March 21, 1961 G. MALENICH 2,975,531

SAFETY WIRE SIMULATOR

Filed Oct. 6, 1958

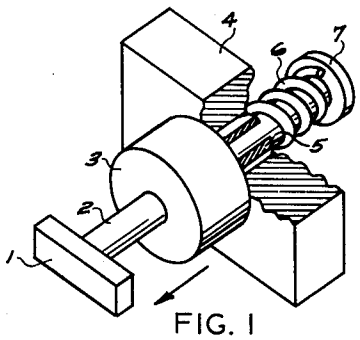


FIG. 1

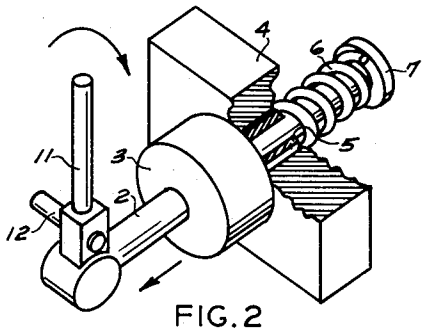


FIG. 2

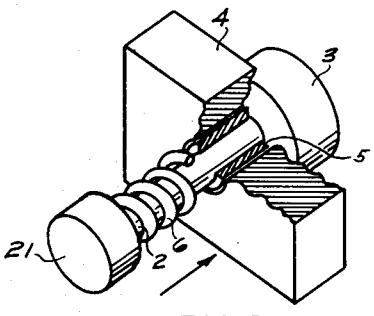


FIG. 3

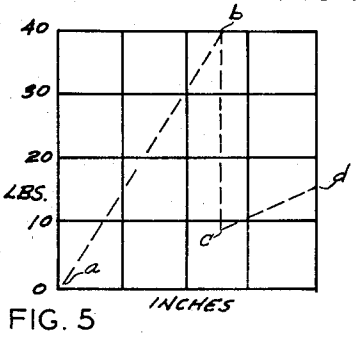


FIG. 5

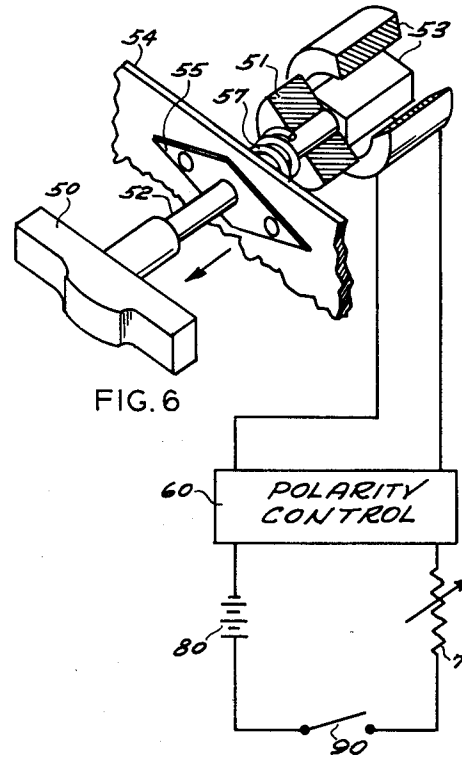


FIG. 6

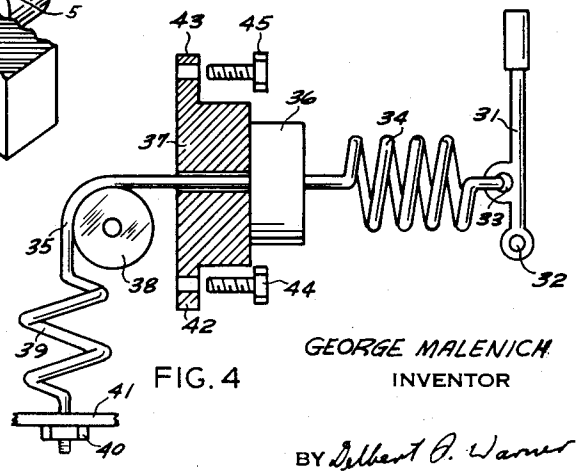


FIG. 4

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United States Patent Office 2,975,531 Patented Mar. 21, 1961

2,975,531

SAFETY WIRE SIMULATOR

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Filed Oct. 6, 1958, Ser. No. 765,524

10 Claims. (Cl. 35—8)

This invention relates to means for simulating devices to which increasing force may be applied until a point is reached at which the device suddenly yields to release the tension built up by the application of the force. More particularly, this invention relates to means for simulating the breaking of safety wire or the like in trainers, simulators, and other educational devices.

