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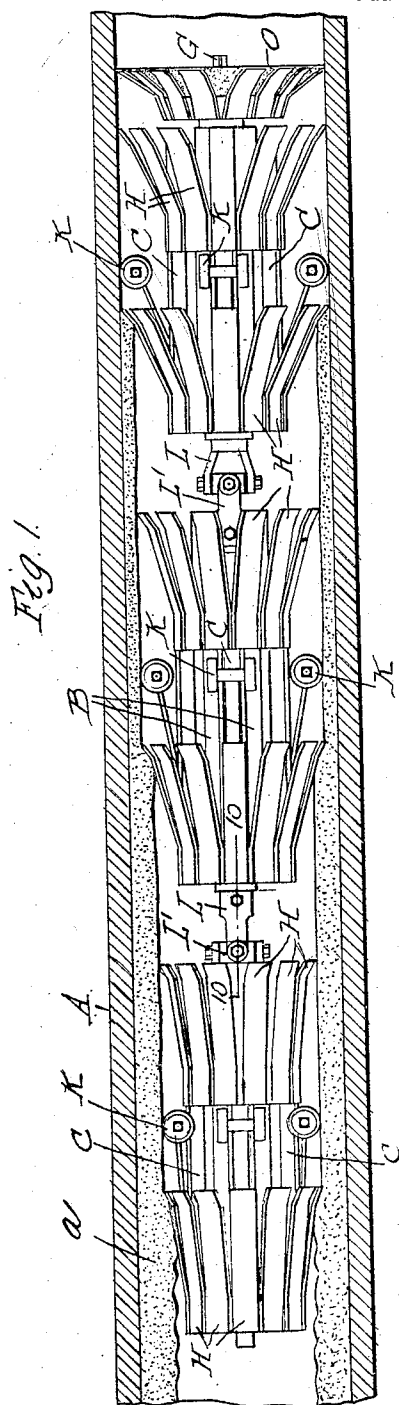
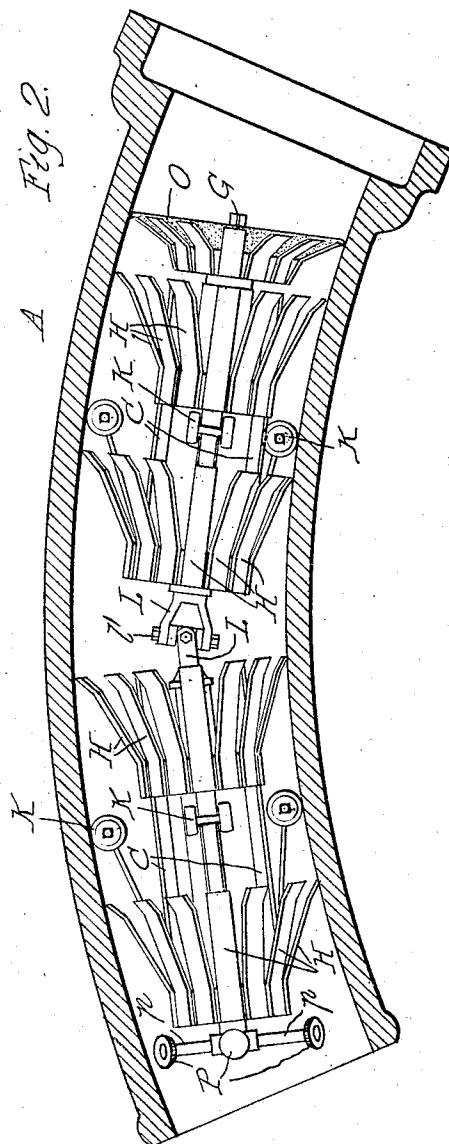
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J. M. THOMPSON ET AL

