Sept. 6, 1927. 1,641,483

H. M. GREENE

MEANS FOR CUTTING OIL WELL CASINGS AND DRILL PIPE

Filed April 8, 1925

Fig. 1

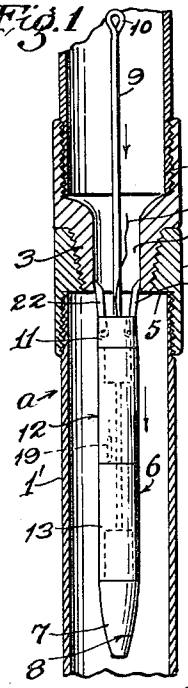


Fig. 3

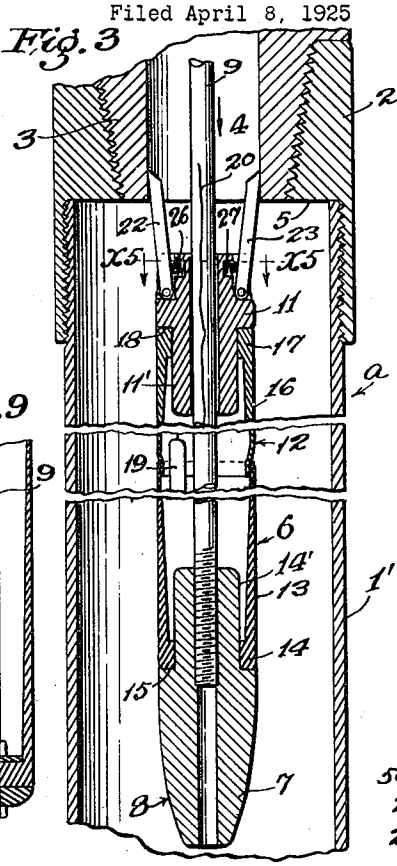


Fig. 7

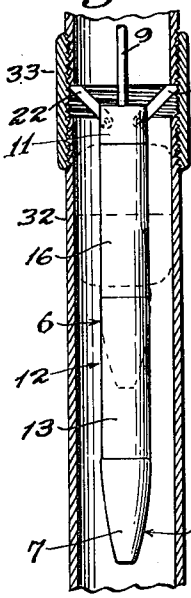


Fig. 8

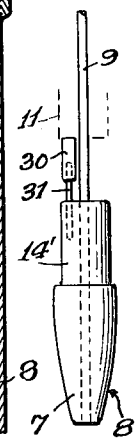


Fig. 9

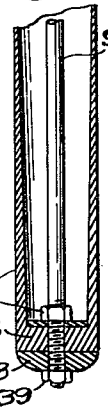


Fig. 5

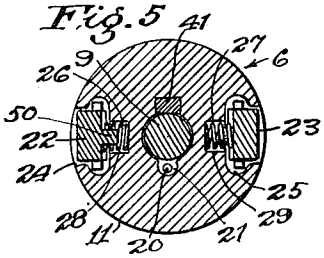


Fig. 2

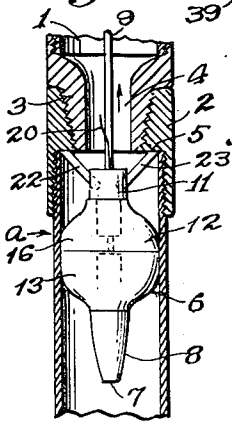


Fig. 4

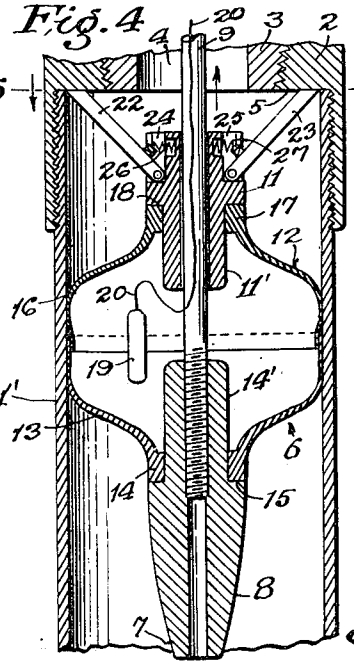


Fig. 6

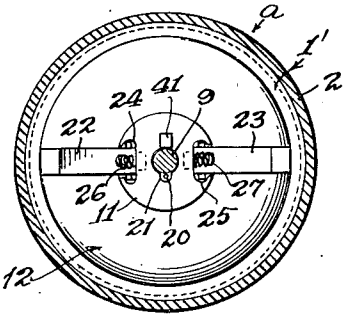
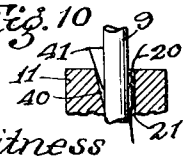


Fig. 10



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UNITED STATES PATENT OFFICE.

