

May 24, 1932.

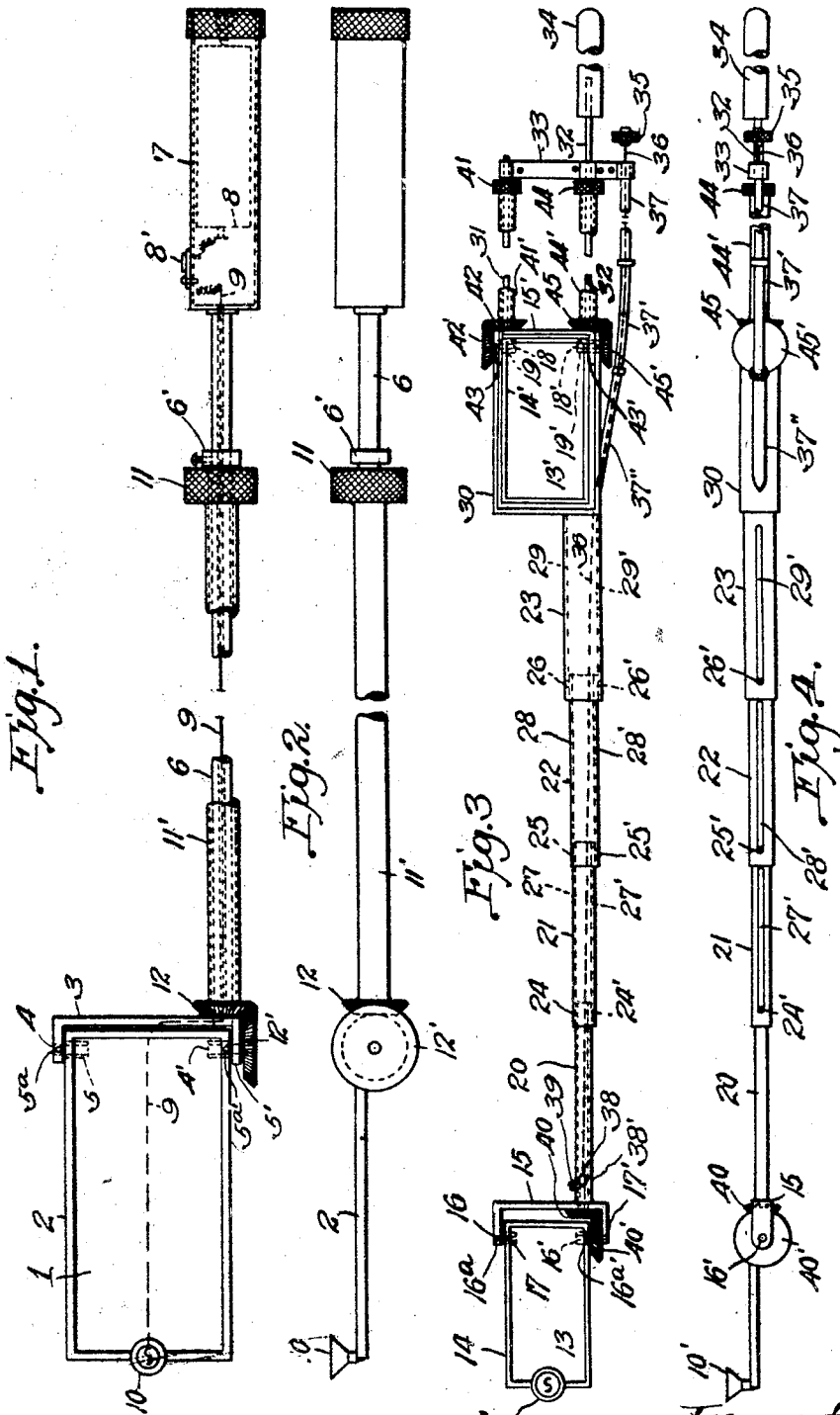
N. H. RANSTEAD

1,859,682

MEANS OF EFFECTING VISUALITY BY REFLECTED LIGHT

Filed Jan. 30, 1929

3 Sheets-Sheet 1



Inventor:
Norman H. Ranstead
By Stanley W. Finch