PIPE CLEANING APPARATUS

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3 Sheets-Sheet 1



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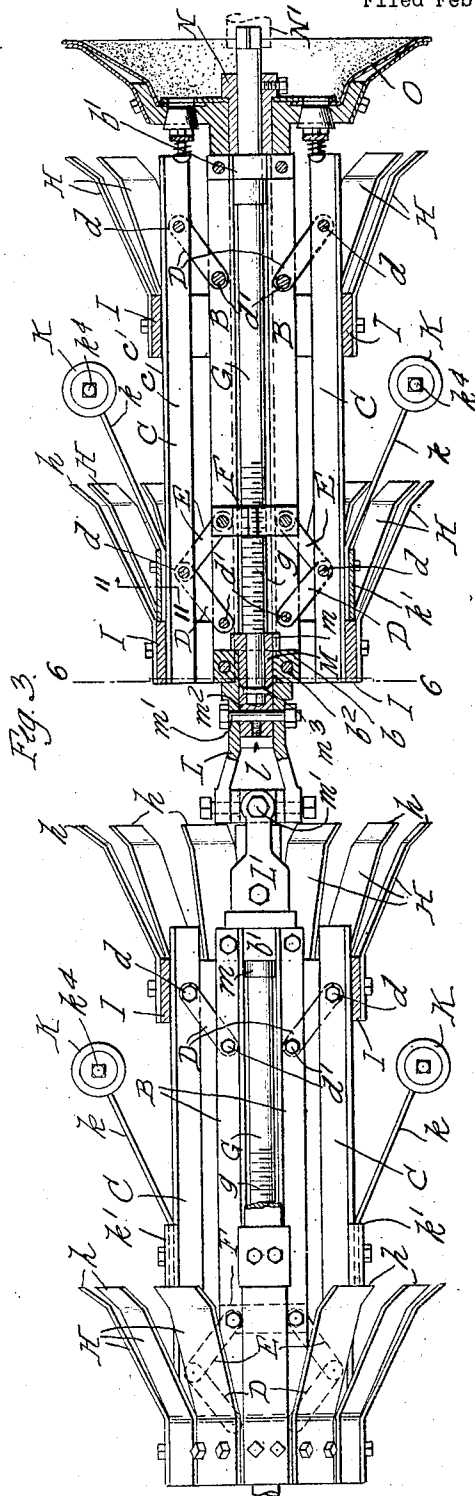


Fig. 6.

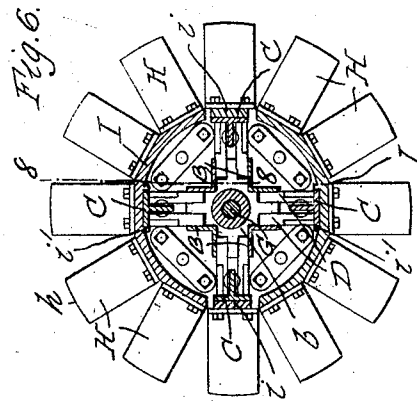


Fig. 5.

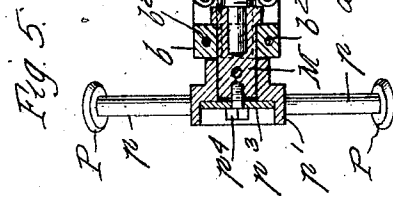
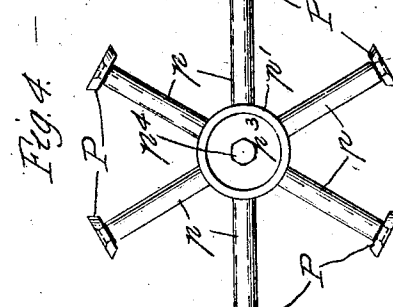


Fig. 4.



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3 Sheets-Sheet 3

UNITED STATES PATENT OFFICE.

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PIPE-CLEANING APPARATUS.

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This invention relates to apparatus or devices for use in cleaning pipe lines or mains, and more particularly to devices of this kind which are moved through a pipe by the pressure of the water or other fluid within the pipe.

The objects of this invention are to provide a pipe cleaning apparatus or device of this kind which consists of a plurality of units flexibly connected with each other and adapted to be expanded or contracted either independently of each other or together through the flexible connection, to place the cutting parts of the units into or out of operative relation to the pipes; also to provide a cleaning device of this kind with a universal joint of improved construction whereby the universal joint forms a connection for imparting movement from one of the units to another and also for enabling the cutting members to be moved into and out of operative relation to the inner surface of the pipe; also to provide a device of this kind with means for cutting excess lead or other materials used as a seal at the junction of adjacent lengths of pipes to form a tight joint, so that the progress of the cleaning device will not be stopped by portions of lead or other material extending into the pipe and whereby such material can be removed from the pipe to prevent the same from offering resistance to the flow of water through the pipe; also to improve the construction of cleaning apparatus or devices of this kind in other respects hereinafter specified.