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MEANS FOR CUTTING OIL-WELL CASINGS AND DRILL PIPE.

Application filed April 8, 1925. Serial No. 21,598.

It occasionally happens in drilling an oil well, that due to an accident or some other unforeseen difficulty the casing or drill pipe or stem becomes wedged or immovably secured in the well, and it is then necessary to sever the drill stem or casing in order that it may be reclaimed; and it is preferable to sever such casing adjacent the point at which it is held in order that a maximum length may be recovered.

An object of my invention is to provide a novel explosive torpedo that will sever the drill pipe or casing when exploded.

Another object is to provide a novel torpedo whereby the drill pipe or casing may be completely severed with a smaller charge of explosive than has heretofore been possible.

A further object is to provide a novel torpedo whereby the explosive mixture may be firmly brought into engagement with the walls of the drill pipe or casing prior to exploding such mixture.

My invention is broadly new, basic and pioneer in that I insert within the drill pipe or casing an explosive torpedo having a relatively small diameter, then compress and expand the explosive charge so as to bring it into engagement with the walls of the drill pipe or casing, and then discharge the torpedo while in the expanded position.

Features of the invention are the provision of an efficient, short length and small diameter torpedo, which may be readily inserted through the hole in the center of the drill pipe connections.

Further features are that the explosive may be tightly compressed prior to the discharging thereof, and in the provision between the torpedo and the sand line of a coupling which may be broken to release the sand line if desired.

Heretofore, explosive charges have been used to sever drill pipes, but such charges have not been satisfactory because heretofore it was impossible to insert a torpedo through the small passages in the drill stem connections that would positively sever the pipe under all conditions. It is well understood that if the explosive charge does not engage the entire periphery of the walls of the drill stem that a hole is liable to be blown out one side or another and the casing or drill stem will not be entirely severed.

In this specification it is understood that the term drill stem is a casing.

An object is to provide simple and efficient means whereby a drill stem may be completely severed by an explosive charge set off within the drill stem.

My novel method of cutting drill stems comprises first inserting an explosive charge into a string of connected drill pipes, then maintaining one end of said charge in practically fixed relation relative to the drill stem, then moving the other end of said charge toward the fixed end thereby contracting and expanding the charge and forcing it into engagement with the drill stem walls, and then exploding the charge.

Other objects, advantages and features of invention, may appear from the accompanying drawing, the subjoined detailed description and the appended claims.

The accompanying drawing illustrates my invention in some of the forms I at present deem preferable.

Figure 1 is a side elevation of my torpedo in a drill stem, a portion of which is shown in section.

Fig. 2 is a view similar to Fig. 1, but showing the torpedo in axially contracted and radially expanded position.

Fig. 3 is an enlarged fragmentally longitudinal axial sectional view of my torpedo in a drill stem.

Fig. 4 is a view similar to Fig. 3, showing the torpedo axially contracted, and radially expanded against the drill stem.

Fig. 5 is a sectional view on line x^5, Fig. 3.

Fig. 6 is a sectional view on line x^6, Fig. 4.

Fig. 7 is a side elevation of my torpedo in position in a well casing a fragment of which is shown in section.

Fig. 8 is a fragmentary detail side elevation of the torpedo point and showing a slightly modified form of detonator.

Fig. 9 is a fragmentary sectional view of a modified form of torpedo point and explosive containing tube.

Fig. 10 is a fragmental detail view showing the wedge means for retaining the slidable collar in fixed relation to the center rod.

The casing a in Figs. 1–4 is the usual hollow drill pipe comprising a plurality of sections 1, 1′, etc., which are connected together by the usual connections or collars 2 to form the drill stem. The collars 2 are

of the usual construction and are provided with a tapered male and female threaded section 3 and with the usual passages or openings 4 that connect the bores of adjacent sections of the drill pipe.