His attorney

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3 Sheets-Sheet 2

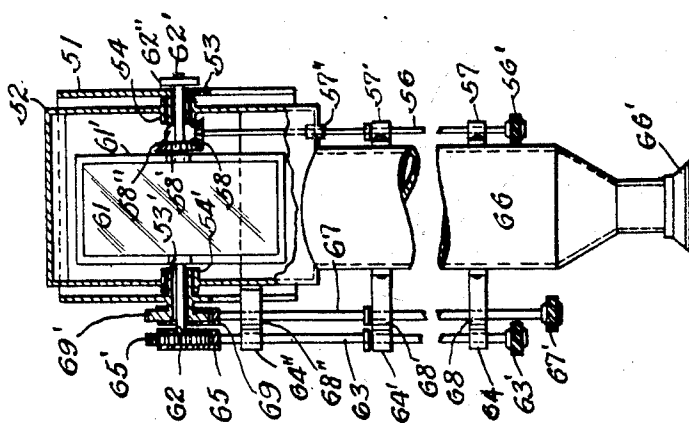


Fig. 6

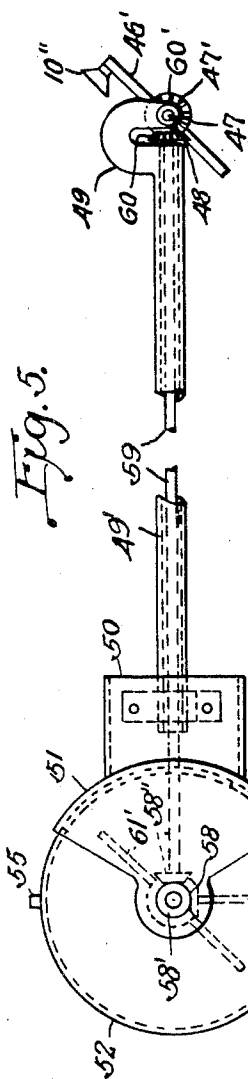
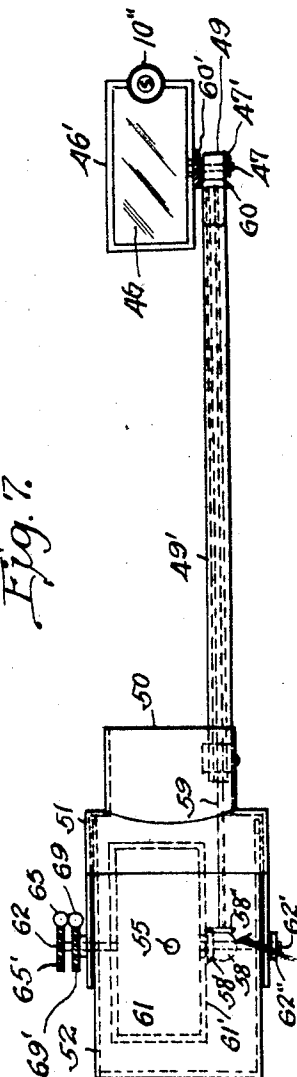