Among the safety devices incorporated in modern aircraft are fire extinguishers which are built into the wings, the fuselage or in close conjunction with the engine. Such fire extinguishers may be designed to provide for automatic operation in response to large increases in temperature, the presence of certain fumes and the like. In order for the pilot to maintain maximum control over his aircraft it is necessary that he too be able to operate the fire extinguishers. To this end controls are available in the cabin of the aircraft, usually one for each fire extinguisher, which may be operated by the pilot or the co-pilot. This control means usually consists of a pull type mechanism which is locked in position by a safety wire which must be broken by a strong pull on the switching device before it becomes possible, by additional pulling, to operate the fire extinguisher.

A need arises in aircraft simulators to provide for accurate simulation of the fire extinguishing facilities so that the student pilot can practice proper procedures in the event that a fire in one of the engines or elsewhere in the aircraft is simulated. In order to obtain realism, this necessitates a full scale reproduction of the cockpit, of the fire extinguishing controls and of the functions of the safety wire.

An obvious way of representing the functions of the safety wire is by the actual placement of safety wire in fire extinguisher control mechanisms in the simulator cockpit so that it must be broken by a pull on the switch before the simulated fire extinguished is operated. The chief trouble with this approach is the difficulty of resetting the switch or lever each time after the wire is broken. In the aircraft itself, the fact that the wire is broken serves as a warning to maintenance personnel to check the system and the few seconds or minutes that it takes to replace the broken wire are unimportant in view of the greater safety insured thereby. In an aircraft simulator, however, the time which would be required to replace the safety wire is too valuable to be used for that purpose; besides which, time out to replace the training wire would tend to upset the training schedule.

Another system which has been used in the past in trainers for simulating safety wire has been a combination of a ball and detent. In this system a small ball is forced into a detent in the face of a cam by a spring to provide a force which must be overcome by pulling the cam surface until the ball is forced out of the detent against the action of the spring. This arrangement has worked fairly satisfactorily but has several disadvantages. It requires special effort to reset the safety handle. It does not result in the sudden release of pressure characteristic of breaking of the wire, since the cam surface must be of relatively

low curvature. It does not provide for the follow-up pressure necessary to activate the fire extinguisher itself.

Still another approach in the prior art has been the use of a leaf spring and lever arm. The lever arm contacted one edge of the leaf spring in such a way that the necessary force to break the safety wire could be exerted by the lever arm on the leaf spring which would bend the leaf spring to a point where the lever arm could slip by with an attendent sudden decrease in the force. This system, like the ball and detent, required the exertion of considerable force in order to be reset. In addition, further apparatus in the nature of a spring or the like was necessary to supply the retarding force to simulate the operation of the fire extinguisher.

Other even more elaborate systems employing hydraulic fluids or air pressure have been proposed as a means for simulating the breaking of the safety wire. Since these systems are relatively expensive and would require the introduction of additional equipment into the simulator, they have not been used in so far as is known.

It is apparent from the foregoing that the prior art devices in general have been relatively elaborate, considering the functions that they were designed to simulate. They represent devices which are too difficult to reset, requiring as they do the expenditure of too much force or time, which would upset the carefully created atmosphere of the training situation. It should be noted also that these devices are tricky to install depending as they do upon close tolerances, the alignment of springs and the accurate adjustment of spring tensions. It should be noted also that, except for the safety wire itself, the systems discussed are all somewhat cumbersome and require the sacrifice of too much space in a crowded cockpit.

It is an object therefore of the instant invention to provide a simple and effective device for simulating safety wire and its effects.

It is another object of my invention to provide a device to simulate safety wire which includes means for resetting the device with a minimum of difficulty.

It is still another object of my invention to provide a device for simulating safety wire which may be installed in a small space, such as the limited space available in a crowded cockpit.

It is a further object of my invention to provide means to simulate a safety wire and breaking mechanism in which more than one type of leverage may be employed.

