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J. V. O'BRIEN

2,631,114

METHOD OF CLEANING OUT OBSTRUCTIONS FROM CONDUITS

Original Filed Jan. 13, 1948

FIG. 1.

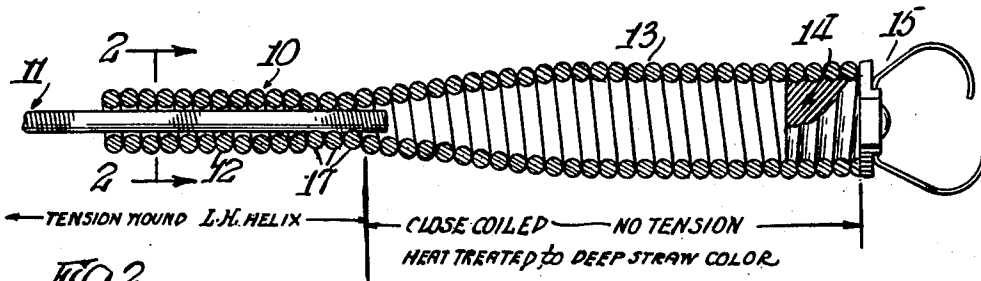


FIG. 2.

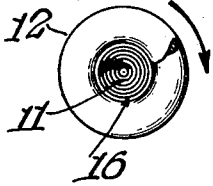


FIG. 3.

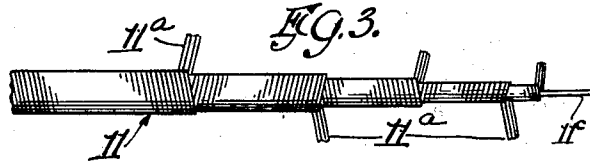


FIG. 4.

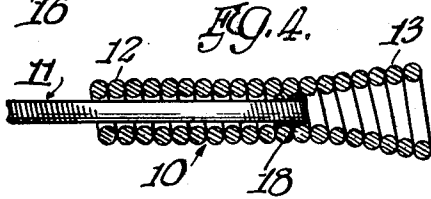


FIG. 5.

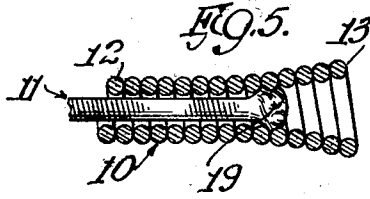


FIG. 6.

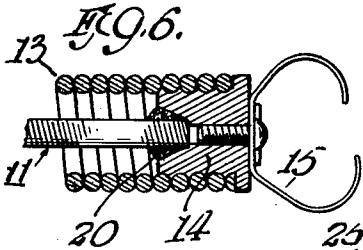


FIG. 7.

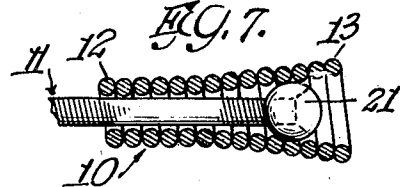
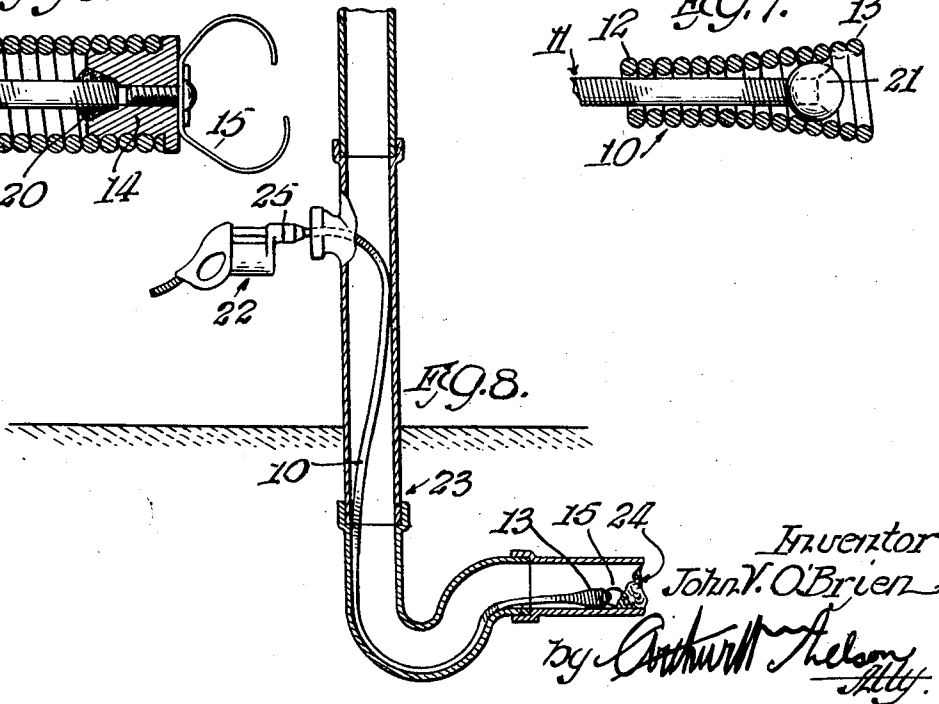


FIG. 8.



