April 10, 1945. C. J. L. MOS 2,373,589

WIRE FEEDER

Filed March 13, 1943 2 Sheets-Sheet 1

Fig. 1.

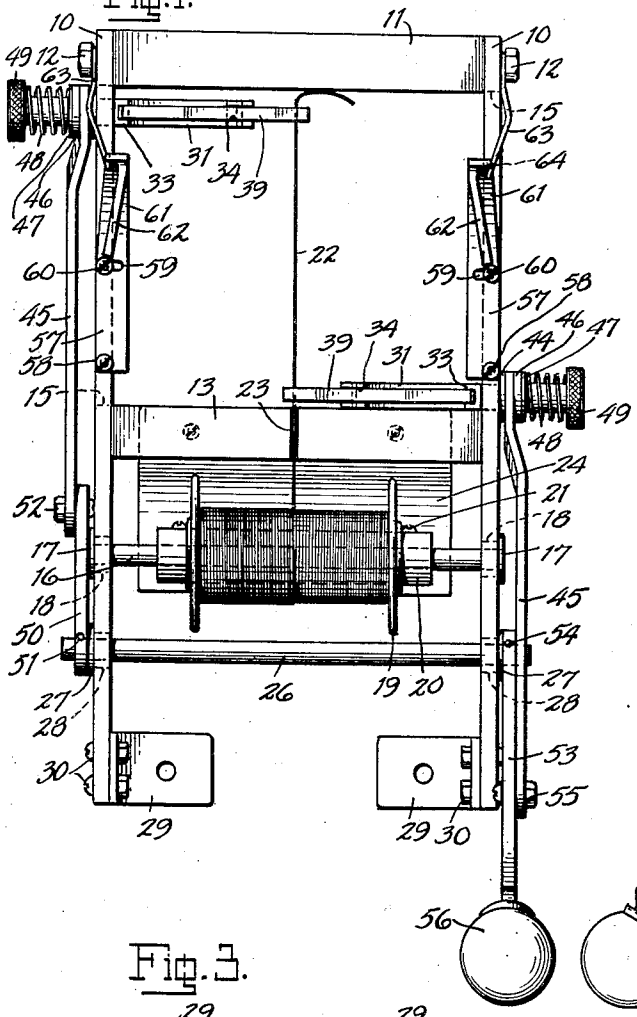


Fig. 2.

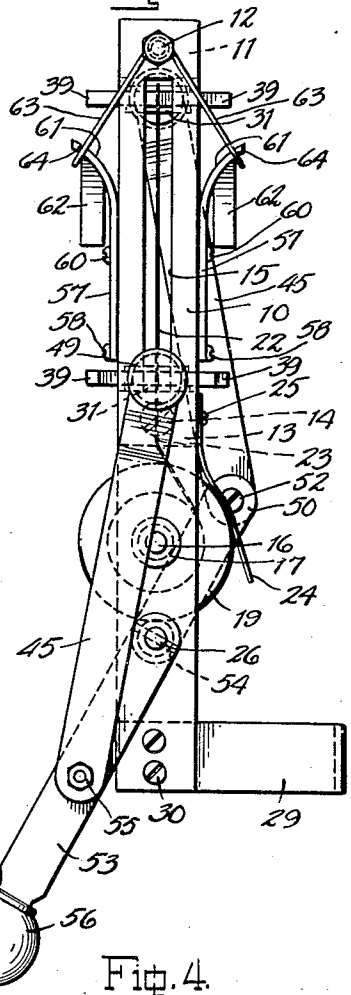


Fig. 3.

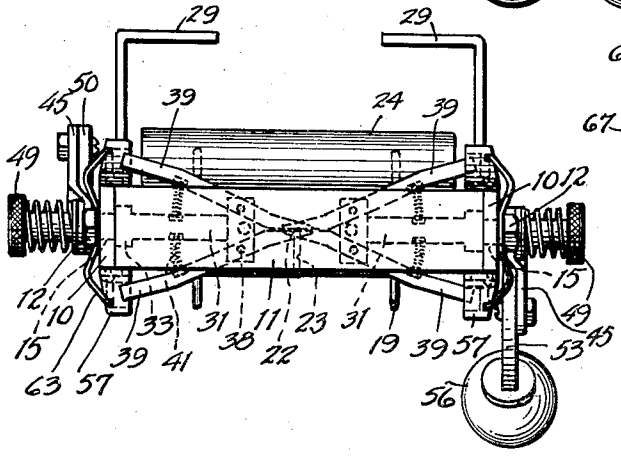
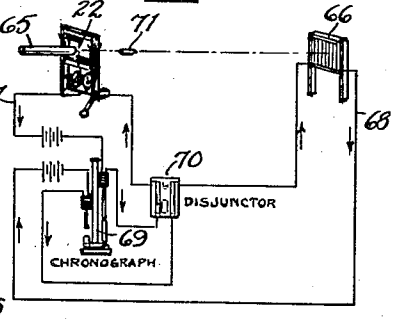


Fig. 4.