Fig. 5

Fig. 7



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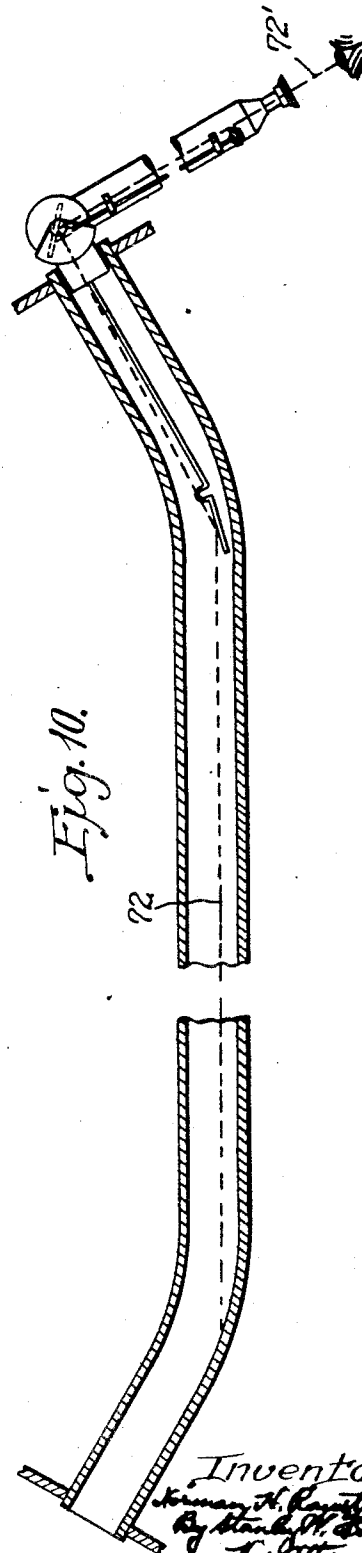
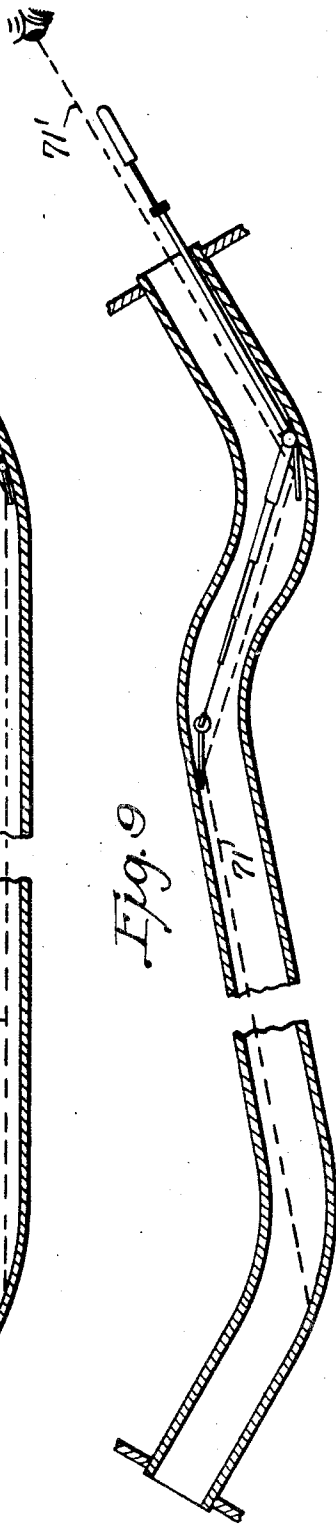
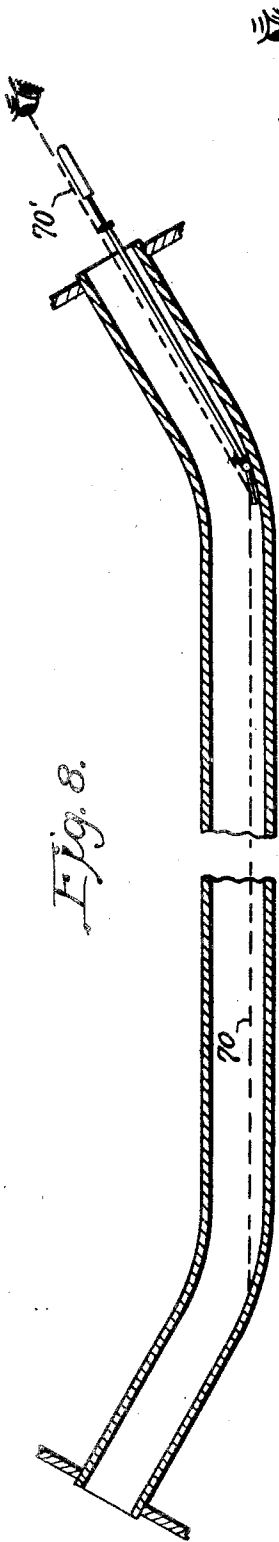
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MEANS OF EFFECTING VISUALITY BY REFLECTED LIGHT

Filed Jan. 30, 1929

3 Sheets-Sheet 3



Inventor
Norman H. Ranstead
By Stanley H. Smith
Attorney

UNITED STATES PATENT OFFICE

NORMAN H. RANSTEAD, OF CHICAGO, ILLINOIS, ASSIGNOR TO JENKINS PETROLEUM
PROCESS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF WISCONSIN

MEANS OF EFFECTING VISUALITY BY REFLECTED LIGHT

Application filed January 30, 1929. Serial No. 336,186.

This invention relates to improvements and means for visualizing, by the aid of reflected light, dim and obscure interiors and particularly those of a difficultly dangerously accessible nature, where the desired objectives are not within the scope of ordinary vision.

A primary object of the invention is to afford visual inspection of the inner surface of the curved or sagged sections of the tubes of an oil pressure still after cleaning.

A correlative object of the invention is to afford visual inspection of the inner surface of tubes containing double or reverse curvatures, or otherwise impassible to ordinary light rays.

