W. S. RUSH.

ALARM OR SIGNAL SYSTEM FOR ENGINES AND MOTORS.

APPLICATION FILED OCT. 4, 1907.

900,428.

Patented Oct. 6, 1908.

3 SHEETS—SHEET 1

Fig. 1.

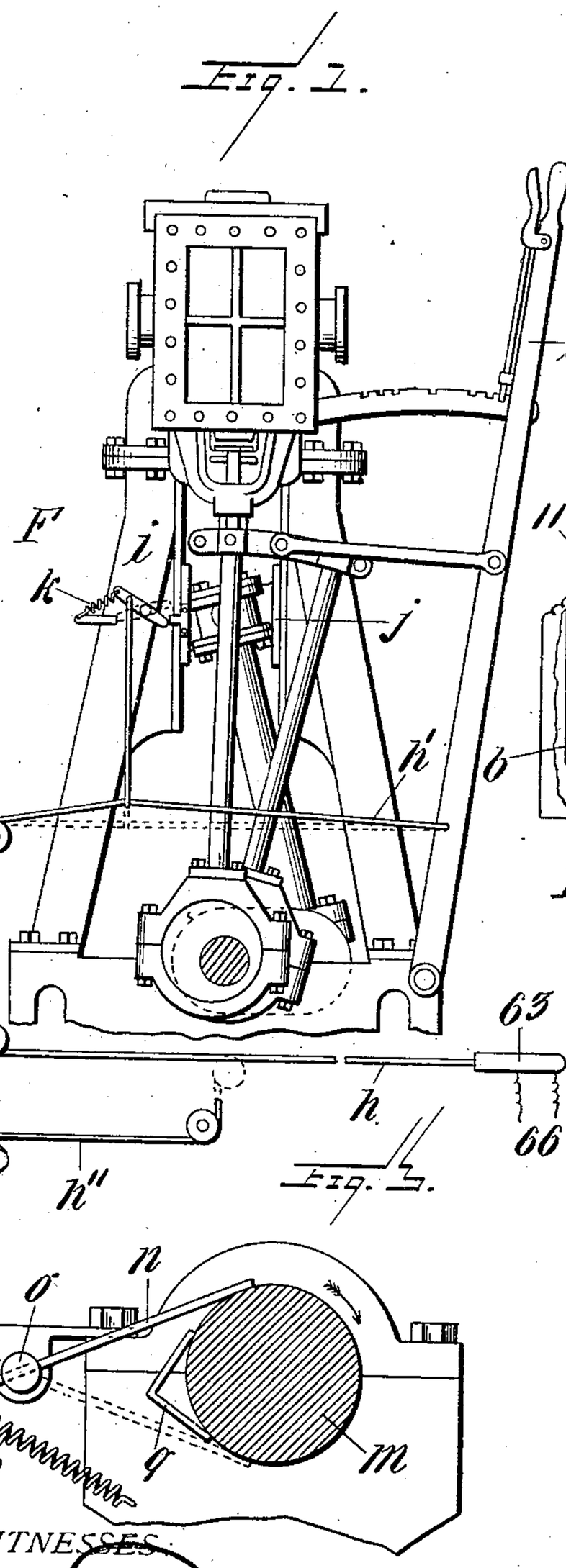

Fig. 2.

