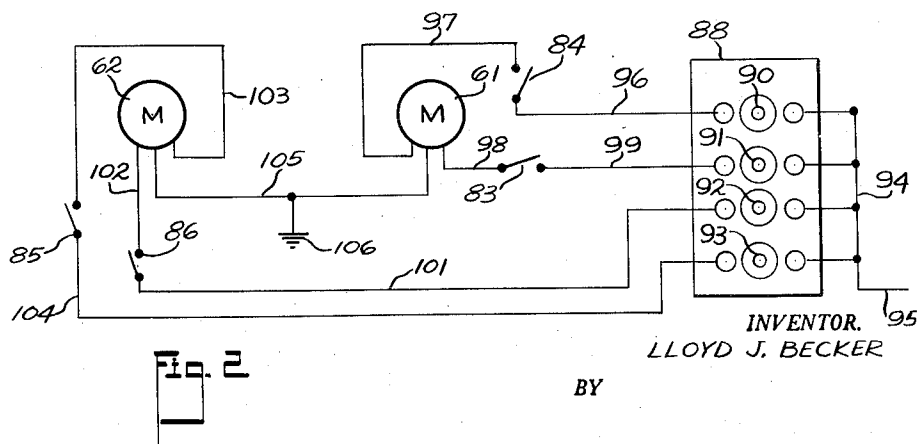
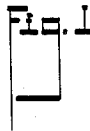


L. J. BECKER

FIRE FIGHTING APPARATUS

2 Sheets-Sheet 1



May 13, 1958

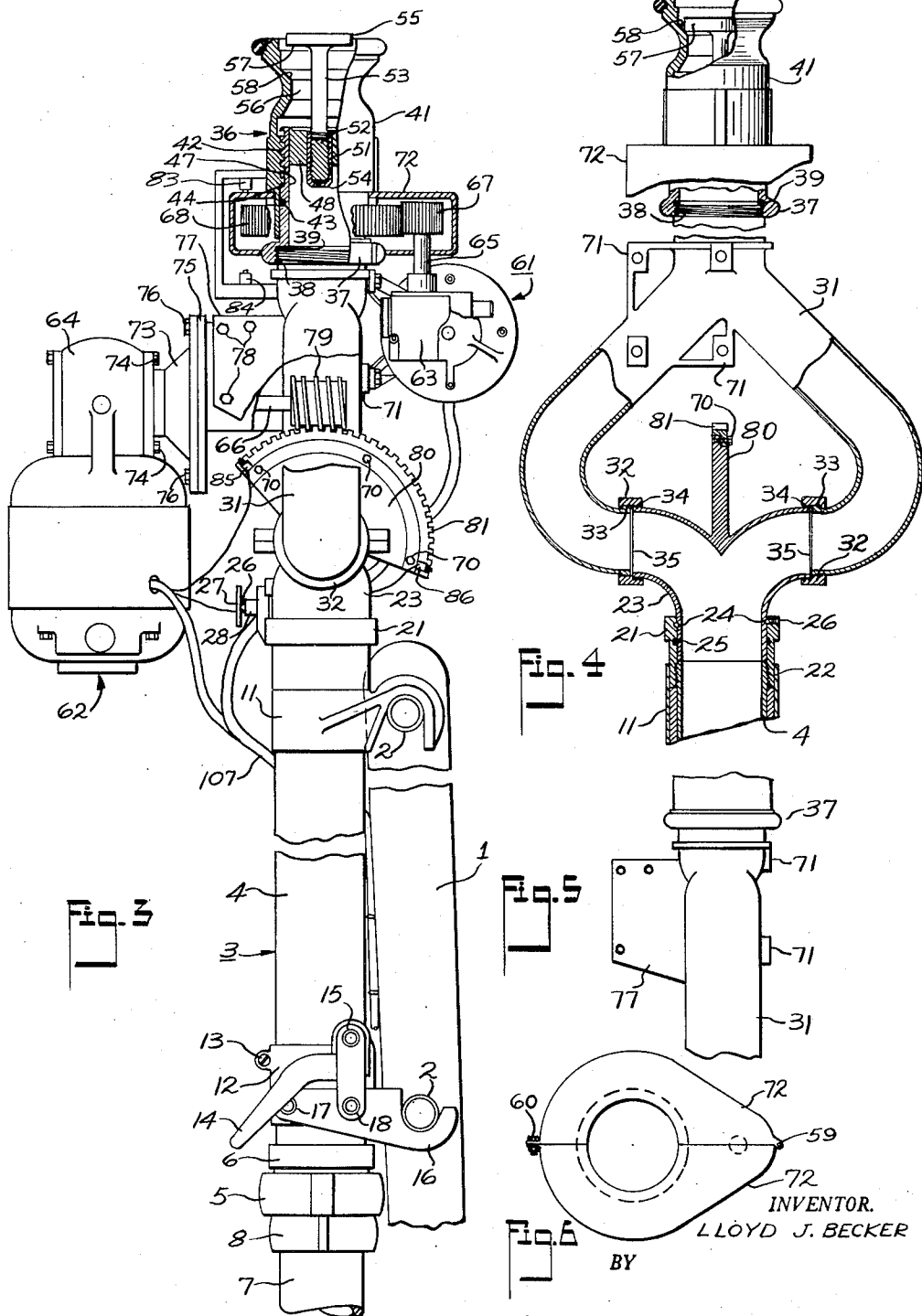
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FIRE FIGHTING APPARATUS