Inventor
 John V. O'Brien
 by Arthur Helson
 Atty.

UNITED STATES PATENT OFFICE

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METHOD OF CLEANING OUT OBSTRUCTIONS FROM CONDUITS

John V. O'Brien, Park Ridge, Ill.

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3 Claims. (Cl. 134—8)

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This invention relates to improvements in methods of cleaning out obstructions from conduits of which sewers, drains, pipes and the like are examples and it consists of the matters hereinafter described and more particularly pointed out in the appended claims.

This application is a division of my co-pending application Serial Number 2,037, filed January 13, 1948.

Cross-reference is also hereby made to my co-pending application Ser. No. 2,038, filed January 13, 1948, entitled Methods of and Apparatus Employing an Elongated Flexible Member for Cleaning Out Obstructions From Conduits, which relates to somewhat similar subject matter.

It is an object of the invention to provide an improved method of removing obstructions from conduits with the aid of a coil which may be entered into and worked along an obstructed conduit while in a substantially free flexible condition and then reduced in diameter by an axial turning of the coil after its work end has engaged an obstruction causing the coil to grip a core within the coil whereby the core internally supports and reinforces the coil against damage when the coil transmits the power required to turn the coil at the work end as when removing an obstruction.

The above mentioned object of the invention, together with others, along with the advantages thereof, will more fully appear as the specification proceeds.

In the drawings:

Fig. 1 is a longitudinal sectional view, substantially on a full size scale of the work end of one form and size of apparatus, including a coil and a core that may be advantageously employed in carrying out the improved method and showing one way in which the core may be operatively attached to the coil to one point in the length of the coil, the space between the coil and core being somewhat exaggerated.

Fig. 2 is a transverse sectional view on line 2—2 of Fig. 1 but on an enlarged scale, through a part of the coil and core, back of the work end of the coil and more accurately showing the annular clearance space between the external surface of the core and the internal surface of the coil when the coil is free from torque.

Fig. 3 is a view in elevation, better showing the preferred form of flexible core employed with the coil of Figs. 1 and 2 and on a scale enlarged over that of Fig. 1.

Figs. 4, 5, 6 and 7 are detail longitudinal sectional views through parts of the coil showing

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various ways in which longitudinal displacement between the work end of the coil and the core is prevented.

Fig. 8 is a longitudinal sectional view through a part of an obstructed drain and shows one way in which the obstruction may be removed therefrom, in accordance with the improved method, when employing the coil and core construction and which will be more fully described later.

The improved method may be carried out by apparatus, which in general includes a closely wound helical coil of desired length and a flexible core for use in the longitudinal bore or passageway of the coil. Coils of this kind are wound either L. H. helix or R. H. helix. The diameter of the core, with reference to that of the bore of the coil is such that when the core is disposed within the bore, a slight clearance is present therebetween. The coil is provided with a work end, which is the end first entered into and worked along a conduit, until it reaches the obstruction therein. It is desired that the core be carried in the bore of the coil and in a manner preventing endwise movement of the core rearwardly from the work end, though permitting a limited longitudinal slipping of the core relative to the coil, as when the coil follows a tortuous path in use and as the coil is inserted in the conduit to be cleaned. It, therefore, is preferred that the core be attached at one point in its length to the coil, adjacent the work end of the coil, so that the core will be pulled along with the coil.

After the coil, with the core disposed in its bore, is located in a conduit with its work end engaged with the obstruction therein, the coil is turned axially either by means of a hand tool or a power tool in the proper direction. Assuming the coil to be wound with left hand helix, as indicated in the drawings, the coil will be turned clockwise, as viewed in Fig. 2, and as indicated by the arrow. With the work end engaged with an obstruction, the axial turning of the coil in the direction mentioned, builds up torque in the coil, causing a reduction in diameter to the limit afforded by the slight clearance space between the core and bore of the coil. The coil is thus caused to engage the core throughout its length and be internally supported and reinforced thereby against premature opening up, breaking or kinking. However, at the time the coil was being inserted into the conduit, it was not in gripping contact with the core, and hence acted as a relatively free spring readily able to accommodate itself to the tortuous path usually found in con-

duits from which obstructions are to be removed. While the diameter of the coil is being reduced, its length is also being increased, but the space between the core and coil permits the necessary slippage between coil and core. Hence, neither the coil nor the core is stretched or strained, so that both return to normal condition after removal from the conduit, provided of course the apparatus be used within the limits for which it is designed.