Another object of the invention is to provide for creation of a light ray of an angle of incidence that will illuminate the desired objective by an angle of reflection visible to the eye.

A further object of the invention is to provide means for producing angles of reflection so that the inner surface of a tube may be visualized from a remote point, thus avoiding possibility of danger from a deleterious or explosive mixture of gas issuing therefrom.

A still further object of the invention is to provide a method for visualizing the inner surface of a tube at a point outside of the drum into which the tubes of an oil still are commonly expanded, thus enabling the inspection of a bank of tubes without the necessity of entering a heated atmosphere of deleterious or explosive gases.

An important object of the invention is to determine cleanliness of the tubes at all points, as it is well known that a small deposit of solid material left after cleaning may cause a hot spot in the ensuing run with danger of premature shutdown and its attendant evils, since small deposits of solid material on curved or sagged sections being without the range of ordinary vision are often impossible of detection by the passage of cleaning tools.

An additional object of the invention is to afford a means for visualizing the removal of an internal deposit or obstruction in a tube,

with the correlative advantage of being able to more efficiently direct the action of the tool employed to effect such removal.

In the operation of a tubular oil pressure still, a deposit of carbon usually forms on the inner walls of the tube bank varying from an amount sufficient to completely close the tubes and foreshorten the run by a matter of hours or days in the case of thermosiphon circulation processes, to a thin film where positive circulation is maintained, which, though not greatly interfering with the positive circulation, eventually has to be removed because of danger of overheating of metal and change in molecular structure thereof, due to migration of carbon atoms.

The major cleaning of any tube is usually effected with comparatively little difficulty by means of vibratory tools well known in the arts, but the removal of the last trace of carbon film, particularly that of a graphitic nature, deposited as a result of many days continuous operation, is often accomplished only by repeated applications of a polishing tool. However, this offers little ultimate difficulty where tubes can be readily inspected as with straight members, but in the case of curved or sagged sections with inner surface more or less invisible, complete removal of deposit is largely a matter of guess work. Inasmuch as even the smallest amount of foreign matter on the inner surface of a tube may later form a hot spot or become a nucleus of a sizeable deposit, with resultant foreshortening of operating period, it is essential that all parts of the tube bank be thoroughly freed from even traces of scale before starting the run.

Furthermore, where tubes are expanded into drums rather than flat headers, the difficulty of inspecting curved tubular sections increases. Occasionally it becomes desirable to critically view the inner surface of a certain tube or tubes without placing the eye directly in front thereof or it may not be convenient to enter the drum at all. At another time it may be necessary to examine the inner surface of a curved or sagged tube completely plugged at one end, or to note

the operative action of the vibratory cleaning tool at some internal local point.

To obtain the objectives mentioned, I have devised an adjustable mirror, system of mirrors, or other light deflecting means, particularly adapted for entering and affording visibility of the entire inner surface of a tube of any shape likely to be encountered in the tube bank of any pressure still; and to also attain such visibility from a point somewhat remote from the tube proper, if desired.

With the foregoing and other objects in view, the invention comprises the novel constructions hereinafter more specifically stated, and illustrated in the accompanying drawings; but it is to be understood that changes, variations and modifications may be resorted to without departing from the scope of the appended claims.

Figure 1 is a plan view illustrating the simplest form of the invention; Figure 2 is a view in elevation of the device shown in Figure 1; Figure 3 is a plan view of the telescoping form of the invention; Figure 4 is a view in elevation of the device shown in Figure 3; Figure 5 is a side elevation of the invention adapted for remote visualization; Figure 6 is an end elevation of the device shown in Figure 5; Figure 7 is a plan view of the device shown in Figure 5, and Figures 8, 9 and 10 show the application of the simplest, telescopic and remote vision adaptation of the invention.

The purpose of the invention will be more clearly understood by referring to the accompanying drawings; in which Figures 1 and 2 illustrate in plan and elevation respectively, the simplest form of the invention, comprising a single face mirror 1, encased in frame 2, and hung in bracket 3, by stub lug shafts 4 and 4', in bearings 5 and 5'. Frame 2 encasing mirror 1, is rotatably mounted on one side at 5 on stub lug shaft 4 which shaft is rigidly attached to bracket 3 by pin 5a and the opposite side of frame 2 is rigidly attached to stub lug shaft 4' by pin 5a', the shaft 4' being rotatably mounted in bracket 3 at 5'. The bracket 3 is rigidly attached to the hollow rod 6, terminating in handle 7, fitted with dry battery 8. The insulated flexible conductor 9, passing through the hollow rod 6, connects the battery 8, with the electric light 10 and forms one leg of the circuit, which circuit is completed by the rod itself, to which rod one terminal each of the electric light and battery are grounded; control of said circuit being effected by the switch 8'.