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2 Sheets-Sheet 2



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FIRE FIGHTING APPARATUS

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This invention relates to fire fighting devices and more particularly to a remotely controllable device which may be carried by a ladder to combat fires in elevated or other inaccessible locations.

One device which has previously been used to combat fires includes a non-adjustable nozzle pivotally mounted on a bracket or ladder pipe. The ladder pipe may be mounted on a powered ladder and the ladder elevated and trained to locate the nozzle in the vicinity of the fire. Ropes are fixed to the nozzle and a fireman manipulates the ropes to elevate or depress the nozzle to train an ejected fluid stream on the fire.

Attempts have been made to employ, in combination with a ladder pipe, a nozzle which can be adjusted to emit either a solid stream of water or a fine mist or "fog." These attempts have been unsatisfactory since adjustment of the stream could only be had if a man climbed the ladder and manually manipulated the nozzle. Such an operation is highly dangerous both because the ladder climber is forced to straddle a fluid providing hose which is connected to the nozzle and supported by the ladder and because the fireman is required to perform the adjusting operation at a location which may be unduly close to the fire which he is to fight.

It is, therefore, one object of this invention to provide an adjustable nozzle which will permit ejection of a selected stream of fire fighting fluid having a contour and a consistency which may be altered by manipulating a remotely controlled mechanism. More specifically an adjusting mechanism is fixed to or carried by the adjustable nozzle which mechanism may, in response to remotely emitted energy impulses which are transmitted to it, be activated to adjust the nozzle to provide a fog to fight a general or an electrical fire or the like, and a straight stream of fluid to combat residual concentrated pockets of fire or other combustion which may best be extinguished with a concentrated straight stream of fluid.

Ladder pipes with nozzles which may be elevated or depressed by remotely controlled ropes have several inherent disadvantages which include the need for constant manipulation and attention by a fire fighting person who is subject to fatigue and the remote but constantly present danger that the ropes themselves may be consumed by the fire, or at least weakened to the breaking point. An additional disadvantage to such a rope control device is that the device requires the constant and complete attention of an operator to manipulate the ropes. In the present invention the control switches are located adjacent the ladder control switches to enable a ladder operator to manipulate the nozzle as well. It is, then, a further object of the invention to overcome these and other disadvantages through provision of a remotely controllable mechanism to elevate and depress the nozzle to aid in training it on a fire.

An additional object of the invention is to provide a fire fighting apparatus for carriage by a ladder pipe which may be moved closer to the proximity of a fire than prior mechanisms both through provision of a device

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which is more resistant to combustion than prior mechanisms and through provision of a device which incorporates the shielding and cooling benefits of a fog or mist like fluid stream.

5 A further object of the invention is to provide a portable device which may be attached to a powered ladder on a fire truck and activated through use of the available electric power of the truck to both elevate or depress and to adjust the contour of a fluid stream to be ejected from a fire fighting nozzle. This objective may be achieved through use of power trains activated by reversible electric motors of suitable size such as 12 volt motors which may be connected to the electrical system of the fire truck.

10 A more specialized object of the invention is achieved through the use of appropriate sets of interacting gears to provide relative pivotal movement of the nozzle and the ladder pipe for elevation and depression of the nozzle and to provide relative stream adjusting movement of the nozzle parts.