Referring now in detail to that embodiment of the invention illustrated in Figs. 1, 2, and 3 of the drawing, the improved method may be carried out by an apparatus that includes an outer member or envelope 10 in the form of a long coil having an internal bore or passage designed to receive a flexible core 11.

The coil 10 is preferably made of a so-called music steel wire having a carbon content of 0.85 to 0.95. Such wire is obtainable in the market, is known to the trade as a "bright music" wire, and well serves the purpose. Preferably the wire has such a cross sectional shape that the sides of adjacent convolutions thereof may "roll" relatively in the bending of the coil. Preferably, therefore, and as shown, the wire has a circular cross section.

The coil 10, which is preferably produced by die coiling machines employing adjustable dies or coiling points which determine the outside diameter of the coil, includes a relatively long body 12 having a relatively short tool carrying portion 13 at one end. The diameter of the body portion 12 of the coil is dependent upon the type of work for which the apparatus is to be used. In coils of different diameters, preferably different diameters of wire are employed.

Fig. 1 shows one size of coil, which may be 50, 75 or 100 feet or more in length, and which is well adapted for use in the sewer cleaning art, especially for the smaller size conduits. The outside diameter of the body 12 of the coil is dependent upon the diameter of the wire to be used therefor, the outside diameter of the core 11 to be used therewith, and the amount of clearance between the coil and core. For a core having an outside diameter of .217/.219 and using a wire of .138" for the coil, such wire is tension wound to such an outside diameter as to afford an overall clearance of .005/.007" between the core and the body of the coil. Such a coil body will have an outside diameter approximating one-half of an inch. Assuming the core to be centrally disposed within the coil, there would then be an annular space of .0025/.0035" between the outside surface of the core and the inside surface or bore of the coil.

As shown, the portion 13 of the coil has an inside diameter of about 0.60 inch for one-half its length and gradually decreases in diameter for the other half of its length, to meet the associated end of the body 12 of the coil. In said portion 13 of the coil, the convolutions are closely coiled or wound, but preferably are not in tension, being heated to a straw color to accomplish this result. Thus, this portion, which is the leading end of the coil, has more flexibility for bending laterally of the axis of the coil and is thus better adapted for passage through a conduit having short bends, curves, joints, etc.

The free open end of said portion 13, as shown, has therein a plug 14, which serves to support an obstruction removing tool 15 and which, in this instance, includes a pair of curved cutting arms. Other forms of tools and work ends may be pro-

vided, the form illustrated in the drawing being merely one well adapted for the use intended.

The core 11 is preferably in the form of a flexible member, such as used for the core part in the drives for speedometer and dental engines. A core which has been found satisfactory comprises a central wire 11c and a plurality of multiple spring wire strands 11a with the strands in each layer wound in opposite directions. Material of this kind, which is best illustrated in Fig. 3 and known as "speedometer core" may be obtained in the open market in various diameters and no claim is herein made to such material, per se.

It will be understood, of course, that the number of layers and the numbers of strands in each layer and the sizes of wire will vary for different or specific sizes. However, it is believed that a general description of certain sizes of cores will be helpful. Hence, the wire requirements for three examples or sizes, known as 220 speedometer core, 187 speedometer core and 130 speedometer core will be given.

Wire requirements, 130 speedometer core

Layer	No.	Helix Lead Angle, Degrees	Wire Dia.
Center	1		.013 Steel Shaft Wire.
1st	4	39	.013 Steel Shaft Wire.
2nd	4	19	.013 Steel Shaft Wire.
3rd	4	14	.015 Steel Shaft Wire.
4th	4	11	.017 Steel Shaft Wire.

Actual O. D.	.125/.127
Weight	lbs. per/M Feet. 32
Internal Friction	.13
Deflection Factor:	
Windup	154
Unwind	70

Wire requirements, 187 speedometer core

Layer	No.	Helix Lead Angle, Degrees	Wire Dia.
Center	1		.017 Steel Shaft Wire.
1st	4	37	.015 Steel Shaft Wire.
2nd	4	18	.015 Steel Shaft Wire.
3rd	4	13	.017 Steel Shaft Wire.
4th	4	10	.017 Steel Shaft Wire.
5th	4	10	.022 Steel Shaft Wire.