It is yet another object of my invention to provide means in a safety wire simulator for accurately controlling the amount of tension which must be applied during the period in which the safety wire is under tension and also for providing means for applying additional force after the simulated break.

Still a further object of my invention is to provide in a safety wire simulating device a means to vary the tension or compression which must be applied without the necessity of making mechanical adjustments.

Yet another object of my invention is the provision of a safety wire simulator capable of simulating the breaking of safety wire and also capable of simulating the counter force of a valve or similar device which would be operated in the actual situation being simulated following the breaking of the safety wire.

The foregoing objects and others ancillary thereto I prefer to accomplish as follows:

According to a preferred embodiment of my invention, I provide on a simulator instrument panel or similar mounting surface, a handle or gripping device which is appropriately labeled and/or colored to indicate its function to the student pilot. To this handle or switching device is attached a cord or preferably a rigid shaft to

which a permanent magnet or an electromagnet is permanently attached. Preferably the shaft will pass through the magnet and through a rigid support which serves as a support for the shaft, as an armature for the magnet and as a seating device for one end of a spring the other end of which abuts against a lock fixed to the shaft to provide a spring bias. This arrangement is such that the application of a force to the handle or switch will cause the force to be extended against the magnetic circuit which will keep the magnet closed against the rigid support which has a portion made of iron or other magnetic material until such time as the force becomes great enough to separate the two. When the force overcomes the magnetic attraction, the handle will be released suddenly, thereby simulating the breaking of a safety wire. The functions of the spring bias are to provide a counter force representing friction of a valve or the like and to reseat the magnet against the metallic support when the force on the handle or switch is completely removed. This invention includes a construction in which two or more biasing springs are provided in lieu of the single one described heretofore. These additional constructions make it possible to provide for the simulation of the pull on the safety wire and its sudden breaking to reduce the tension on the supporting shaft or cord and for more realistic simulation of the additional pull necessary to represent the force required to activate the fire extinguisher after the safety wire is broken.

The novel features that are characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings in which:

Fig. 1 is a perspective drawing in partial section illustrating a simplified version of the invention employed as a simple force and reset mechanism,

Fig. 2 is a view of my invention similar to that of Fig. 1 illustrating the employment of a different type of lever arm,

Fig. 3 is a perspective view of my invention in which the force may be applied by pushing instead of pulling.

Fig. 4 illustrates yet another version of my invention employing a plurality of biasing springs to provide for changes in tension,

Fig. 5 is an idealized diagram illustrating the relationship between tension and displacement in the apparatus of Fig. 4.

Fig. 6 illustrates my invention used in conjunction with an electromagnet for varying the force that must be applied and means for reversing the direction of that force by reversing the polarity of the electromagnet.

The simulation of safety wire and the simulation of the conditions attending the breaking of safety wire and the reseating of the mechanism used in such a simulator, as well as the circumstances which follow the breaking of the safety wire, will be understood when considered in the light of the following detailed description:

Turning first to Fig. 1, there is illustrated a simple device embodying a portion of the instant invention. The numeral 1 illustrates a grip or handle, such as would appear in the cockpit of an aircraft to represent the control for a fire extinguisher or other device. The handle 1 is connected by means of the shaft 2 to a magnet 3 which may be either a permanent magnet or an electromagnet. The magnet 3 is attracted to the armature or element 4, since the element 4 is made of a magnetic substance. The armature 4 may be fastened permanently to the bulkhead or a portion of the instrument panel and remains fixed in position. An annular bearing through the element 4 is shown at 5 which permits the shaft 2 to pass therethrough. At the opposite end of the shaft 2 from the handle 1 is shown a retaining element 7 which may be threaded to the shaft 2 or fastened thereto in some other fashion. The purpose of the retaining element 7 is to serve as a stop for a coil or a helical spring 6. Spring 6 abuts on the retaining element 7 and on one face of the element 4.