15 An additional specialized object of the invention is to provide an appropriate mechanism to prevent excessive, damaging movement of the movable parts past the adjustment limits. This objective may be achieved through incorporation of appropriately sized and located limit switches of known construction.

20 A further specialized object of the invention is to provide electric circuits having self opening switches such as spring biased toggle switches or push buttons so that adjusting movement will be had only when the operator presses and holds the desired switch or button.

25 A further specialized object of the invention is to provide an inexpensive combination having sure, positive, and yet simple adjustment. To achieve this objective a nozzle which has a baffle carried by a base and a sleeve which is in threaded engagement with the base is employed. In such a nozzle relative axial adjusting movement is obtained through relative rotation of the base and sleeve through incorporation of this type of nozzle in combination with a pair of interacting gears and a reversible motor an inexpensive combination having sure, positive yet simple adjustment is obtained.

30 As an additional specialized object of the invention a housing is provided on the nozzle to shield the attached gears from water or other fluid spray.

35 Further objects and advantages will be apparent to one skilled in the art from the following detailed description of the preferred mode of practicing the invention and from the attached drawings which are to be considered as part of the specification.

40 In the drawings:

45 Fig. 1 is a side elevational view showing an adjustable nozzle pivotably carried by a ladder and a ladder pipe, the ladder and the ladder pipe being shown in fragmentary views, the remotely controllable reversible motors and supporting members, the interacting nozzle adjusting gears, the housing surrounding the nozzle adjusting gears, a portion of one of the pivotal adjustment gears, and the limit switches.

50 Fig. 2 is a wiring diagram of the control circuits showing the electrical connections for the reversible motors, the limit switches and the toggle switches and a control panel;

55 Fig. 3 is a side elevational view partly in section, with parts broken away and removed, of an adjustable nozzle, the adjustment mechanisms, and, in foreshortened form, a ladder and a ladder pipe, the view of the ladder being a fragmentary sectional view;

60 Fig. 4 is a cross sectional view of the upper end of the ladder pipe, the supporting base, one of the pivotal adjustment gears, and a bottom plan view of a part of the siamese including the nozzle motor bracket, and a sec-

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tional view of the nozzle in a closed or shut position of adjustment showing its connection to the siamese;

Fig. 5 is a fragmentary side elevational view of the siamese and the nozzle showing the relationship of the motor supporting brackets to the other elements of the device; and,

Fig. 6 is a bottom plan view of the nozzle housing or shield.

Referring to the drawings and to Figs. 1 and 3 in particular, a ladder 1 having rungs 2 is shown with a ladder pipe, shown generally at 3, mounted on it. The ladder pipe 3 includes an elongated tubular conduit or inlet pipe 4 having at its lower end a suitable coupling formed by a swivel 5 and a swivel adaptor 6 for connection to a hose 7 by hose coupling 8.

Upper and lower split ring mounting brackets 11 and 12 are carried by the inlet pipe 4 to provide a clamping device for facile mounting on and disconnection from the ladder 1. Each of the brackets 11 and 12 is formed from a pair of split rings which are suitably fastened together as by screws 13. Suitable longitudinal adjustment for appropriate spacing of the mounting brackets 11 and 12 is provided as by sliding the lower bracket 12 axially along the inlet pipe 4 to the desired position and then locking it in place by tightening the screw 13. The ladder pipe 3 is locked on the rungs 2 of the ladder by pivoting lever arm 14 downwardly about pivot 15 which, through the interaction at pivot connection 18, moves bracket arm 16 upwardly by pivoting on pivot 17 to cause the bracket arm to grip the lower of the rungs 2.

A base adaptor 21 is connected to the inlet pipe 4 at its upper end by threaded engagement at 22 (Fig. 4), and a supporting base 23 is carried by the base adaptor 21. Balls 24 are interposed between the base adaptor 21 and the supporting base 23 to permit the supporting base to be rotated or swiveled in the base adaptor. An O-ring 25 is also interposed between the base adaptor 21 and the supporting base 23 to provide a fluid tight seal between the two base members. The balls 24 are introduced into their positions between the base adaptor and the supporting base through a hole in the base adaptor which is closed by plug 26.

The supporting base 23 may be swiveled in the base adaptor 21 to the desired position and then locked in place by the action of a plunger or thumb screw 26 having a hand wheel 27. The plunger is threaded through plunger housing 28 and locking or set screw action is obtained by rotating the thumb wheel 27.