The mirror 1 may be adjusted at any desired angle by turning the milled hub 11 of sleeve 11', the latter being held in position on rod 6, by the collar 6', and terminating in the bevel gear 12, enmeshing with the simi-

lar gear 12', set on prolongation of the stub shaft 4' and rigidly attached thereto.

Figures 3 and 4 illustrate in plan and elevation, respectively, a telescopic form of the invention, comprising the single faced mirrors 13 and 13', encased in frames 14 and 14', and hung in brackets 15 and 15'. Frame 14 encasing mirror 13 is rotatably mounted on one side at 17 on stub lug shaft 16, which shaft is rigidly attached to bracket 15 by pin 16a, and the opposite side of frame 14 is rigidly attached to stub lug shaft 16' by pin 16a', the shaft 16' being rotatably mounted in bracket 15 at 17'. The mirror 13 is supported by stub lug shafts 16 and 16' in bearings 17 and 17', and the mirror 13' is similarly supported by stub lug shafts 18 and 18' in bearings 19 and 19'. Frame 14' encasing mirror 13' is rotatably mounted on one side at 19 on stub lug shaft 18, which shaft is rotatably mounted in bracket 15' and rigidly attached to frame 30 by pin 43, and the opposite side of frame 14' is rigidly attached to stub lug shaft 18' by pin 43', the shaft 18' being rotatably mounted in bracket 15', and frame 30 at 19'. The bracket 15 is rigidly attached to the tube 20, telescoping in the tube 21, the latter in tube 22, and tube 22 in tube 23; the telescoping of the tubes without rotation and the limitation of tubular extension being obtained by the pins 24, 24', 25, 25', and 26, 26' projecting into the limiting slots 27, 27', 28, 28' and 29, 29' respectively. The bracket 15' is similarly joined to the rods 31 and 32; the two rods being further connected by the yoke piece 33, and one of the rods 32 terminating in the handle 34.

The bracket 15 with its mirror 13, may be set, within the telescopic limits of the apparatus, at any desired distance from the brackets and mirror combination 30, 15' and 13' by pushing or pulling the handle 35 of the flexible steel shaft 36 passing through sleeve 37 which is supported by yoke piece 33, thence through flexible tube 37' and fixed sleeve 37'' attached to frame 30, and finally through telescopic tubes 23, 22, 21 and 20, to stub shaft 38, to which the flexible steel shaft 36 is connected, the stub shaft being prevented from longitudinal movement by the pin 39 engaging in annular bearing 38' encircling the stub shaft.

The mirror 13 may be adjusted at any desired angle within the bracket 15, by rotating the same flexible shaft 36 by means of its handle 35; such rotation causing the rigidly attached bevelled gear 40 on the end of the stub shaft 38 to engage with a similar gear 40', mounted on and attached to the stub lug shaft 16'. By such adjustment any required elevation or depression of the mirror 13 may be effected.

The encompassing bracket 30, with its rigidly attached telescopic tubes and mirror and

bracket combination 13' and 15', may be set at any desired angle to the encompassed bracket 15', by turning the milled hub 41 of sleeve 41', the latter being held in position on rod 31 by the yoke piece 33; sleeve 41' terminating in the bevelled gear 42 which enmeshes with a similar gear 42' rigidly mounted on stub lug shaft 18 which shaft is attached to the bracket 30 by pin 43.

The mirror 13' may be adjusted at any desired angle within the bracket 15', by turning the milled hub 44 of sleeve 44', the latter being held in position on the rod 32 by the yoke piece 33; sleeve 44' terminating in the bevelled gear 45, which enmeshes with a similar gear 45' rigidly mounted on stub lug shaft 18' which shaft is attached to the frame 14' by pin 43'.

The mirror 13 is adapted to be illuminated by electric light 10' which receives its current supply by a circuit (not shown) similar to that shown in Figure 1.