The operation of the embodiment of the invention shown in Figure 1 may be explained in the following manner: The figure, as shown, illustrates the invention with the elements in what might be called the set position, i.e. with the magnet 3 abutting on one face of the element 4 and with the coil spring 6 in an expanded condition. With the elements in the position they occupy in Figure 1, the application of a force, as by the hand of the student pulling on handle 1, will cause tension in the shaft 2 which will be translated to the magnet 3 to cause a force counter to the magnetic force to be exerted between the magnet 3 and the element 4. The force which may be applied on handle 1 may be increased until the point is reached at which this force overcomes the force due to the magnetic field existing between elements 3 and 4, at which time the magnet will suddenly lose contact with element 4 and the shaft and magnet will be pulled in the direction of the pull on the handle, and there will be a sudden decrease in tension. The spring 6 may be fixed on the shaft 2 in such a way that it has no effect on the force necessary to separate the magnet 3 from the element 4. This condition may be fulfilled by providing a spring which is shorter than the space between the face of element 4 and that of stop 7 when the magnet is closed on the element 4.

After the force has been released by breakage of the magnetic circuit between the magnet 3 and the element 4, the stop 7 will move towards element 4, placing the spring 6 under compression, and it will continue to so move until the spring is compressed to produce a force equal to that being exerted on the handle or until the handle is released. The force required to compress the spring may be likened to the force required to operate the fire extinguisher in the aircraft being simulated after the safety wire is broken. When the handle 1 is released the energy stored in the spring 6 will be released to cause the magnet 3 to move back towards element 4. The motion started by the spring will be continued by the action of the magnetic field pulling against the element 4 as the magnet 3 and element 4 approach each other. It will be seen from the foregoing that the spring 6 will function to reset the mechanism shown in Figure 1 to its original condition.

The embodiment of the invention shown in Figure 2 is identical to that shown in Figure 1 in most respects, and the corresponding elements are numbered in the same way and are illustrated in the same position. In Figure 2 a lever arm 11 is pivoted on a shaft 12 in such a way that the student pilot or other operator may push on the assembly instead of pulling on it in order to produce the same effect. A push is needed on the upper portion of the lever arm 11 to separate the magnet 3 and the body 4 instead of a pull on handle 1 as required in the construction shown in Figure 1.

Figure 3 shows an embodiment of the invention which may be adapted to a push button device. In this embodiment, a push-button 21 is connected to a shaft 2 which in turn is rigidly attached to a magnet or an electromagnet 3. In the set position, the magnet 3 is held against an armature or piece 4, made of some magnetic material, by the force of magnetic attraction. An annular bearing 5 may be observed through the piece 4 which permits the shaft 2 to pass therethrough. A spiral spring 6 is provided around the shaft 2 to operate as a resetting device as explained in connection with Figure 1. The operation of Figure 3 is analogous to that of Figure 1 and Figure 2. The application of sufficient force on the push button 21 will cause the magnet 3 to suddenly pull away from the piece 4 thereby resulting in a sudden drop

in force exerted along the shaft 2. The push button 21 may then be pushed toward the element 4 until the ends of the spring 6 are engaged at which time the spring will begin to exert a force in reaction to the force on button 21. When the force on the button 21 is removed, the spring will be under tension and will commence the motion of the button 21 away from the element 4 which will be continued by the action of the magnetic field emanating from magnet 3 as it approaches element 4 and continue until 3 and 4 are again in their closest possible position.

It will be seen that the unit shown in Figure 3 could be adapted to a somewhat different type of safety wire situation, or could be used in lieu of the system of Figure 1 in the event that it becomes necessary to simulate the use of pushbuttons of this type in aircraft simulators.

The embodiment of the invention shown in Figure 4 is a further extension of the ideas illustrated in Figures 1 and 2, embodying as it does two separate spring systems in order to produce the effect which will be described. A lever arm 31 is pivoted about a pivot 32 to provide a force upon a bearing surface 33. It will be recognized, of course, that a simple handle such as handle 1 in Figure 1 could be substituted for the lever arm 31 and pivot 32. Whatever type of handle is employed, a force applied at pivot 33 will be translated through a spiral or coil spring 34 to a shaft or cable 35 which is directly connected to the magnet 36. The magnet 36 is attracted to and holds the armature or element 37 for so long as the shaft 35 is not subjected to a force exceeding the force of attraction between the magnet 36 and the element 37.

In the particular embodiment shown in Figure 4, the element 35 is a cable connected to magnet 36 and it passes through the element 37, over a pulley 38 and connects to a second coil spring 39, which is attached at its opposite end to a fixed element 41 by fastening means such as the nut 40. The armature or element 37 may be fastened, through a pair of wings or other fasteners 42 and 43, to the bulkhead or other fixed surface of the simulator by bolts such as 44 and 45. The operation of the device shown in Figure 4 may best be understood if it is considered in conjunction with the graph shown in Figure 5.