INVENTOR
CARL J. L. MOS.
BY
D. Werner Smythe
ATTORNEYS

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Filed March 13, 1943 2 Sheets-Sheet 2

Fig. 5.

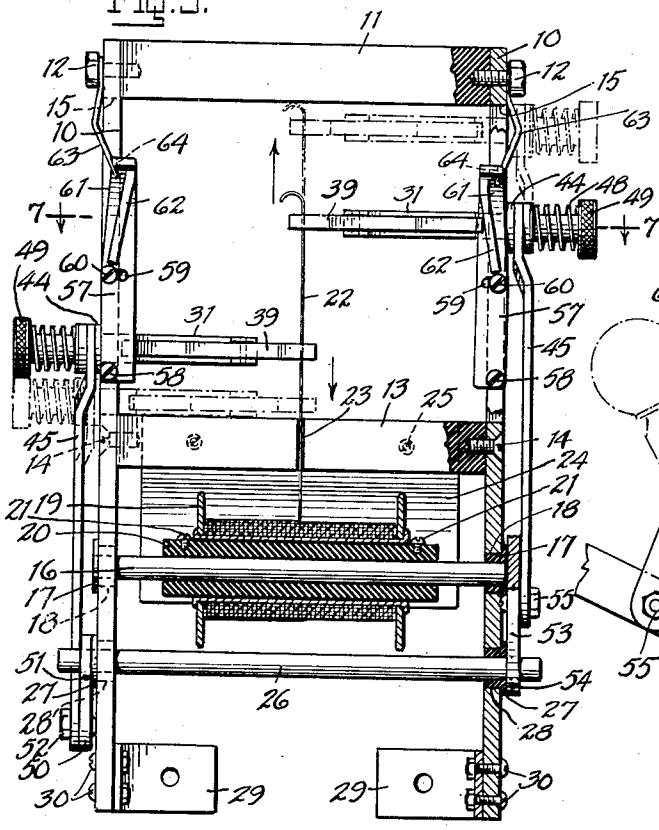
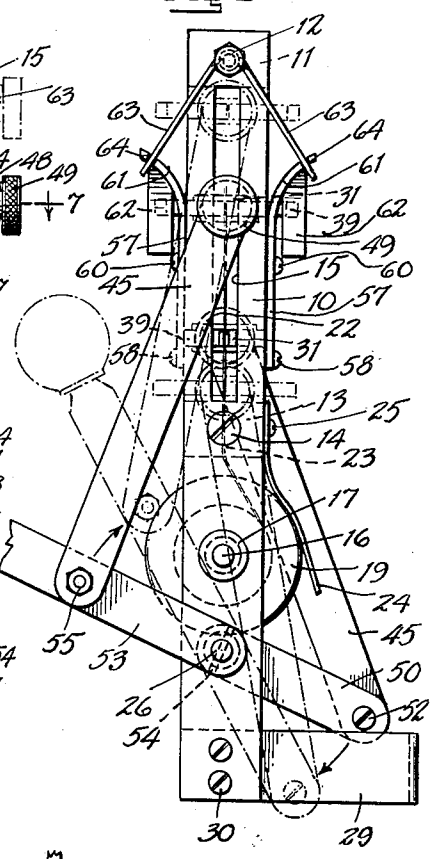


Fig. 6.