In the accompanying drawings.

Fig. 1 is a longitudinal section of a pipe or tube showing a cleaning apparatus or device embodying the invention arranged therein.

Fig. 2 is a longitudinal sectional view of a bent portion of a tube showing two units of a cleaning device arranged therein.

Fig. 3 is a side elevation partly in section of a cleaning device.

Fig. 4 is a front elevation of the lead cutting arrangement which is shown as arranged at the front end of the foremost unit of the cleaning device.

Fig. 5 is a fragmentary sectional view through the front portion of the lead cutting device and the front end of a unit of the cleaning device showing the manner of arranging the lead cutting device on the cleaning device.

Fig. 6 is a transverse sectional elevation on line 6—6, Fig. 3.

Fig. 7 is an enlarged sectional view of a water main joint showing lead or other joining material extending into the same and showing the front end of a cleaning device with a lead cutter in operative relation to the pipe.

Fig. 8 is a fragmentary longitudinal sectional elevation on an enlarged scale on line 8—8, Fig. 6.

Fig. 9 is a fragmentary transverse sectional elevation thereof on line 9—9, Fig. 8.

Fig. 10 is a fragmentary longitudinal sectional elevation thereof on line 10—10, Fig. 1, showing the universal joint connection between units of the cleaning device.

Fig. 11 is a fragmentary transverse sectional elevation thereof on line 11—11, Fig. 3.

Fig. 12 is a side elevation of one of the guide rollers which serve to properly position the cleaning device within the pipe.

In the accompanying drawings A represents a pipe or tube having on the inside thereof an accumulation or deposit *a* of foreign matter which is to be removed by means of the cleaning device.

The tube cleaning apparatus or device is preferably composed of a plurality of units, three such units being shown in Fig. 1, and two units being employed in the cleaner shown in Fig. 2. One of the cleaning units, preferably the rear one is provided with a plunger or piston against which the water pressure may act to propel the several units of the cleaning device through a pipe or tube. The units of the cleaning device are substantially alike and each unit includes a central body portion which in the construction shown is made of a plurality of angle bars B, four of these angle bars being used in the embodiment of the invention illustrated in the drawings. These bars extend lengthwise of the cleaner and the ends of the bars are rigidly secured to front and rear fittings or end pieces *b* and *b*¹. The angle bars in the construction shown are so arranged that the legs of the bars form four spaces or channels between the adjacent legs of adjacent bars. The bars may be secured to the end pieces by any suitable means such for example as rivets or the like *b*².

Each unit of the cleaning device also includes a plurality of parallel supporting

bars C on which some of the scraping or cleaning parts of the device which are intended to act on the interior of the pipe are mounted. These supporting bars may be of any suitable construction, those shown being substantially of T-shaped cross section and having webs *c* arranged in substantially radial planes with reference to the body of the pipe cleaner, thus presenting the flanges *c'* in a position to receive the various pipe engaging parts to be mounted thereon. Any desired number of these supporting bars may be provided, four being shown in the construction illustrated and these supporting bars are adjustably mounted on the central body portion in such a manner that the bars may be adjusted toward and from the body portion while remaining substantially parallel thereto. In the construction shown for this purpose each of the supporting bars is connected to the flanges of two adjacent angle bars of the body portion by means of two or more parallel links D, the outer ends of which are pivotally connected to the radially arranged webs *c* of the supporting bars by means of pivots *d* or the like. The inner ends of the parallel links are connected to the flanges of the angle bars B by means of pivots *d'*.

The adjusting of the parallel supporting bars of each unit relatively to the central body portion of the unit may be effected by means of toggle or adjusting links E, the outer ends of which are pivotally connected to the radial webs *c* of the supporting bars, and the inner ends of the links are pivotally connected to an adjusting block or nut F which in the construction shown is movable lengthwise of the body portion of the unit. The adjusting nut or block F is guided in its lengthwise movement by the angle bars B of the body portion of the unit, and these angle bars also hold the block or nut against turning. Longitudinal movement is imparted to the nut or block F by means of a rotary rod or shaft G, the ends of which are journaled in the end pieces *b*, *b'* of the body portion of the unit, and a portion of the rod or shaft G is screw threaded as indicated at *g*, and these screw threads, engaging with corresponding threads in the nut or block F impart longitudinal movement thereto. Consequently by turning the shaft G, the nut F may be moved in either direction so that through the medium of the links D the supporting bars C of this unit are moved toward or from the axis of the cleaner. Any other means for adjusting the supporting bars toward and from the axis of the cleaner may, of course, be employed.