For the purposes of the present invention, the swivelable connection of the siamese 23 to the pipe 4 need not be included. The device is operable if the siamese is simply fixed to the pipe.

A connecting conduit or siamese 31 is pivotally carried by the supporting base 23. A pair of fluid tight swivel connections are formed between the siamese 31 and the base support 23 through the interaction of elbow swivels 32 which embrace flanges 33 on the siamese 31 and which are threaded on the supporting base 23 at 34, and a pair of suitable gaskets 35 which are interposed between the ends of the siamese and the supporting base.

A nozzle, shown generally at 36, is fixed to the other end of the siamese as by threaded engagement of a nozzle base member or part 37 at 38 in a fluid tight connection formed by a suitable gasket 39. While it is within the contemplated scope of the invention to employ any of the known adjustable fire-fighting nozzles for fluid stream selection such as the type in which a baffle is axially moved in a body or sleeve or the type having a plurality of fluid conducting passages through which fluid may be directed, one at a time, by manipulation of a movable valve or part, for simplicity and ease of operation as well as economy of manufacture, the type of nozzle disclosed in the drawings is preferred. This preferred nozzle, which may for example be a nozzle having a capacity of 478 gallons per minute at 100 pounds pressure, has a

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sleeve member or part 41 threaded on the base part 37 at 42.

An O-ring 43 is interposed between the nozzle base and sleeve parts 37 and 41 to form a fluid tight seal therebetween. A sleeve bumper ring 44 is interposed between an end annular surface on the base part 37 and an end annular surface on the sleeve part 41 to prevent damaging engagement of these end surfaces when the sleeve part 41 is fully threaded onto the base part 37.

The base part 37 has an axial through passage defined by a cylindrically shaped inner surface 47 and a spider or web 48 extending inwardly from the inner surface 47 at its inner or sleeve end. The web 48 has an enlarged central portion 51 having an internally threaded axial passage therethrough which receives a threaded end 52 of a baffle 53. A lock nut 54 is screwed onto the threaded end 52 to secure the threaded engagement of the baffle 53 and the web central portion 51. The sleeve part 41 also has a through passage 56 which is defined by a plurality of circular inner surfaces which are concentric to and coaxial with both the base inner surface 48 and the baffle 43.

When the sleeve part 41 is threaded fully onto the base part 37 (Fig. 3) the interaction of head 55 of the baffle 53 and the various curved inner surfaces which define the passage 56 through the sleeve 41 causes fluid passed through the nozzle to be ejected in a concentrated or straight stream. As the sleeve 41 and the base part 37 are relatively rotated the sleeve shifts axially outwardly (or upwardly as seen in Figs. 3 and 4) and the interaction of the baffle head 55 and the various curved axial inner surfaces of the sleeve cause the contour of a stream of fluid being ejected from the nozzle to alter by widening and the consistency of the stream to become a fine mist or fog. As the rotational movement is continued further inner edge 57 of the baffle head 55 contacts inclined circular inner sleeve surface 58 to stop the flow of fluid and the nozzle is then in a closed or shut position (Fig. 4).

To accomplish remotely controlled movement both to elevate and depress the nozzle and to adjust the nozzle parts for altering the contour of an ejected fluid stream, force mechanisms having force exerting or adjustment supplying elements which are responsive to remotely emitted energy impulses transmitted to them and force reacting elements are connected to the relatively movable parts. In the preferred embodiment of the invention these force exerting elements are reversible electric nozzle and pivotal adjustment motors 61 and 62 and the force reacting elements are interacting gears which will subsequently be described in more detail.

As an example, a $\frac{1}{50}$ horsepower 12 volt reversible motor is of suitable size for the nozzle adjustment motor 61 and a $\frac{1}{6}$ horsepower 12 volt motor is suitable for the pivotal adjustment motor 62. Rotational forces generated by the motors activate gear trains (not shown) which are contained in housings 63 and 64. In the preferred arrangement with the previously indicated motor and nozzle capacities, a suitable gear reduction for adjustment of the nozzle parts will cause nozzle adjustment drive shaft 65, which is journaled in the nozzle gear housing 63, to rotate at 72 revolutions per minute, while pivotal adjustment drive shaft 66 which is journaled in the pivotal gear housing 64, suitably is caused to rotate at 19.2 R. P. M.'s.