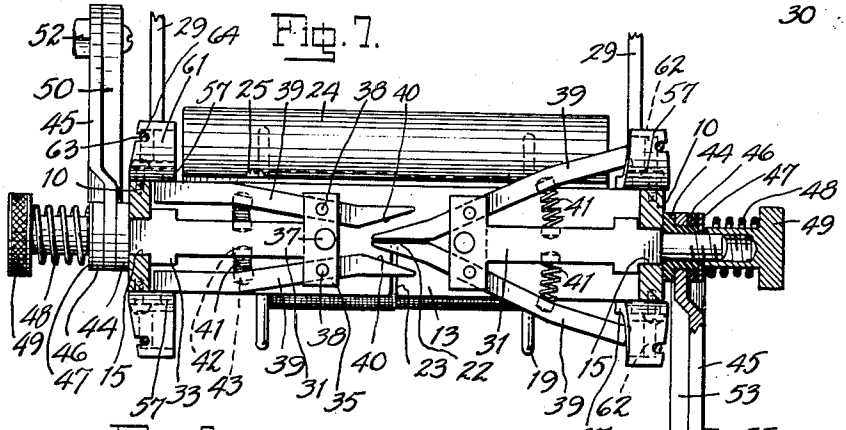


Fig. 7.

Fig. 8.

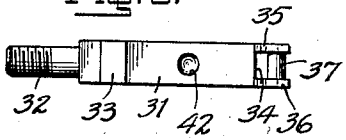
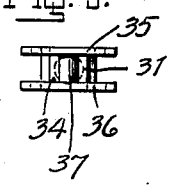


Fig. 9.



INVENTOR
CARL J. L. MOS.
BY
D. Werner Smythe
ATTORNEYS

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2,373,589

UNITED STATES PATENT OFFICE

2,373,589

WIRE FEEDER

Carl J. L. Mos, Cincinnati, Ohio, assignor to Remington Arms Company, Inc., Bridgeport, Conn., a corporation of Delaware

Application March 13, 1943, Serial No. 479,080

8 Claims. (Cl. 200—125)

The present invention relates to a wire feeder, and particularly an automatic device of this character for use in cooperation with a ballistic chronograph, and having for its object the rapid replacing of the strip of copper wire broken every time a gun is fired in measuring velocity with the chronograph, thus greatly speeding up the testing operation by enabling more ammunition to be tested in a given period.

In measuring the velocity of ammunition, the bullet is caused to pass two successive points in its path spaced a known distance apart, each point being provided with electric circuit-breaking means which is actuated at the instant the bullet passes it. The two circuits are connected to the ballistic chronograph, which registers the time of flight of the bullet between the successive circuit breaks. The present invention is concerned with a velocity measuring apparatus wherein a wire is strung across the muzzle of the gun as the first target or circuit-breaking means. It has heretofore been the practice for the gunner to thread the muzzle wire between the terminals of the chronograph by hand, and as a large number of shots are usually fired in each velocity test considerable time has been required in the manual threading of the wire between each shot, and there was also apt to be slight inaccuracies and variations in the positioning and tensioning of successively threaded wires, depending as it does on the skill and care of the operator.

It is proposed, according to the illustrative embodiment of the invention disclosed herein, to provide an automatic device, operated simply by the manual actuation of a control member, and by which the broken end of the strip of wire is discarded and a new strip of wire is drawn from a reel and strung across the gun muzzle and tensioned in this position, these operations being an automatic function of the device initiated by the manual actuation of the control member. It is further proposed to provide an automatic wire feeder which, through elimination of the manual handling and threading of the wire, insures exact uniformity between each successive stringing and more positive electrical connections between the wire and the chronograph.

With the above and other objects in view, an embodiment of the invention is shown in the accompanying drawings, and this embodiment will be hereinafter more fully described with reference thereto, and the invention will be finally pointed out in the claims.

In the drawings:

Fig. 1 is a front elevation of a wire feeder device, according to the illustrated exemplary embodiment of the invention, and showing the parts in their operative position with the unbroken length of circuit-breaking wire strung across the path of the bullet.

Fig. 2 is a side elevation thereof.

Fig. 3 is a top plan view.

Fig. 4 is a diagrammatic view, showing the device of the invention and its electrical connections with the target and the chronograph.

Fig. 5 is a front elevation, partly in section, showing the parts in an intermediate position during the stringing of the wire, and showing in dot-and-dash lines the operative position of the parts upon completion of the stringing operation.

Fig. 6 is a side elevation of the device, showing the parts in the intermediate position shown in Fig. 5, and also showing in dot-and-dash lines the operative position upon completion of the stringing operation.

Fig. 7 is a horizontal sectional plan view, taken along the line 7—7 of Fig. 5, and on an enlarged scale.

Fig. 8 is a detail side elevation of one of the wire gripper holder arms employed in the device.

Fig. 9 is an inner end elevation thereof.