The collars 2 are provided with inwardly extending shoulders 5, 5'.

My torpedo 6 in normal position is of such a diameter that it will conveniently pass through the openings 4, and may therefore be lowered to any desired depth in the drill stem. The torpedo comprises a point 7, which is formed with a rounded surface or tapered exterior 8 so that it will more readily pass through the openings 4.

A supporting rod 9 preferably of steel is threaded or otherwise suitably secured at one end in the point 7, and is provided with a loop 10 at its other end to receive convenient means for coupling the rod to the usual sand line (not shown). It is desirable that such connecting means be sufficiently weak that it may break before the sand line, yet such means are strong enough for operative purposes. The connection is made weaker so as to permit the sand line to be released and withdrawn if the torpedo should become stuck at a point other than where it is desired to explode the charge.

A dog carrier or collar 11 is slidably mounted on the rod 9. An expansible, flexible or yieldable explosive containing tube or sheath 12 is mounted between the collar 11 and point 7, and comprises a lower member 13, which has at one end a thick non-expansible portion or ring 14 that fits a reduced portion 14' on the point 7 and engages a shoulder 15 formed by such reduced portion, and also comprises an upper member 16 which has at one end a thick non-expansible portion or ring 17 that fits a reduced portion 11' on the collar 11 and engages a shoulder 18 formed thereby on the collar 11.

The other ends of the members 13 and 16 telescope with each other to form the tube 12, and are sufficiently thin adjacent the telescoping part to readily expand for engagement with the walls of the drill rod or casing. The tube 12 may be made of any desirable material, which is sufficiently pliable or expansible, and may be formed in one or more pieces as may be found preferable.

The tube 12 is filled with a suitable explosive, not shown, for purposes of clearness, but which is well known and is preferably of a thick gelatinous consistency. A detonator 19 is positioned in the tube 12 and electric wires 20 extend therefrom through a longitudinal bore or groove 21 in the collar 11 to a suitable source of electrical energy that is controlled on the surface of the ground.

A pair of dogs 22, 23 are pivotally mounted in recesses 24, 25, respectively, formed in the upper end of the collar 11, and springs 26, 27 engage the dogs 22, 23, respectively, to urge them outwardly. The springs 26, 27 fit in recesses 28, 29, respectively, in the collar 11 and encircle pins 50 fixed to the dogs 22, 23 to prevent accidental displacement of the springs and dogs.

A recess 40 is formed in the top of the collar 11 and is adapted to receive a tapered key 41 that is driven into the recess 40 and against the rod 9 to prevent accidental upward movement of the collar 11 on the rod 9 and thus also prevents the collar 11 from being accidentally caught on projections in the casing and separated from the tube 12 when the torpedo is being lowered into a casing.

In Fig. 8, I have shown a modified form of exploding the detonator 30 which is mounted on a pin 31 that is secured in the upper end of the reduced portion 14' of point 7, and is adapted to be exploded when forced against such pin 31 by the collar 11 when the torpedo is axially contracted.

In Fig. 9 the explosive container 35 is formed at both ends with a thick end and collar section 36, which is received on the rod 9 and the lower end section is clamped between a nut 37 above the section 36 and a rounded point or washer 38 below the said section. A nut 39 holds the washer in place on the rod. The point 38 may be tapered if desired to assist in passing the torpedo through the opening 4.

In operation the sand line is secured to the rod 9 and the torpedo 6 is lowered into the hollow drill stem *a*. The diameter of the torpedo is such that it will readily pass through the openings 4. When the depth is reached at which it is desired to sever the casing or drill stem, the sand line and the torpedo are drawn upwardly until the dogs 22, 23 which have been forced outwardly by springs 26, 27 engage the shoulders 5 and prevent further upward movement of the collar 11.

Further upward movement of the sand line draws the rod 9 and point 7 upwardly towards the collar 11. The middle of the tube 12 being thin will readily bulge outwardly until it comes into engagement with the entire periphery of the walls of the drill stem, as shown in Figs. 2 and 4.

The explosive in the tube will be tightly compressed in complete contact with the drill stem and when it is exploded by the detonator 19 the force of the tightly packed explosive will sever the drill stem at the point of contact.