To transmit rotational forces from the nozzle adjustment motor 61 to the nozzle, a drive gear 67 is connected to the nozzle drive shaft 65 to interact with sleeve gear 68 which is fixed to reduce diameter portion 50 of the sleeve 41. The nozzle adjustment motor is mounted on a suitable bracket 71, which is preferably cast as an integral part of the siamese 31, to connect the motor to the nozzle base part 37. Thus, force generated by the motor will cause relative adjusting movement of the nozzle parts.

To shield the nozzle gears 67 and 68 from fluid spray

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a thin-walled stamped or fabricated housing or shield 72 which is shown in detail in Fig. 6 surrounds the gears and may be suitably connected to the nozzle 36 as by fixing it to either the nozzle sleeve 41 or the base part 37. Preferably the housing 72 has two symmetrical parts which are connected by a hinge 59 at one end and a pair of extensions held together by a screw 60 at the other. The bracket has appropriate openings which peripherally embraces the nozzle drive shaft 65, the reduced diameter portion 50 and the nozzle base 37. A spacer 69 is interposed between the gear 68 and the gear housing 72 to hold the housing in appropriate spaced relationship with the sleeve 41 and to cause the housing 72 to shift axially with the sleeve 41 and the gear 68 when the nozzle is adjusted.

The pivotal adjustment motor 62 is suitably attached to the siamese 31. In the disclosed mode of attachment, the pivotal adjustment motor 62 is fixed to the pivotal gear housing 64 which in turn is fixed to mounting bracket 73 by bolts 74. The mounting bracket 73 is connected to adaptor bracket 75 by bolts 76 and the adaptor bracket 75 is fastened to support member 77 by bolts 78. The support member 77 is, like the nozzle adjustment motor bracket 71, preferably cast as an integral part of the siamese 31.

A worm gear 79 is fixed to or carried by the pivotal adjustment drive shaft 66 to interact with gear segment 81. The gear segment 81 is fixed by screws 70 to mounting bracket 80 which may be cast as an integral part of the supporting base 23. Hence, rotational movement of the pivotal adjustment drive shaft 66 will, through interaction of the associated gears 78 and 81, cause relative pivoting movement of the siamese 31 and the connected nozzle 36 about the supporting base 23.

To prevent excessive movement of the relatively movable parts appropriate limit switches are mounted on one of the movable parts in spaced relationship with the other of the movable parts to activate the limit switches to interrupt the motor activating circuits when the maximum limits of adjustment have been reached. In the preferred embodiment limitation of nozzle adjustment is achieved by mounting a bracket 82 on the nozzle base 37, or as shown, on the siamese 31 to carry a pair of limit switches 83 and 84. The switches are appropriately located on the switch bracket 82 so that the switch 83 will be opened by contact with the gear housing 72 when the closed or shut position is attained by the nozzle, and the switch 84 will be opened by contact with the gear housing when the straight stream or fully opened position of the nozzle is attained.

In the preferred construction for limitation of the relative pivotal adjusting movement of the siamese 31 and the supporting base 23 a pair of limit switches 85 and 86 are mounted on the gear bracket 80. The switch 85 will be opened by contact with the worm gear 79 to interrupt one of the pivot motor adjusting circuits when maximum depression of the nozzle is achieved and the other switch 86 will be opened by contact with the worm gear to interrupt the other of the pivot adjusting motor circuits when the nozzle has been elevated to its highest position.

Referring to Fig. 2 a toggle switch or push button panel 88 is provided for mounting in a suitable location, such as on a fire truck. The panel 88 has a plurality of toggle switches 90, 91, 92 and 93 which are connected through common conductor 94 to a suitable source of voltage indicated at 95. The toggle switches are shown diagrammatically in the drawings. In practice a pair of two-way toggle switches are preferably used. Such a source of voltage may, for example, be a fire truck 12 volt electrical system or a 110 volt alternating current source which some modern trucks are equipped to provide.

The toggle switch 90 is serially connected through conductor 96, the limit switch 84, and conductor 97 to one side of the nozzle adjustment motor 61. The other side of the nozzle adjustment motor is serially connected

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through conductor 98, the limit switch 83 and conductor 99 to toggle switch 91. Toggle switch 92 is serially connected through conductor 101, limit switch 86 and conductor 102 to one side of the pivot adjustment motor 62, while the other side of the reversible pivot adjusting motor 62 is connected through conductor 103, limit switch 85, and conductor 104 to the toggle switch 93. The motors 61 and 62 are connected through conductor 105 to a ground indicated at 106.