Actual O. D.	.186/.188
Weight	lbs. per/M Feet. 69
Internal Friction	.07
Deflection Factor:	
Windup	15
Unwind	31

Wire requirements, 220 speedometer core

Layer	No.	Helix Lead Angle, Degrees	Wire Dia.
Center	1		.017 Steel Shaft Wire.
1st	4	37	.015 Steel Shaft Wire.
2nd	4	18	.015 Steel Shaft Wire.
3rd	4	14	.017 Steel Shaft Wire.
4th	4	13	.024 Steel Shaft Wire.
5th	4	13	.033 Steel Shaft Wire.

Actual O. D.	.217/.219
Weight	lbs. per/M Feet. 100
Internal Friction	.09
Deflection Factor:	
Windup	9
Unwind	15

When using 220 speedometer core (Example 1) having an outside diameter of .217"/.219" for the core 11 and using a .138" diameter wire for the

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coil body, the coil body wire is wound to provide an overall clearance of .005"/.007" between the outside of the core and the bore of the coil. Assuming the core to be disposed centrally in the bore, there will be a clearance space of between .0025"/.0035" between each side of the core and the associated side of the bore. This clearance space is best shown and indicated in Fig. 2 by the numeral 16. The body 12 of such a coil will have an outside diameter of approximately .5".

Examples of other more commonly used cores and coils will be given for illustrative purposes. Using 187 speedometer core (Example 2) having an outside diameter of .186"/.188" for the core 11 and using .120" diameter wire for the coil body, the coil body wire is wound to provide an overall clearance of .005"/.007" between the outside of the core and the bore of the coil. Assuming the core is disposed centrally in the bore there will be a clearance space of between .0025"/.0035" between each side of the core and the associated side of the bore. Such a body 12 will have an outside diameter of about .433".

Using 130 speedometer core (Example 3) having an outside diameter of .125"/.127" for the core 11 and using .080 diameter wire for the coil body, the coil body wire is wound to provide an overall clearance of .005"/.007" between the outside of the core and the bore of the coil. Assuming the core to be disposed centrally in the bore, there will be a clearance space of between .0025"/.0035" between each side of the core and the associated side of the bore. Such a body 12 will have an outside diameter of about .292".

Thus, it is assured that while the core is permanently carried by the coil, a relative longitudinal slippage may occur between them in passing around and about a tortuous path as is sometimes presented by a conduit, and this without a complete displacement between the core and coil. Thus, both the core and the coil are in their most freely flexible condition readily to follow said path and this without producing a kink or permanent change of form therein. As soon as sufficient torque is imposed upon the coil, it constricts itself to engage the core so the core affords an internal support for the coil against the action of torque tending to fracture the core or produce kinks or breaks therein.

In Fig. 1 is illustrated one convenient way to form an attachment between the core and the coil. Attachment is provided by reducing the last three coils 17 of the body 12, where it joins the end portion 13, thereby tightly gripping the core at that point. This reduced portion of the coil may be provided at the time the coil is formed, in which event the core would then be placed in position to be gripped. Or, if desired, the entire coil may be formed first, the core inserted and roller or die pressure applied along the several coils 17 to reduce the coil locally.

Fig. 4 illustrates another way in which the core may be secured to the coil as by a weld 18, which weld may be made from the end of the portion 13 before the plug 14 has been applied, if a plug is to be used.

In Fig. 5 the end of the core is shown as being upset or flattened to form an enlarged head 19 therefor, which prevents the core, as a whole, from moving longitudinally away from the portion 13, toward the point where the coil is turned, but still permits the relative slippage between the coil and core when they are being threaded through a conduit having bends, elbows and the

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like therein, or when the coil is wound upon a storage reel or drum.

In Fig. 6, the end of the core is shown as being indirectly attached to the coil through the medium of the tool carrying plug 14. In this instance the end of the core is welded, as at 20, in a recess in the inner end of said plug. It will be understood that the part 13 is as in Fig. 1 and will taper to join with the main body 12, but without any reduced portion 17.

In Fig. 7 the core is shown as having its end fixed in a spherical body 21, located in the inner end of the portion 13 of the coil and which body is of such diameter as to prevent its entrance into the body 12 of the coil. The ball 21 is preferably applied to the end of the core before inserting it into the coil from the open extremity of the end portion 13 of the coil.