Similar reference characters indicate corresponding parts throughout the several figures of the drawings.

Referring to the drawings, the wire feeder device, according to the illustrated exemplary embodiment of the invention, comprises a rectangular frame consisting of a pair of upright metal bars 10—10 connected at their upper ends by a horizontal cross-bar 11, formed of non-conducting material, such as fiber, and secured by set screws 12—12, and connected intermediate their upper and lower ends by a cross-bar 13, also formed of non-conducting material, such as fiber, and secured by countersunk screws 14—14, the cross-bar 13 being in spaced parallel relation below the cross-bar 11. Each of the upright bars 10 is provided with a vertical slot 15 having its upper end in line with the undersurface with the upper cross-bar 11 and its lower end in line with the upper surface of the lower cross-bar 13.

In spaced relation below the cross-bar 13 there is provided a horizontal reel supporting shaft 16, having its ends supported in non-conducting flanged washers 17—17, of fiber or the like, set into holes 18—18 in the upright bars 10, so that the shaft is electrically insulated from the upright bars. Upon this shaft there is rotatably supported for longitudinal movement the wire reel 19 mounted on a non-conducting tubular

bushing 20, of wood, fiber, or the like, which projects beyond the ends of the reel, so that in the longitudinal back and forth movement of the reel, as the wire is unwound, the reel will not contact the metal upright bars 10. The reel is positioned upon the bushing 20 by set screws 21—21, secured in the bushing adjacent each end of the reel. The wire 22 upon the reel, which is preferably copper wire of the desired gauge and type for velocity testing, is carried upwardly from the reel through a vertical guide slot 23 provided centrally of the forward side of the cross-bar 13, and extending to a depth where its vertical end wall is disposed centrally between the forward and rearward faces of the cross-bar. Hence, the length of wire to be strung vertically in the rectangular frame formed by the upright and cross bars is positioned along the central vertical line of this frame, and as will hereinafter more fully appear.

The reel is frictionally restrained in its rotation by means of a flexible spring member 24, preferably consisting of a rectangular sheet of non-conducting material such as heavy gauge Celluloid, and which is secured to the rearward face of the cross-bar 13 by screws 25, the Celluloid sheet depending from the cross-bar 13 and being curved and tensioned through its engagement with the relatively large diameter end plates of the reel. The length of the sheet 24 is such that the end plates of the reel will remain in contact therewith as the reel is shifted longitudinally upon the shaft 16.

In spaced relation below the reel there is provided a crank shaft 26, having its ends journaled in flanged washers 27—27, formed of non-conducting insulating material, such as fiber, and set into holes 28—28 in the upright bars 10, the ends of this crank shaft projecting outwardly to support the operating crank levers of the device, as will presently more fully appear.

To the lower ends of the upright bars 10 angle iron supports 29—29 are secured by bolts and nuts 30—30, which enable the device to be conveniently bolted to a suitable mounting, which mounting will also preferably mount the velocity testing gun in aligned relation with its muzzle end crossed by the vertical stringing line of the wire 22.

Within the slot 15 of each of the upright side bars 10 there is provided for vertical movement a wire gripper adapted to have vertical reciprocatory movement imparted thereto by crank means, presently to be more fully described, and so connected that the wire gripper at one side moves upwardly as the wire gripper at the other side moves downwardly, the two wire grippers in the operative wire holding position being disposed respectively adjacent the upper and lower cross-bars 11 and 13, with a length of wire strung vertically between them, as shown in Fig. 1. As the two wire grippers are identical, the same reference characters will be applied to the corresponding parts of each of them.

Each wire gripper comprises a horizontally disposed holder arm 31 of rectangular cross-section, provided at its outer end with a threaded shaft extension 32, adapted to project beyond the outer surface of the upright bar 10, the end portion of the arm adjacent this shaft extension being adapted to fit slidably within the slot 15 and being positioned against outward displacement by means of laterally projecting shoulder projections 33—33 adapted to engage the inner surface of the upright 10 at each side of the slot. At its inner end the arm 31 is of T-shape in plan, and is laterally slotted, as at 34, to provide upper and lower bearing wing portions 35 and 36 forming the upper and lower walls of the slot 34 and projecting at each side of the arm. The wing portions are braced by means of a centrally disposed vertical post 37, riveted at its ends within holes in the wing portions. In the projecting ends of the wing portions at each side of the arm there are secured vertically disposed pivot pins 38—38, upon which are pivotally mounted the pincer-like gripper member 39—39, these gripper members being respectively provided at their inner ends with flat gripping surfaces 40—40, which in the closed gripping position are substantially parallel to each other. The gripper members are normally held in this gripping position by means of a pair of compression strings 41—41, engaged at their respective ends in pocket formations 42—42 in each side of the holder arm 31 and pocket formations 43—43 in the respective inner sides of the outwardly extending lever portions of the gripper members.