The point 7 and collar 11 are preferably formed of a soft metal so that the explosion will shatter them after which the sand line may be readily withdrawn.

As shown in Fig. 7, my torpedo may be

employed to sever a well casing 32. The construction of the torpedo is identical to that already described, the only difference being that the dogs 22, 23 engage the shoulders formed by the lower end of a section of casing in the joint 33 to prevent upward movement of the collar 11 and as before stated the term casing includes a drill stem.

I claim:

1. A torpedo for cutting oil well casing or drill pipe comprising a flexible tube containing an explosive; a rod for supporting said tube, and means to expand said tube against the wall of the casing or pipe on the upward movement of said rod.

2. A torpedo for cutting oil well casing or drill pipe comprising a rod; a flexible tube containing an explosive; means securing the lower end of said tube to said rod; means slidably mounting the upper end of said tube on said rod; and means to expand said tube against the wall of the casing or pipe on the upward movement of said rod.

3. A torpedo for cutting oil well casing or drill pipe comprising a rod; a flexible tube containing an explosive; means securing the lower end of said tube to said rod; means slidably mounting the upper end of said tube on said rod; means to expand said tube against the wall of the casing or pipe on the upward movement of said rod; and means to detonate the explosive.

4. A torpedo for cutting oil well casing or drill pipe comprising a rod; a flexible tube containing an explosive; means securing the lower end of said tube to said rod; means slidably mounting the upper end of said tube on said rod; means limiting the upward movement of the upper slidable mounting means; and means to draw the rod upwardly and expand said tube against the walls of said pipe or casing.

5. A torpedo for cutting oil well casing or drill pipe comprising a rod; a flexible tube containing an explosive; means securing the lower end of said tube to said rod; means slidably mounting the upper end of said tube on said rod; means limiting the upward movement of the upper slidable mounting means; means to draw the rod upwardly and expand said tube against the walls of said pipe or casing; and means to detonate said explosive.

6. A torpedo for cutting oil well casing or drill pipe comprising a rod, a flexible tube containing an explosive; a point secured to said rod, a collar slidably mounted on said rod; means to mount said tube on said collar and point; and means limiting the upward movement of said collar.

7. A torpedo for cutting oil well casing or drill pipe comprising a rod, a flexible tube containing an explosive; a point secured to said rod, a collar slidably mounted on said rod; means to mount said tube on said collar and point; means limiting the upward movement of said collar; means to draw said rod upwardly and expand said tube outwardly, and manually controlled means to detonate said explosive.

8. A torpedo for cutting oil well casing or drill pipe comprising a rod, a flexible tube containing an explosive; a point secured to said rod, a collar slidably mounted on said rod; means to mount said tube on said collar and point; dogs pivotally mounted on said collar; and means urging said dogs outwardly to engage an obstruction in the pipe or casing and limit the upward movement of said collar.

9. A torpedo for cutting oil well casing or drill pipe comprising a rod, a flexible tube containing an explosive; a point secured to said rod, a collar slidably mounted on said rod; said tube comprising an upper member, a non-expansible ring on one end of said upper member adapted to encircle said collar, a lower member having a non-expansible ring on one end thereof encircling said point, the outer ends of said upper and lower members being thin and telescoping; and means limiting the upward movement of said collar.

10. A torpedo for cutting oil well casing or drill pipe comprising a rod, a flexible tube containing an explosive; a point secured to said rod, a collar slidably mounted on said rod; said tube comprising an upper member, a non-expansible ring on one end of said upper member adapted to encircle said collar, a lower member having a non-expansible ring on one end thereof encircling said point, the outer ends of said upper and lower members being thin and telescoping; dogs pivotally mounted on said collar and adapted to engage an obstruction in said pipe or casing; and means to detonate the explosive.

11. A torpedo for cutting oil well casing and the like, comprising a flexible tube containing an explosive charge; a rod connected to said tube, and spring actuated means for holding the torpedo against upward movement during the compression and expansion of the tube by the upward movement of said rod.

12. A torpedo for cutting oil well casing and the like, comprising a flexible tube containing an explosive charge; a rod connected to said tube and said rod being adapted for upward movement to force said tube into engagement with the well casing prior to firing said explosive charge.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 2nd day of April, 1925.

HASKELL M. GREENE.