In the use of any of the structures above mentioned, a tool, either hand-operated or motor-operated, is used for turning the coil axially and this in the direction of the arrow in Fig. 2. These tools are or may be conventional and are well known in the art. I have illustrated a motor operated tool 22 having a chuck 25 to grip and turn the coil. After the work or tool end of the coil has engaged an obstruction, for example 24 in Fig. 8, in a conduit and the turning action is continued in the proper direction, torque is built up in the coil and this causes the coil to constrict itself in diameter and engage the core as before explained.

From the above, it will be obvious that in using the method disclosed herein, the coil functions substantially as a free flexible spring shaft which will readily slide around bends and elbows and past joints in a conduit thereby greatly facilitating insertion of the coil into the conduit. When the work end engages the obstruction, however, and turning movement is imparted to the coil in the manner indicated, from a point outside the conduit, to cause a reduction in the size of the coil and thereby engage the core, the core acts to provide internal support. Tests show greatly improved power transmitting capacity without injury to the coil.

It will also be understood that while the core extends substantially throughout the entire length of the coil, the coil and core are only joined or prevented from moving relatively in a longitudinal direction at the work end. Hence, relative longitudinal movement between the coil and core can readily take place as the coil is reduced in diameter and increased in length in the preliminary stages of removing an obstruction from a conduit. Because the core is held at the work end of the coil against backward movement, the core moves along with the coil as it is inserted into the conduit. Therefore, there is always part of the core closely adjacent the work end of the coil under all conditions, in position to support the surrounding coil when the diameter of the coil is reduced, as before explained.

Several examples of coil sizes, cores, space between core and coil and wire requirements, etc. have been given. While these have been found satisfactory in actual use, it should be understood they have been given as by way of illustration and not necessarily by way of limitation, except where the functioning requires such limitation. For example, the annular space between the core and bore of the coil has been given as of the order of .0025"/.0035" but this may vary, depending upon the size and characteristics of the wire of which the coil is formed. The purpose of the

space between the coil and core is to permit the coil initially to function as a substantially free coil with relative slippage between coil and core and then when subjected to torque, which elongates it and reduces its diameter, to be supported internally by the core whereby to increase the power transmission capacity of a given coil whilst maintaining it in good condition. Hence, while the space between core and coil may be more or less than that given, it should never for any particular core-coil combination be so small that the freedom of the coil in the initial part of an obstruction removing operation is impaired to the extent that will cause damage to the coil or core when the device is used for its intended purpose and within the power range for which the device is designed.

Again, the space between the core and coil should not be too great—otherwise damage to the coil will be caused before it engages the core and is given internal support thereby. Therefore, the maximum space between the core and coil should be such that it can be taken up by the reduction, under torque action, of the coil diameter before the elastic limit of the particular coil wire is exceeded. Hence, the smallest amount of space between the core and coil, which will afford free slippage between coil and core in the initial part of the operation, is generally preferred.

Specification of cores which have been satisfactorily used, have been given, but these too are by way of illustration. For example, wire other than steel may be used where corrosion is an important consideration. The wire of the core should, however, have spring characteristics so that when flexed it will return to normal and not take a permanent kink or set.

Hence, while in describing the invention I have referred in detail to the form, arrangement and construction of and diameters of the parts involved, the same is to be considered only in the illustrative sense and therefore I do not wish to

be limited thereto except as may be specifically set forth in the appended claims.

I claim as my invention:

1. The method of cleaning out obstructions from conduits which consists in feeding a hollow freely flexible spring wire coil into a conduit work end first until the work end encounters an obstruction, the coil being substantially internally unsupported while it is being so fed, then after the work end has encountered an obstruction reinforcing the coil internally throughout substantially its entire inner periphery and in turning the coil axially, while it is so reinforced, to clear the obstruction from the conduit.

2. The method of cleaning out obstructions from conduits which consists in feeding a hollow freely flexible spring wire coil into a conduit work end first until the work end encounters an obstruction, the coil being substantially internally unsupported while it is being so fed, then after the work end has encountered an obstruction bringing substantially the entire inner periphery of the coil into contact with a reinforcing core member, and in turning the coil axially, while the coil and core are thus in contact, to clear the obstruction from the conduit.

3. The method of cleaning out obstructions from conduits which consists in feeding a hollow freely flexible spring wire coil into a conduit work end first until the work end encounters an obstruction, the coil being substantially internally unsupported while it is being so fed, then after the work end has encountered an obstruction reinforcing the coil internally throughout substantially its entire inner periphery, in turning the coil axially, while it is so reinforced, to clear the obstruction from the conduit, and in relieving the coil of its internal support while withdrawing the coil from the conduit after the obstruction has been cleared from the conduit.

JOHN V. O'BRIEN.

No references cited.