Upon the shaft extension 32 there is engaged a flanged bearing bushing 44, formed of non-conducting insulating material, such as fiber, and having its flanged end engaged against the outer surface of the upright bar 10, this bearing bushing having rotatably engaged thereon the upper apertured end of a connecting rod 45 which is held upon the bushing by means of a bearing ring member 46, also formed of non-conducting insulating material, such as fiber, and which is held in place upon the bushing by means of a spacer washer 47, this washer being engaged at its outer surface by the inner end of a compression string 48 engaged about the hub of an adjustable knob member 49 screwed upon the outer threaded end of the shaft extension 32. By adjusting this knob member, the pressure of the spring may be increased or diminished as desired, it being pointed out that the spring exerts outward pressure upon the gripper holder arm 31 and inward pressure upon the bushing 44 to frictionally retain the position of the arm in the slot 15, while permitting it to be slidably raised and lowered therein upon operation of the crank means. It will be seen that the insulating bushing 44 and the insulating ring 46 provide an electrical insulation between the gripper holder arm 31 and the connecting rod 45, as well as between the upright bar 10 and the connecting rod 45, the holder arm 31 being at all times in firm electrical contact with the upright bar 10 under the pressure of the spring 48.

The operating crank means for imparting reciprocation to the wire grippers consists of a crank arm 50 secured upon one projecting end of the crank shaft 26 by a key pin 51 and pivotally connected at its end by a bolt and nut connection 52 to the lower end of the connecting rod 45 at one side, and a diametrically oppositely extending crank arm 53 secured to the other projecting end of the crank shaft by a key pin 54, and pivotally connected by a bolt and nut connection 55 to the lower end of the connecting rod 45 at the other side at a point along the arm 53 spaced from the axis of the shaft 26 to correspond to the length of the crank arm 50. The crank arm 53 is extended beyond its connection with the connecting rod to provide an operating handle extension, preferably provided at its end with a hand-grip knob 56 for convenience in swinging the crank arm upwardly or downwardly. The crank arm 53 being 180° removed from the crank

arm 50, upward or downward movement of one takes place during the opposite movement of the other, and consequently one gripper member will be moved upwardly as the other is moved downwardly.

Cam means for opening and closing the wire grippers is provided upon each of the upright bars 10. Each such cam means comprises a pair of cam members 57—57, pivotally mounted at their lower ends upon the respective forward and rearward sides of the upright bar by means of pivot screws 58—58, and each of these cam members being provided intermediate its upper and lower ends with a slot 59 engaged by a screw 60 screwed into the upright bar to permit limited swinging movement of the cam member. The two cam members project inwardly relatively to the inner surface of the upright 10 so that they are in the vertical plane of the path of movement of the outer ends of the wire gripper members, their lower end portions being parallel to each other, while their upper end portions are flared outwardly, as at 61. Upon the undersides of the outwardly flared upper end portions there are secured by welding or other suitable means downwardly depending outwardly inclined cam plate members 62—62 which are disposed in the vertical upward path of the outer ends of the gripper members in the normal closed position of the lower wire gripper. A relatively light-weight wire spring 63, of inverted V-form, is secured at its bight beneath the head of the set screw 12 and its divergent bowed leg portions are respectively engaged in notches 64—64 in the outer edges of the upper ends of the cam members, pressing them inwardly to their normal position.