Preferably the various conductors connecting the toggle switches or push buttons to the limit switches and the conductor connecting the motors to ground are housed in a common cable 107 (Figs. 1 and 3) which is supported by the ladder 1. Additionally, in the preferred embodiment a pair of toggle switches of the type which may be moved in two directions to close either of two circuits may be substituted for the pairs of diagrammatically shown switches 90 and 91 and 92 and 93 respectively.

In operation the ladder pipe 3 is first connected to the ladder 1 and the conductor 107 is suitably affixed to the ladder. The ladder is then elevated to position the nozzle in the vicinity of a fire which is to be combated. Water is caused to pass through the hose 7 then through the ladder pipe 3, the siamese 31 and the nozzle 36. The nozzle 36 is adjusted to the appropriate stream by manipulation of the toggle switches 90 and 91 by the operator. Toggle switches 92 and 93 are then manipulated by the operator to cause the pivotal adjustment motor to elevate or depress the nozzle to train the stream on the fire. In the preferred apparatus which is equipped with toggle switches having springs adjusting movement can be obtained only by exerting physical pressure on the switches which are normally held open by the springs. Thus, once it is adjusted and trained the fire fighting apparatus needs no further attention until the operator wishes to train the nozzle on a different portion of the fire or until the character of the fire has altered to a condition which requires a different type of fire fighting stream. The nozzle is then readjusted, to alter the contour of the ejected fluid stream, or elevated or depressed to train the ejected water on a different location.

A fire fighting apparatus suitable for facile connection to and carriage by a ladder, which has remotely controllable adjustments both to elevate and depress and to alter the contour and consistency of a fluid stream has thus been provided.

In accordance with the patent statutes the principles of the present invention may be utilized in various ways, numerous modifications and alterations being contemplated, substitution of parts and changes in construction being resorted to as desired, it being understood that the embodiment shown in the drawings and described above and the particular method set forth are given merely for purposes of explanation and illustration without intending to limit the scope of the claims to the specific details disclosed.

What I claim and desire to secure by Letters Patent of the United States is:

1. A remotely controlled fire fighting apparatus comprising a ladder pipe for facile connection to a ladder, upper and lower mounting brackets carried by the ladder pipe, the brackets being in longitudinally adjustable relationship on the ladder pipe, one of the brackets including a clamp arrangement to removably fix the ladder pipe to a ladder, a support base of generally Y-shaped construction, the support base having one inlet and two outlet openings, a siamese carried by the support base and having first and second inlet openings, pivotal fluid tight connection means pivotally connecting the siamese to the support base with the siamese first and second inlet openings being in communication with the support base first and second outlet openings respectively, a gear segment fixed to and forming a part of the support base, the siamese including a first motor bracket, a first revers-

ible motor fixed to the siamese motor bracket, the motor having a drive shaft, a first worm gear carried by the first motor shaft, the first worm gear and the gear segment being in engagement with one another whereby operation of the first reversible motor in one direction will elevate the siamese and operation of the first motor in the other direction will depress the siamese, an adjustable nozzle carried by the siamese, said nozzle having a base, a sleeve, and a baffle, the baffle being fixed to the base, the sleeve being a tubular member threaded to the base and disposed about the baffle, the sleeve member and the baffle together defining an adjustable annular fluid opening, a sleeve gear disposed circumferentially about and fixed to the sleeve, the sleeve and sleeve gear being shiftable axially relative to the base upon rotation relative to the base, the siamese including a second motor bracket, a second reversible motor fixed to the siamese second motor bracket, the second motor having a shaft and a drive gear fixed to the second motor shaft, the drive gear being fixed axially and being engaged with the sleeve gear whereby operation of the second motor will cause the sleeve to move axially relative to the base and baffle to adjust the size of the annular fluid opening, means to selectively operate the first motor in either direction, and means to selectively operate the second motor in either direction.

