the cutter.

It is a further object of this invention to provide an improved shell cutter of simple and inexpensive construction which will accomplish the above objects.

Other objects and advantages of the invention will be apparent from the following description and accompanying drawings, in which:

Figure 1 is a side elevational view of a shell cutter embodying this invention.

Figure 2 is a longitudinal sectional view of the shell cutter shown in Figure 1.

Figure 3 is an end view of the shell cutter shown in Figure 1, taken from the toothed end.

Figure 4 is a diagrammatic view of the operation of a shell cutter embodying this invention, and

2

Figure 5 is a diagrammatic view of the operation of a conventional shell cutter.

Referring now to the drawings, there is shown in Figure 1 a shell cutter 10 embodying this invention. The cutter comprises a hollow cylindrical shell 12 having means at the rearward end thereof, such as the inner threads 14, for attaching the cutter to a boring bar (not shown) for rotation thereby. The other end of the shell 12 is provided with a plurality, nine as shown in the drawings, of axially extending integral cutting teeth 16. Preferably the diameter of the shell 12 tapers slightly rearwardly. The front of each tooth (i. e., with reference to its direction of rotation) is provided with a substantially plane radial cutting surface 18, while the forward end of each tooth has a surface 20 that is inclined rearwardly of the direction of tooth movement. The intersection of these two surfaces form a cutting edge described in greater detail hereinafter.

The outer forward end edge of each tooth 16 is recessed, as at 22. This recess divides the cutting edge of each tooth into two parts—one, an advance inner cutting edge 24 and, two, a following outer cutting edge 26. It will be noted that the following cutting edge 26 is much shorter than the advance cutting edge 24.

Although the cutting surface 18 of each tooth 16 is shown in the drawings as being a plane radially disposed surface, it will be understood that this surface need not be plane nor disposed exactly radially of the cutter but, instead, may be curved and/or arranged at an angle to a radius extending through such surface. Likewise, the cutting edges 24 and 26 need not be straight. It is essential, however, that the advance and following cutting edges 24 and 26, respectively, be offset both radially and axially as shown. Preferably, during the manufacturing process, the teeth 16 are hardened and have the hardness of their roots subsequently drawn to provide a spring temper thereto.

The intermediate section of the shell 12, between the teeth 16 and the attaching threads 14, preferably is provided with several circumferential series of holes 28 to permit adequate lubrication of the cutter and for permitting the passage of fluid therethrough when cutting a pipe line that is in service.

In use, the inner annularly arranged series of cutting edges 24 acts in advance and, when these cutting edges have cut almost entirely through the wall 30 of a pipe, the coupon 32 may fracture off along the forwardly flaring ragged edges 34

indicated in Figure 4 of the drawings. This fracturing off of the coupon 32 before the cut has been completed causes the diameter of the coupon to be somewhat greater than that of the cut made by the annularly arranged series of advance cutting edges 24. It will be noted, however, that the lines of fracture 34 do not extend radially outwardly beyond the area to be encountered and cut by the annularly arranged series of following cutting edges 26. Therefore, this latter series of following cutting edges will ream off the ragged edge of the opening left by the coupon 32 to provide a smooth walled cut having a diameter large enough to receive the coupon which has been fractured off by the advance cutting edges 24.

In contrast to the operation of a shell cutter embodying this invention, a conventional shell cutter 35 having a single series of cutting edges 36 will fracture off a coupon 38 along the ragged edges 40 indicated in Figure 5 of the drawings. It will be noted in this instance that the lines of fracture 40 extend radially outwardly beyond the diameter of the annular cut made by the single series of cutting edges 36. Hence, the coupon 38 has a ragged rim of a diameter somewhat greater than that of the circular hole made by the cutter 35. This coupon 38 is retained on the pilot drill 42 of the conventional cutter but is frequently pulled off of the same when withdrawing the cutter from the main upon completion of the boring operation.

In order to retain the coupon 32 cut from the pipe by the improved cutter 10 and to provide some means for withdrawing the same from the hole, the inside of the shell 12, adjacent its forward end, is provided with tapping threads 44 on the inner side of each tooth 16. These threads 44 serve to tap and securely grip the coupon 32 so that after the hole has been cut through the pipe the coupon will be withdrawn simultaneously with the cutter 10. Preferably, these threads 44 have the same pitch as the rate of automatic feed per revolution of the cutter. In this connection it is pointed out that shell cutters of this type, particularly when cutting holes into or through a pipe line, are normally used with a drilling machine having an automatic feed. Hence, as previously stated, the tapping threads 44 have the same pitch as the rate of feed per revolution of the automatic feed device incorporated in the drilling machine. It has been found in actual practice that these threads 44 grip the coupon 32 so tightly that it is even somewhat difficult to remove the coupon from the cutter 10 after the cutter has been withdrawn from the pipe.

It has also been found that in the smaller forms of the improved cutter described above no pilot drill is required. A pilot drill supplies some guiding of the cutter during the cutting operation, but the principal function of such pilot drill in conventional main-boring cutters is to retain the removed coupon for withdrawal with the cutter. It may be necessary, however, to employ a pilot drill with the larger sizes of the improved cutter 10 in order to steady the same in use.

It will be realized that the specific embodiment of the invention described is for the purpose of illustrating the principles of the invention and that various changes may be made by one skilled in the art while retaining these same principles. Therefore, this invention includes all modifications and embodiments which are encompassed by the spirit and scope of the following claims.

I claim:

1. In a shell cutter for making an annular cut through the side wall of a pipe line so that removal of the resulting coupon leaves a circular aperture, the cutter having an annular series of axially extending teeth each provided with inner and outer curved surfaces and a somewhat rearwardly inclined end surface, the combination of means defining a step at the outer edge of the end surface of each tooth to form inner and outer cutting edges thereon with said outer cutting edge being offset rearwardly of said inner cutting edge with reference to the direction of feed of the cutter, the length of said outer cutting edge being less than the length of said inner cutting edge, whereby if the coupon fractures off along forwardly flaring surfaces when the cutter has nearly completed an annular cut through the side wall of a pipe line, the fracture surfaces will extend from the cut made by said inner cutting edges and result in a coupon of less major diameter than the diameter of the cut made by said outer cutting edges and the latter will ream off the ragged edges of the aperture in the pipe wall so that the coupon can be withdrawn easily through such aperture.

2. The structure defined in claim 1 wherein the depth of the step substantially equals its radial dimension whereby the outer cutting edge is offset rearwardly from the inner cutting edge by a distance substantially equal to the length of said outer cutting edge.

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