Any suitable cleaning devices or scrapers may be mounted on the supporting bars C of each unit of the cleaning apparatus. In the particular construction shown the cleaners or scrapers are in the form of spring blades H,

the outer edges of which may be sharpened as indicated at *h*. The inner ends of the scraping or cleaning blades are preferably secured to plates I, which are rounded and secured to the supporting bars C, two of these rounded plates I being shown in the construction illustrated, see particularly Fig. 6, which plates are secured to a pair of oppositely disposed supporting bars C. The scraping or cleaning blades H which are secured to the other two supporting bars C are mounted on blocks *i*, which in turn are secured to the supporting bars C. Consequently when it is desired to adapt a unit of the cleaner to operate on a pipe of different diameter, the plates I and blocks *i* are removed from the supporting bars C and are replaced by other plates I of different curvature and other blocks *i*, having scraping blades H mounted thereon, the outer edges of which are also rounded at a different curvature corresponding to the curvature of the pipe to be cleaned. The curved plates I are preferably also provided with inwardly extending projecting portions or ribs *i'*, which are adapted to engage the opposite sides of a supporting bar C, so that the plates I will be securely held in place on the supporting bars. Any suitable means for securing the plates to the supporting bars may be employed, such for example, as bolts or screws *i''*.

Means are preferably also provided for holding the several units of the cleaning device concentrically within the pipe to be cleaned, and for this purpose, in the construction shown, supporting rollers K are employed, which are mounted on the outer ends of spring bars or supports *k*, the inner ends of which may be secured on the supporting bars C in any suitable or desired manner, for example, as is clearly shown in Figs. 11 and 12, this end of the spring bar *k* may be placed between a supporting bar C and a saddle member *k'* having side flanges or legs *k''* which straddle the end of the spring bar *k* and also the sides of the outer flange of a supporting bar C, and a bolt *k'''* may be used to secure the saddle to the supporting bar C.

A pair of rollers K are preferably arranged on the outer end of each of the spring bars *k*, these rollers in the construction shown being arranged on a pivot or pin *k''*, which is journaled in any suitable manner at the end of the spring bar *k*, for example, by means of a strap *k'''*, the ends of which are secured by means of rivets or other fastening devices to the opposite faces of the outer end of the spring bar *k*. The intermediate or looped portion of the strap forms a bearing for the pivot pin *k''*. Any other means for rotatably mounting the rollers K on the spring bars *k* may be employed if desired. The spring bars *k* are preferably consider-

ably stronger than the scraping blades H so that the rollers K together with the spring bars $\frac{1}{2}$ will serve to hold the units of the cleaning device substantially concentrically in the tube or pipe, so that the upper portions of the tube or pipe will be subjected to the cleaning action of the scrapers.

In order to make it possible to connect the several units of a cleaning device with each other so that one of the sections may supply the necessary power to propel the other sections through a tube or pipe, a flexible or universal connection is preferably used, which connection is so organized that it forms not only the means for transmitting the propelling force from one unit to another, but also transmits rotary movement from the central adjusting rod or shaft G of one of the units of the cleaning device to another unit, so that by turning one of the rods or shafts G, all of the shafts of the various units are turned, so that all of the units of a cleaning device can be simultaneously adjusted within a pipe. A universal joint of any suitable construction may be employed as a part of this connection, that shown including a pair of bifurcated members L and L', the bifurcated arms of which are arranged at right angles to each other and are pivotally arranged with reference to a central connecting member Z, screws or studs Z' forming the pivotal connection between the connecting member Z and the bifurcated arms of the two parts L and L' of the universal joint. By means of the universal joints connecting the several units of the cleaning device, each of these units may swing in any direction relatively to the other units, so that the pipe cleaning device can readily pass through the usual bends or curves encountered in a pipe line.