Considering Figure 4, as shown, to be in the unstressed position, that is with the springs 34 and 39 having no tension applied to them, we find a situation existing such as is indicated at *a* in the lower left hand corner of the chart in Figure 5 where no pressure has been applied and no displacement has occurred. When a force is applied at 31, or at 33, the spring 34 will commence to expand and its expansion and the displacement of bearing 33 will be proportional to the displacement in the chart along some line *ab*. The line *ab* is shown in the diagram as a straight line, however, it is well known that the relationship between the expansion of the spring and the force applied is ordinarily not a linear function, and it will be recognized that the line *ab* represents an idealized situation. As the force on spring 34 increases, the spring will continue to lengthen and bearing 33 will move until it reaches some point corresponding to the point labeled *b* in Figure 5, at which time the force exerted on the cable 35 equals the force of attraction between the magnet 36 and the element 37. Any further increase in the force exerted on bearing 33 will cause a sudden drop in the tension as the magnet breaks away from element 37, the drop corresponding in the chart to the drop along some line, indicated ideally as *bc* in Figure 5. As shown in the chart, there will be only a slight displacement of the bearing 33, until the spring 34 has taken up some of the slack. When the spring 34 contracts sufficiently so that the force on cable 35 equals the force which may then be exerted by spring 39, a point such as *c* in Fig. 5 will have been reached and a reaction force provided by spring 39 will produce a new force-displacement relationship such as that illustrated by line *cd* in Fig. 5.

It will be recognized that the behavior of the embodiment shown in Fig. 4 approximates that of a fire extinguisher safety device or other safety device more closely than does a device such as that shown in the other figures. It will be recalled from the prior description that a pull on the fire extinguisher handle is met initially with considerable resistance until a force is built up sufficiently great to break the safety wire, or in the case of the simulator to separate the magnet from its armature. It will be further recognized that such a point is reached as indicated at *b* in Fig. 5. It will be further recalled that after the safety wire breaks, or after the magnet parts from its armature, that there is a sudden drop of force in the connecting link. This sudden drop of force on the fire alarm handle continues until the handle begins to open the fire extinguisher valve itself, or to actuate the mechanism for controlling the fire extinguisher, at which time a slight increase in pressure with motion of the handle will be felt. This latter situation is simulated in the instant device by the force exerted by the spring 39 as it begins to stretch under tension from the cable 35. It will thus be seen that all of the characteristics of a fire extinguisher release mechanism are accurately simulated by the mechanism shown in Figure 4.

The embodiment of the invention shown in Figure 4 incorporates the feature of automatic resetting which has previously been indicated as very desirable. It will be noted that when the spring 39 has been stretched with the force indicated along line *cd* of Fig. 5 that it will exert a force on cable 35 which will tend to pull the cable back over the pulley 38 and close the gap between the magnet 36 and its armature 37. This tendency will result in actual motion whenever the force on bearing 33 is removed, as by release of the lever arm 31 or a handle 1, assuming that such a handle is used in the mechanism of Fig. 4, and the mechanism in Fig. 4 will be reset to its original condition.

The embodiment of the invention shown in Fig. 6 represents a departure from the prior embodiments partially by virtue of the electromagnet illustrated at 53 which may either attract or repel a magnet placed at 51 and partially by other characteristics. It is a well recognized principle of elementary magnetism that like magnetic poles repel each other and that unlike magnetic poles attract each other so that by placing a permanent magnet at 51 and changing the polarity of the poles on electromagnet 53 both attraction and repulsion may be attained.

As shown in Figure 6, the handle 50 is connected by a shaft 52 with the element 51. As diagrammed, element 51 serves as the armature for a magnet and it could be a slab of some magnetic material such as soft iron having low residual magnetism, however it could be a magnet made of high grade magnetic steel magnetized with the poles aligned as desired. The part 54 represents a portion of the cabin of the trainer or other supporting piece through which the shaft 52 passes. Element 55, fastened to element 54, is a direct support for the shaft 52 and provides a thrust surface for the spring 57. The spiral spring 57 surrounds the shaft 52 as indicated. The windings of an electromagnet 53 are connected to a switching device 60 for reversing polarity, to a battery 80, to a potentiometer 70, and to a switch 90, as shown. The switching device 60 is designed to produce polarity reversal in the current flowing in the coils of the electromagnet to reverse the magnetic field produced by the electromagnet.