Figures 5, 6 and 7 represent in side elevation, end elevation, and plan respectively, the adaptation of the invention for remote visualization, wherein the single face mirror 46, encased in frame 46', is mounted on the stub lug shaft 47, turning in the bearing 48 of the bracket 49, and held in position by the collar 47'.

The bracket 49, through its hollow rod extension 49', is rigidly attached to the short tubular guiding entrance section 50, which is formed as a part of the shield quadrant 51, the quadrant being free to rotate around drum 52 on the hollow stub shafts 53 and 53', turning in bearings 54 and 54', to the extent of approximately $37\frac{1}{2}^\circ$, as limited by the pin 55.

The mirror 46 may be adjusted at any desired angle by turning the milled handle 56' of shaft 56, the latter being supported by bearings 57, 57', and 57'' and terminating in bevel gear 58; which through the intermediary gear 58', turning on shaft 62', held in position by collar 62'', engages the gear 58'' causing rotation of the shaft 59; which passing through the hollow rod 49' as a bearing, and terminating in bevel gear 60 which is rigidly attached to shaft 59 and engages the similar gear 60' set on mirror stub shaft 47; thus effecting such elevation or depression of mirror 46 as may be required.

The mirror 46 is adapted to be illuminated by electric light 10'' which receives its current through a circuit extending to any desired source of supply as an ordinary lighting socket.

The drum 52 is fitted with the mirror 61, encased by the frame 61', which is supported by shafts 62 and 62', the hollow stub shafts 53 and 53' serving as bearings. Rotation of the mirror 61 through any desired angle may be effected by turning the milled handle 63' on shaft 63, the latter being supported by

bearings 64, 64' and 64'', and terminating in worm 65, engaging gear 65', set on stub shaft 62 to which mirror frame 61' is firmly attached.

The drum 52 is also fitted with a remote vision tube 66, with its major axis lying in the same plane as the rod extension 49', attached to guiding entrance section 50. The tube 66, which may be of telescopic form, and provided with magnifying lenses if desired, terminates in eye piece 66'. The rod extension 49', with its mirror combination 46, may be set at any desired angle to the tube 66, in the plane of the major axis thereof, within the limits specified, by rotating the milled handle 67' of the shaft 67, which passes through bearings 68, 68' and 68'', and terminates in worm 69, engaging segment gear 69', rigidly fastened to hollow stub shaft 53', to which quadrant 51, is firmly attached.

Figures 8, 9, 10 represent the applications of the simplest, telescopic and remote vision adaptations of my invention to tubes of irregular contour; the lines 70, 71, 72 denoting the rays of incidence, and lines 70', 71' and 72' those of reflection respectively, as obtained by proper adjustment of the various bracket and/or mirror controls, in a manner that will be apparent from the foregoing description.

What I claim is new and desire to protect by Letters Patent is:

1. A device of the class described, comprising an adjustable rod; a handle for supporting the rod; adjustable mirrors carried by said rod; and means carried by the handle for separately controlling the mirror adjusting means, said means comprising a flexible rod, and tubes having gears rigidly attached at one end, said gears being adapted to enmesh with a similar gear carried by the mirror supporting means.

2. A device of the class described for inspecting the inner surface of tubes of relatively small diameter; comprising a plurality of light deflecting means; a telescoping rod adapted to support the light deflecting means; means mounted on the telescoping rod for adjusting the light deflecting means; a handle formed at one end of the telescoping rod; means mounted on the handle for controlling the light deflecting means, said means comprising a flexible rod, tubes, and gears; and illuminating means for the light deflecting means.

3. A device for inspecting the inner surface of hollow bodies; comprising a plurality of adjustable mirrors, a telescoping rod for supporting the mirrors, mirror adjusting means mounted on the telescoping rod, a handle formed at one end of the telescoping rod, means mounted on said handle for remotely controlling the mirror adjusting means, and illuminating means for the mirrors.

4. A device for visualizing the inner sur-

face of tubes of relatively small diameter, such as those of an oil pressure still, said visualizing device comprising a supporting means terminating at one end in a handle and at the other end in a bracket, a mirror mounted in said bracket, said mirror having a rotatable engaging means rigidly attached thereto and said supporting means containing rotative control means adjacent said handle connected to a pinion means near said bracket for meshing with said rotatable engaging means on said mirror whereby said mirror may be adjusted from said handle.

5. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal supporting rod terminating at one end in a handle, a bracket having depending arms, said bracket being rigidly attached to the other end of said supporting rod and eccentrically positioned thereon with one of said depending arms extending substantially in the longitudinal axis thereof, a mirror mounted within said bracket and clear of the longitudinal axis of said supporting rod, and pivotal connections between said arms and mirror for setting the mirror in various angular positions with respect to said bracket and longitudinal rod to effect inspection of the inner surface of said tubes visually unobstructed by said longitudinal rod.

6. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal supporting rod terminating at one end in a handle, a bracket having depending arms, said bracket being rigidly attached to the other end of said supporting rod and eccentrically positioned thereon, a mirror mounted within said bracket with one side thereof extending substantially in the longitudinal axis of said supporting rod, and pivotal connections between said arms and mirror for setting the mirror in various angular positions with respect to said bracket and longitudinal rod to effect inspection of the inner surface of said tubes visually unobstructed by said longitudinal rod.

7. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a mirror, a longitudinal supporting rod terminating at one end in a handle, a bracket rigidly attached to the other end of said supporting rod and encompassing one end of said mirror, an electric lamp mounted upon said mirror, and pivotal connections between said bracket and said mirror for setting the mirror and electric lamp in various angular positions with respect to said bracket and longitudinal rod to effect visualization of the inner surface of said tubes.

8. A device for visualizing the inner sur-

face of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal supporting rod terminating at one end in a handle, a mirror transversely pivoted at the other end of said rod, an electric lamp mounted upon said mirror, and means for setting the mirror in various angular positions with respect to said longitudinal rod, said electric lamp being rigidly attached to said mirror and adapted to move in angular relation therewith to effect visualization of the inner surface of said tubes.

9. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal rod, a bracket rigidly attached at each end of said rod, a mirror mounted in each bracket, a handle member pivotally connected to one of said brackets and means for angularly adjusting the longitudinal rod supporting said brackets and mirrors with respect to said handle.

10. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal rod, a bracket rigidly attached at each end of said rod, an adjustable mirror mounted in each bracket, a handle member pivotally connected to one of said brackets and independent means adjacent said handle for separately controlling the angular adjustment of said mirrors with respect to said brackets and of said longitudinal rod with respect to said handle.

11. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal rod, a handle for supporting the rod, a plurality of adjustable mirrors transversely carried by said rod, means of adjusting the distance between said plurality of mirrors along said rod and means of setting each of said mirrors at various angles of reflecting relationship with the other of said mirrors.

12. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal rod, a handle for supporting the rod, a plurality of adjustable mirrors transversely carried by said rod and means of setting each of said mirrors at various angles of reflecting relationship with the other of said mirrors.

13. A device for visualizing the inner surface of tubes of relatively small diameter, such as those of an oil pressure still, comprising a longitudinal rod including a plurality of telescoping sections, a handle for supporting the rod, a plurality of mirrors transversely carried by said rod, one of said mirrors being adjustably mounted at the end of said rod and having a gear rigidly attached thereto, a pinion meshing with said gear and

a rotatable shaft connected to said pinion and to the telescoping section at the end of said supporting rod, said rotatable shaft extending along said supporting rod to said handle and adapted to be rotated to effect angular adjustment of the mirror at the end of said rod and to be reciprocated longitudinally of said rod to effect telescoping of the sections thereof whereby the distance between said mirrors may be varied along said rod.

14. A device for inspecting the inner surface of hollow bodies from a point relatively remote and at a variable angle to the major axis of the bodies being inspected, comprising eccentrically mounted adjustable light deflecting means, means of supporting the light deflecting means and a vision tube adjustable at a variable angle to the axis of said supporting means.

15. A device of the class described for inspecting the inner surface of hollow bodies at a point relatively remote and at a varying angle to the major axis of the hollow bodies; comprising a vision member adjustable at a variable angle to said major axis, a drum at the upper end of said vision member, an adjustable mirror carried by said drum, a rod rotatively connected to said drum and an adjustable mirror eccentrically supported by said rod.

16. A device of the class described for inspecting the inner surface of tubes of relatively small diameter from a point relatively remote at a varying angle to the major axis of the tube being inspected; comprising a plurality of adjustable mirrors, a remote vision tube adjustable at a variable angle to said major axis, a drum carried by one end of said vision tube, a rod rotatively connected to said drum, means for separately adjusting the mirrors, and rotative means mounted on the tube for controlling the mirror adjusting means.

In testimony whereof I have affixed my signature.

NORMAN H. RANSTEAD.