In order that the force exerted by any unit on other units of a pipe cleaning device to move the same through a pipe line may not be transmitted to the adjusting rods or shafts G and at the same time to enable the universal joints to transmit motion of rotation from one shaft or rod to another, the following construction is preferably employed: The shafts G are provided at the ends thereof adjacent to the universal joints with bearing members or extensions M, which are journaled in the end pieces b of the main frames of the sections. Each of these bearing members or extensions is provided at one end with a flange m. The other end of the bearing member M extends beyond the end pieces b and is adapted to be rigidly connected to a part of the universal joint, for example to the shank portion thereof, by a bolt or other securing means m' which passes through the shank portion of the bifurcated member and the forward extension m² of the bearing member M. The

shank portion of the bifurcated member also extends rearwardly to engage the side of the end piece b, so that the extension m² of the bifurcated member of the universal joint and the flange m engage on opposite sides of the end piece b of the frame of a cleaner unit, so that all the strains or forces exerted by the universal joint on a unit of the cleaner are exerted on an end piece or extension b. The shafts G are secured to the bearing members M in any suitable manner, for example, the end of the shaft B may extend into a hole in the bearing member M and may be secured to the bearing member by means of a rivet or pin m³. Consequently when a shaft G is rotated, the rotary motion is transmitted through the universal joint to the shaft of another unit of the cleaning device, but the shafts G themselves are not subjected to any longitudinal strains, these strains being transmitted by the bearing members or extensions M to the end pieces of the units of the cleaning device.

In the case of the end unit of the cleaning device which is arranged at the rear of the device, a bearing member or bushing N is provided through which the end of a shaft G extends and the rear end of this shaft G is provided with a portion adapted to be engaged by a key or wrench for turning the same, for example, the end of the shaft G, in the construction shown in Fig. 3 is shown square in cross section so that the same may engage a key, the socket portion N' of which is shown in Fig. 3.

O represents a plunger of any suitable or desired construction which may be mounted on any one of the units of the pipe cleaning device, for example, on the rear end of the rearmost unit of the cleaning device, as shown in Figs. 1 and 2. Preferably the shaft G of the rear unit of the cleaner extends through the plunger into a position to be accessible when the device has been inserted into a pipe.

It will be understood from the construction described that after the cleaning device has been inserted into a pipe, the several units in a pipe may be simultaneously expanded or contracted by turning the shaft G of the rearmost unit of the cleaning device, since the rotation of the shaft of the rearmost unit of the cleaning device will be transmitted to the other shafts through the universal couplings. Also if, before the device is inserted into a pipe, it is desired to adjust any one of the units independently of the other units, this can easily be done, either by disconnecting the joint which connects the unit to be adjusted with the other unit or by turning one of the units relatively to the other units, so that, for example, the several units may be adjusted to different diameters as shown in Fig. 1 to remove dif-

ferent portions of the layer of the deposit *a* within the pipe.

In the laying of pipe lines intended to carry liquid under pressure, the joints between adjacent sections of the pipe are frequently sealed by means of lead or other material which is introduced into the joint in molten form and this sealing material frequently enters into the interior of the pipe and forms an obstruction therein as indicated at X in Fig. 7. In order to enable the cleaning device to remove obstructions of this kind from the interior of a pipe, a series of cutters are preferably mounted on the cleaning device, preferably on the front end thereof. In the construction shown for this purpose, a plurality of rotary cutters P is employed, which have beveled outer or cutting faces and these cutters are mounted on the ends of arms *p* extending outwardly from a hub portion *p'* which may be suitably secured on one of the units of the cleaning device. In the construction shown for this purpose, the hub *p'* is provided with an internal bore adapted to fit on the forwardly extending portion of the bearing member M of the foremost unit and is held in place thereon by a disk or washer *p³* which engages an internal shoulder in the hub *p'* and which is held in fixed relation to the forwardly extending portion of the bearing M by means of a set screw *p⁴*, engaging in a threaded hole extending axially with reference to the foremost portion of the bearing member M. By means of the construction described, the hub portion *p'* is freely rotatable about the bearing M and since the cutting members P are also rotatable about the arms *p*, the cutting members can easily avoid any permanent obstructions in the pipe, such for example, as the ends of branch pipes or cocks extending into the same. On the other hand, if the cutters encounter lead or other relatively soft sealing material, the cutters, being of relatively hard material, will easily embed themselves in the soft lead, so that the cutting member will not turn but will cut off the obstruction.