With the electromagnet operating to attract element 51, the operation of this embodiment of the invention is much like that shown in Figs. 1, 2 and 4.

There is one noteworthy difference however, namely that the field strength of the magnet may be varied by resistor 70 which will result in a change in the force required to move the handle 50. It is apparent that this feature could be incorporated into the embodiments shown in Figures 1, 2, 3 and 4 and it is envisioned that such an incorporation might be desired in a situation

calling for changes in the force needed to break the safety wire being simulated.

With reversal in the polarity of the electromagnet 53 and with a permanent magnet at 51 having poles of like polarity lined up with the poles in magnet 53, the magnets shown in Figure 6 will repel instead of attract and handle 50 will serve more the function of a push button like 21 in Figure 3 than the function of a pull device. With poles opposed the magnets 51 and 53 will tend to push apart, shaft 52 will tend to be pushed away from the electromagnet 53, and the spring 57 will be placed under compression. The extent of motion of shaft 52 will be determined by the relative magnitudes of the repulsive forces of the magnets and the force which may be exerted by the spring 57. Under these circumstances, the handle 50 will be in a neutral position where it may be either pushed or pulled to upset the equilibrium and, whether it is pushed or pulled, it will be returned to its neutral position whenever the outside disturbing force is removed. It is expected that this particular construction will be used for various control devices in a simulator in which "on," "off," and "neutral" positions or signals are desired.

The electromagnet shown in Fig. 6, or if desired a plurality of electromagnets, may be employed for the purpose of simulating an accidental break in the safety wire as by opening the switch 90, or may be used to prevent resetting of the device after an intentional break. Maintaining the activating handle in its extended position, or even hanging loosely may be desirable to inhance the realism prevailing under certain training conditions. For example, in certain types of aircraft the handle will hang loosely once the safety wire is broken and it may appear to be desirable to maintain the appearance of a broken safety wire for further training purposes, such as might occur if an engine is assumed to catch fire a second time after having had a previous fire extinguished at which point in the actual aircraft the further use of a fire extinguisher might be impossible and other remedial measures would have to be taken. Control of the reset mechanism is thus left to the instructor and will be activated or not by him in accordance with the training situation.

It will be seen from the foregoing that the instant invention has resulted in an improved device for simulating the presence of safety wire in conjunction with various mechanisms in an aircraft simulator, and provides a realistic portrayal of what happens when the safety wire is broken. Along with an improved simulating device, my invention provides means for resetting the device with a minimum of difficulty, either directly when the forces which broke the wire are removed or by remote means under control of the instructor.

One of the greatest achievements of this invention is the provision of a device for simulating safety wire which may be installed in a very small space. The invention requires very little volume for effective operation, and may readily be installed in the space available for the mechanism being simulated in an actual cockpit.

This invention is not limited solely to aircraft trainers, having general utility wherever it is necessary to simulate similar breaks in safety wire, string, rope, cord, shafts or the like.

This invention has the additional advantage of great durability employing as it does only a few working parts which are of such a nature that they will not readily wear out, may be easily replaced, require no elaborate tools for manufacture and are relatively easy to install in existing equipment. It should be noted also that this device may be installed with no modifications of existing equipment except for the extension of connecting lines to remote control units such as an on and off switch, a polarity reversing switch, means for varying the voltage, or an indicator such as a light to show it has operated.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained, and since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. A device for simulating the breaking of frangible elements, such as wire, or the like, comprising a magnet and an armature for said magnet constituting a magnetic circuit, support means rigidly supporting said armature, hand operated means attached to said magnet for separating said magnet and said armature upon the application of a force, spring biasing means, and means including a retaining element cooperating with said armature and with said spring biasing means to assure the restoration of said magnetic circuit promptly and automatically upon the removal of said force.

2. A device for simulating the breaking of frangible elements, such as wire, or the like, comprising a magnet, an armature for said magnet placed across the poles thereof, hand operable means coupled to said magnet for separating said magnet and said armature upon the application of a force thereto, and spring biasing means coupled to said armature and to said hand operable means, said spring biasing means restoring said magnet to contact with said armature automatically upon the removal of said force.