2. A remotely controlled fire fighting apparatus comprising a ladder pipe for facile connection to a ladder, upper and lower mounting brackets carried by the ladder pipe, the brackets being in longitudinally adjustable relationship on the ladder pipe, one of the brackets including a clamp arrangement to removably fix the ladder pipe to a ladder, a support base of generally Y-shaped construction, the support base having one inlet and two outlet openings, a siamese carried by the support base and having first and second inlet openings, pivotal fluid tight connection means pivotally connecting the siamese to the support base with the siamese first and second inlet openings being in communication with the support base first and second outlet openings respectively, a gear segment fixed to and forming a part of the support base, the siamese including a first motor bracket, a first reversible motor fixed to the siamese motor bracket, the motor having a drive shaft, a first worm gear carried by the first motor shaft, the first worm gear and the gear segment being in engagement with one another whereby operation of the first reversible motor in one direction will elevate the siamese and operation of the first motor in the other direction will depress the siamese, an adjustable nozzle carried by the siamese, said nozzle having a base, a sleeve, and a baffle, the baffle being fixed to the base, the sleeve being a tubular member threaded to the base and disposed about the baffle, the sleeve member and the baffle together defining an adjustable annular fluid opening, a sleeve gear disposed circumferentially about and fixed to the sleeve, the sleeve and sleeve gear being shiftable axially relative to the base upon rotation relative to the base, the siamese including a second motor bracket, a second reversible motor fixed to the siamese second motor bracket, the second motor having a shaft and a drive gear fixed to the second motor shaft, the drive gear being fixed axially and being engaged with the sleeve gear whereby operation of the second motor will cause the sleeve to move axially relative to the base and baffle to adjust the size of the annular fluid opening, a first pair of limit switches mounted on the gear segment to provide first and second extremes of relative movement between the worm gear and the gear segment, a source of electric potential, elevating serial connections between one of the first pair of limit switches, the source of electric potential, and the first motor, depressing serial connections between the other of the first pair of limit switches, the source of electric potential, and the second motor, said one of the first pair of limit switches being mounted to interact with the worm gear when said first

extreme of relative movement is reached, said other of the first pair of limit switches being mounted to interact with the worm gear when said second extreme of relative movement is reached, a sleeve gear housing axially shiftable with the sleeve and the sleeve gear, a switch bracket fixed to the siamese, a second pair of limit switches carried by the bracket, the nozzle having first and second positions of maximum adjustment, one of said second pair of limit switches being positioned to interact with the housing when the first position of maximum nozzle adjustment is reached, the other of said second pair of limit switches being positioned to interact with the housing when the second position of maximum nozzle adjustment is reached, first nozzle serial connections from said source of electric potential to said one of said second pair of limit switches and to said second motor, and second nozzle serial connections from said source of electric potential to said other of said second pair of limit switches and said second motor.

3. In a firefighting device having an adjustable nozzle, the improvement which comprises, a nozzle having a base, a baffle, and a sleeve, the base and baffle being fixed together, the base having a through circular fluid passage, the baffle having an axis coaxial with the base passage axis, the sleeve having an inner surface defining a through passage, the sleeve inner surface having a threaded portion, the sleeve being threaded onto the base and disposed in spaced relationship about the periphery of the baffle, the sleeve inner surface and the baffle coacting to control the contour of a stream of water emitted from the nozzle when the nozzle is in operation, the sleeve being axially shiftable relative to the base and baffle on relative rotation of the sleeve and the base to adjust such emitted stream contour, shiftable power train means operatively connected to the sleeve, reversible drive means connected to the base and operably connected to the shiftable power train means, the reversible drive means being to selectively drive the shiftable power train means to cause such rotation and axial movement of the sleeve relative to the base and baffle, the power train being shiftable to maintain operable connection between the drive means and the sleeve as the sleeve shifts axially.

4. In a firefighting device having an adjustable nozzle, the improvement which comprises, a nozzle having a base, a baffle, and a sleeve, the base and baffle being fixed together, the base having a through circular fluid passage, the baffle having an axis coaxial with the base passage axis, the sleeve having an inner surface defining a through passage, the sleeve inner surface having a threaded portion, the sleeve being threaded onto the base and disposed in spaced relationship about the periphery of the baffle, the sleeve inner surface and the baffle coacting to control the contour of a stream of water emitted from the nozzle when the nozzle is in operation, the sleeve being axially shiftable relative to the base and baffle on relative rotation of the sleeve and the base to adjust such emitted stream contour, a motor connected to the base, the motor having a drive shaft, a sleeve gear connected to the sleeve, a drive gear operably connected to the drive shaft and in engagement with the sleeve gear, the drive gear having an axis parallel to the axis of the nozzle and the sleeve gear, said sleeve and sleeve gear being shiftable axially on rotation caused by the motor, said drive gear being fixed axially, and means to limit the axial movement of the sleeve and sleeve gear and maintain the engagement of the gears.

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