The operation of the cam means is such that during the upward movement of the wire gripper, the outer tail ends of the two gripper members move at the outer sides of the parallel lower portions of the cam members out of contact therewith, and thereupon contact the inclined cam plates 62 causing the cam members to swing outwardly against the pressure of the relatively light spring 63 to allow the gripper members to move upwardly beyond the upper flared ends of the cam members, the gripper members being in their closed wire gripping position during the entire upward movement. During the downward movement of the wire gripper the tail ends of the gripper members move inside the outwardly flared upper ends of the cam members, the continued downward movement causing the outer tail ends of the gripper members to be compressed, as they engage the flared ends and pass downwardly between the inner parallel surfaces of the cam members, and the wire gripping jaws of the gripper members to be spread into open position. The opening of the wire gripper moving downwardly at one side allows the passage through its open pincer jaws of the closed pincer jaws of the wire gripper moving upwardly at the other side, and as shown clearly in Figs. 5 and 6. As the downwardly moving wire gripper moves below the lower ends of the cam members its two gripper members are released and moved to their closed position under the pressure of the springs 41, the releasing point being sufficiently spaced above the cross-bar 13, which determines the lower position of the gripper member, so that the gripper member is closed for a short period during its final downward movement, this being for the purpose of imparting tension to the strung wire, and as will presently more fully appear.

In operation the wire feeder device is set up to align the vertically strung wire with the muzzle of the testing gun 65, the latter being aimed at the target 66 spaced a predetermined distance from the gun, as illustrated diagrammatically in Fig. 4. The target 66 is of any suitable known type wherein an electric circuit is broken as the bullet hits it. The wire feeder device and the target are electrically connected by separate electric circuits 67 and 68 to the chronometer and registrar of the ballistic chronograph 69 and to its disjunctor device 70, the conductor wires of the chronometer circuit 67 being connected to the two upright bars 10. As these two bars are electrically insulated from each other, except for the length of conductor wire strung between the two wire grippers, breakage of this wire breaks the circuit 67 and actuates the chronometer of the chronograph, the registrar of the chronograph being actuated upon breaking the circuit 68 at the target 66. The chronograph illustrated by way of example is the well-known Boulengé chronograph, but it will be understood that the device of the invention may be used with any suitable type of chronograph.

In initially stringing the wire feeder device, the wire 22 is drawn from the reel and its end engaged by the lower wire gripper, the crank arm 53 being then actuated to move the lower wire gripper upwardly and the upper wire gripper downwardly, the upwardly moving wire gripper remaining in closed position as it moves over the cam plates 62 of the cam members 57, and the downwardly moving wire gripper being opened as the outer tail ends of its gripper members move between the cam members 57, as shown in Figs. 5 to 7. This downwardly moving wire gripper moves below the lower ends of the cam members 57 before it completes its downward travel, so that it closes upon the wire, and through the final upward movement of the upper wire gripper and downward movement of the lower wire gripper the length of wire between them is tensioned.

In the velocity test, the wire is broken by impact of the bullet 71 and at the same instant breaks the chronometer circuit 67 of the chronograph. For each successive velocity test a new length of wire is strung simply by swinging the crank arm upwardly or downwardly from its previously moved position. The broken end of wire held by the upper wire gripper is automatically released as the downwardly moving upper wire gripper is opened through engagement within the cam members 57, and at the same time the lower wire gripper carries the end of the replacement length of wire held thereby upwardly through the open jaws of the downwardly moving wire gripper, the two wire grippers finally moving to their upper and lower operative positions, indicated by the dot-and-dash lines in Figs. 5 and 6, where the replacement length of wire is tensioned and held.

The form of the invention illustrated in the drawings and described herein is typical and illustrative only, and it is evident that the invention is capable of embodiments in other forms, all falling within the scope of the appended claims, which are to be broadly construed.

What is claimed is:

1. In a wire feeder device, a frame including a pair of spaced parallel guide members, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members and each adapted to be electrically connected to a chronograph, or the like, and con-

ductor wire supply means arranged with respect to the said wire gripper means to supply successive lengths of replacement strands to be engaged by said gripper means to provide a breakable electrical conductor extended between them.

2. In a wire feeder device, a frame including a pair of spaced parallel guide members constituting conductors adapted to be electrically connected to a chronograph, or the like, and insulating means arranged to insulate said guide members from each other, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members, and conductor wire supply means arranged with respect to the said wire gripper means to supply successive lengths of replacement strands to be engaged by said gripper means to provide a breakable electrical conductor extended between them, said gripper means constituting electrical conductors between said wire and said guide members.

3. In a wire feeder device, a frame including a pair of spaced parallel guide members, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members and each adapted to be electrically connected to a chronograph, or the like, conductor wire supply means arranged with respect to the said wire gripper means to supply successive lengths of replacement strands to be engaged by said gripper means to provide a breakable electrical conductor extended between them, and actuating means connected to said wire gripper means to impart simultaneous reciprocatory movement thereto in opposed directions, whereby one of said gripper means moves in one direction to feed a length of wire from said supply means as the other moves in the opposite direction.