3. A device for simulating the breaking of frangible elements, such as wire, or the like, comprising a magnetic circuit including permanent and electro-magnetic portions, current carrying means for varying the strength of the electromagnetic portion of said magnetic circuit, means including said current carrying means for reversing the polarity of the electromagnetic portion of said computer circuit, hand operated disconnecting means for breaking said circuit by disconnecting said current carrying means, means for rigidly supporting said device, and spring biasing means for automatically resetting said device to a preferred state upon the operation of said disconnecting means.

4. A safety wire simulator comprising means for representing the force which must be exerted to break a safety wire and the sudden decrease in said force as the safety wire breaks, said means including a magnet and a magnet armature, a handle connected to said magnet, means holding said magnet armature in a fixed position whereby increasing force may be applied to said magnet through said handle until a selected force is exceeded to cause said magnet to part from said magnet armature to simulate a break in the wire, spring biasing means, and means coupling said spring biasing means to said handle and to said means holding said armature, said spring receiving a portion of said increasing force causing the spring to develop a counter force, and said spring exerting said counter force to restore said magnet to contact said armature upon the release of said increasing force.

5. A device for simulating the breaking of frangible elements such as wire, or the like, comprising a magnet, an armature for said magnet placed across the poles thereof, hand operable means coupled to said magnet for separating said magnet and said armature upon the application of a first force thereto, first spring biasing means coupled to said magnet and to said hand operable means, second spring biasing means coupled to the opposite side of said magnet and to a fixed support, said sec-

ond spring biasing means serving to provide a second force which applies to said magnet after said magnet separates from said armature to simulate a factor such as friction and to restore said magnet to a position touching said armature on the release of said first force.

6. A device for simulating the breaking of frangible elements, such as wire, or the like, comprising a magnetic circuit including permanent and electromagnetic portions, means for varying the strength of the electromagnetic portion of said magnetic circuit, means for reversing the polarity of the electro-magnetic portion of said magnetic circuit, hand operated means for opening said magnetic circuit upon the application of a predetermined mechanical force, and spring biasing means for automatically closing said magnetic circuit upon the removal of said force.

7. A device for simulating the breaking of frangible elements, such as wire or the like, comprising a magnetic circuit including permanent and electro-magnetic portions, current carrying means for varying the strength of the electro-magnetic portion of said magnetic circuit, means including said current carrying means for reversing the polarity of the electro-magnetic portion of said magnetic circuit, hand operated disconnecting means for opening said magnetic circuit by the application of a mechanical force, means for rigidly supporting said device, and spring biasing means for automatically resetting said device to a preferred state upon the release of said mechanical force.

8. In a safety wire simulator means for simulating the conditions prevailing on breakage of the wire comprising a supporting means composed of magnetic material, an annular bearing in said supporting means, a shaft running through said annular bearing and supported thereby, retaining means mounted at a first end of said shaft for retaining a spiral spring in a position on said shaft between said first end and said supporting means, a handle mounted at the second end of said shaft, and a magnet fixed to said shaft between said second end of said shaft and said supporting means.

9. In a safety wire simulator means for simulating the conditions prevailing on breakage of the wire comprising a supporting means composed of magnetic material, an annular bearing in said supporting means, a shaft running through said annular bearing and supported thereby, retaining means mounted at a first end of said shaft for retaining a spiral spring in a position on said shaft between said first end and said supporting means, a handle mounted at the second end of said shaft, a magnet fixed to said shaft between said second end of said shaft and said supporting means, said magnet adhering to said supporting means by magnetic attraction, whereby the application of a predetermined force will separate the magnet from said supporting means.

10. In a safety wire simulator means for simulating the conditions prevailing on breakage of the wire comprising a supporting means composed of magnetic material, an annular bearing in said supporting means, a shaft running through said annular bearing and supported thereby, retaining means mounted at a first end of said shaft for retaining a spiral spring in a position on said shaft between said first end and said supporting means, a handle mounted at the second end of said shaft, a magnet fixed to said shaft between said second end of said shaft and said supporting means, said magnet adhering to said supporting means by magnetic attraction, whereby the application of a predetermined force will separate the magnet from said supporting means, and compress the spring, said spring thereafter operating to reseat the magnet and said supporting means upon the release of the force on the handle.

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