We claim as our invention:

1. A pipe cleaning apparatus consisting of a plurality of units, each unit including a plurality of supporting members adjustable toward and from each other to adapt said apparatus to operate on pipes of different sizes, a rotary member on each unit for effecting adjustment of said supporting members, and flexible connecting means between the rotary members of each adjacent pair of units of said cleaning apparatus whereby the adjustments of the supporting members of one unit will cause a corresponding adjustment of the supporting members of the other units.

2. A pipe cleaning apparatus consisting

of a plurality of adjustable units, each unit including a longitudinally arranged rotary adjusting member for expanding and contracting said unit, and flexible connecting means between said rotary members of different units, through which means movements for causing expansion or contraction of one unit are transmitted to cause a corresponding adjustment of other units.

3. A pipe cleaning apparatus consisting of a plurality of units, each of said units including adjustable cleaning means, adjusting members on each of said units for moving said cleaning means toward and from the inner wall of a pipe to be cleaned, and flexible connections between the adjusting members of adjacent units whereby movement of one adjusting member is transmitted to the other adjusting members to permit the several units of the pipe cleaning apparatus to be simultaneously adjusted.

4. A pipe cleaning apparatus consisting of a plurality of units, each of said units including adjustable pipe cleaning means, flexible connections between adjacent units, said connections being adapted to transmit longitudinal forces from one unit to another to cause the units to be moved through a pipe, said connections being rotatable relatively to said units, and adjusting members in each of said units for moving said cleaning means toward and from the inner surface of a pipe, said adjusting members being connected with said flexible connections whereby rotary movement of one adjusting member will be transmitted through the flexible connections to the adjusting members of adjacent units.

5. A pipe cleaning apparatus consisting of a plurality of units each including adjustable pipe cleaning means, flexible connecting devices arranged between adjacent units and each having a swivelled connection with said units which are held against lengthwise movement relatively to said units, and adjusting members in each of said units adapted to move said cleaning means toward and from said pipe and connected with said connecting devices, to cause movement of the adjusting member of one unit to be transmitted to an adjacent unit.

6. In a pipe cleaning apparatus the combination of a plurality of units, each unit including a rigid frame member extending substantially from end to end of said unit, and pipe cleaning means arranged to be adjusted radially to and from said frame member for adjusting said cleaning means toward and from the inner surface of a pipe, flexible couplings between adjacent units of said apparatus, each of said couplings having a swiveled connection with the frame member of adjacent units, whereby force exerted on the frame member of

one unit in the general direction of its length is transmitted through the flexible coupling to the frame member of an adjacent unit, and adjusting members arranged on said units for moving said cleaning means toward and from the interior surface of a pipe and connected with said coupling members to transmit rotary motion from the adjusting member of one unit to the adjusting member of an adjacent unit.

7. A pipe cleaning apparatus including a plurality of units, each of said units including a rigid frame member extending lengthwise thereof, cleaning devices adjustably arranged on said frame member and adjustable substantially radially relatively thereto, bearing members journaled in the ends of said frame members and held against lengthwise movement relatively thereto, universal joints connected with said bearing members for transmitting rotation from a bearing member of one unit to the bearing member of an adjacent unit, and for transmitting longitudinal forces on the frame member of one unit to another unit, and adjusting members for adjusting said

cleaning devices and secured to said bearing members, whereby rotation of the adjusting member of one unit will be transmitted to the adjusting member of an adjacent unit. 30

8. A pipe cleaning apparatus consisting of a plurality of units, each including adjustable pipe cleaning means which are adjustable radially into and out of engagement with the inner wall of a pipe, and connections between adjacent units whereby the cleaning means of all of said units may be adjusted simultaneously. 35

9. In a pipe cleaning apparatus, the combination of pipe cleaning means, and a cutting device including a hub portion rotatable freely relatively to said pipe cleaning means, and a plurality of cutting devices which are rotatably mounted on said rotatable hub and which extend into proximity to the inner surface of the pipe, said cutting devices being rotatable about axes extending substantially radially with reference to the axis of said hub portion. 40 45

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