4. In a wire feeder device, a frame including a pair of spaced parallel guide members, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members and each adapted to be electrical connected to a chronograph, or the like, conductor wire supply means arranged with respect to the said wire gripper means to supply successive lengths of replacement strands to be engaged by said gripper means to provide a breakable electrical conductor extended between them, and actuating means comprising a pair of operatively connected oppositely arranged crank means respectively connected to said wire gripper means to impart simultaneous reciprocatory movement thereto in opposed directions, whereby one of said gripper means moves in one direction to feed a length of wire from said supply means as the other moves in the opposite direction.

5. In a wire feeder device, a frame including a pair of spaced parallel guide members, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members and each adapted to be electrically connected to a chronograph, or the like, said wire gripper means each having a pair of movable wire gripping jaws disposed in their closed position in alignment with each other and adapted in the open position of one pair of jaws to permit passage therethrough of the other pair of jaws in the closed position of the latter, and conductor wire supply means arranged with respect to the said wire gripper means to supply successive lengths of replacement strands to be engaged by the jaws of said gripper means to provide a breakable electrical conductor extended between them.

6. In a wire feeder device, a frame including a pair of spaced parallel guide members, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members and each adapted to be electrically connected to a chronograph, or the like, said wire gripper means each having a pair of movable wire gripping jaws disposed in their closed position in alignment with each other and adapted in the open position of one pair of jaws to permit passage therethrough of the other pair in the closed position of the latter, conductor wire supply means arranged in aligned relation with the direction of reciprocation of said wire gripper means to supply successive lengths of replacement strands to be engaged by the jaws of said gripper means to provide a breakable electrical conductor extended between them, actuating means connected to said wire gripper means to impart simultaneous reciprocatory movement thereto in opposed directions, whereby one of said gripper means moves in one direction toward said supply means as the other moves in the opposite direction away from said supply means, and cam means arranged to open the jaws of said gripper means during the reciprocatory movement thereof in said one direction toward said supply means to permit passage therethrough of the closed jaws of the gripper means moving in said opposite direction away from said supply means.

7. In a wire feeder device, a frame including a pair of spaced parallel guide members, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members and each adapted to be electrically connected to a chronograph, or the like, said wire gripper means each having a pair of movable wire gripping jaws disposed in their closed position in alignment with each other and adapted in the open position of one pair of jaws to permit passage therethrough of the other pair in the closed position of the latter, conductor wire supply means arranged in aligned relation with the direction of reciprocation of said wire gripper means to supply successive lengths of replacement strands to be engaged by the jaws of said gripper means to provide a breakable electrical conductor extended between them, actuating means connected to said wire gripper means to impart simultaneous reciprocatory movement thereto in opposed directions, whereby one of said gripper means moves in one direction toward said supply means as the other moves in the opposite direction away from said supply means, and cam means arranged to open the jaws of said gripper means during the reciprocatory movement thereof in said one direction toward said supply means to permit passage therethrough of the closed jaws of the gripper means moving in said opposite direction away from said supply means, said cam means being yieldably mounted to be engaged and by-passed by said gripper means moving away from said supply means.

8. In a wire feeder device, a frame including a pair of spaced parallel guide members, a pair of reciprocating wire gripper means respectively carried for reciprocatory movement by said guide members and each adapted to be electrically connected to a chronograph, or the like, said wire gripper means each having a pair of movable wire gripping jaws disposed in their closed position in alignment with each other and adapted in the open position of one pair of jaws to permit passage therethrough of the other pair in the closed position of the latter, conductor wire supply

means arranged in aligned relation with the direction of reciprocation of said wire gripper means to supply successive lengths of replacement strands to be engaged by the jaws of said gripper means to provide a breakable electrical conductor extended between them, actuating means connected to said wire gripper means to impart simultaneous reciprocatory movement thereto in opposed directions, whereby one of said gripper means moves in one direction toward said supply means as the other moves in the opposite direction away from said supply means, and cam means arranged to open the jaws of said gripper means during the reciprocatory movement thereof in said one direction toward said supply means to permit passage therethrough of the closed jaws of the gripper means moving in said opposite direction away from said supply means, said cam means terminating short of the full movement of said gripper means toward said supply means whereby the jaws of said gripper means close to impart tension to the wire during the final movement of said gripper means.

CARL J. L. MOS.