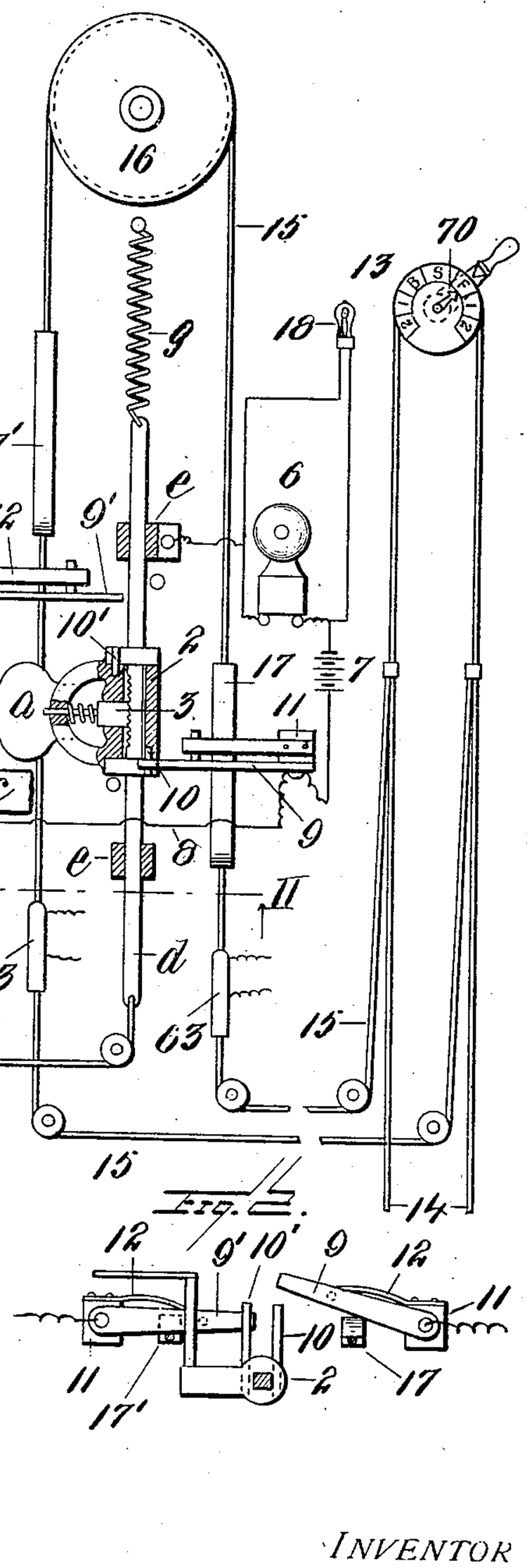

Fig. 3.

Fig. 4.

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3 SHEETS—SHEET 2.

Fig. 5.

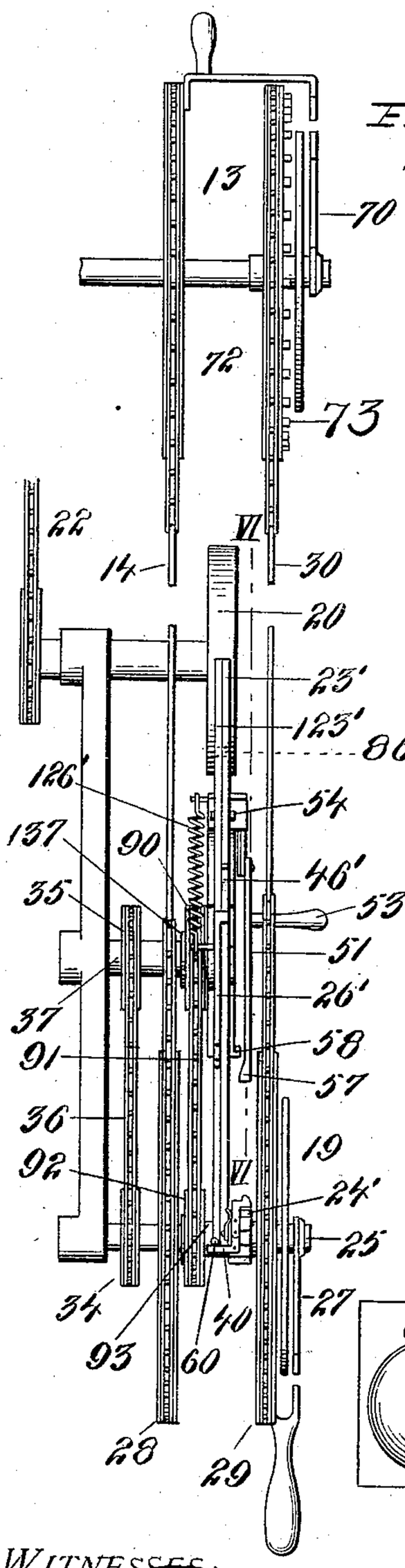
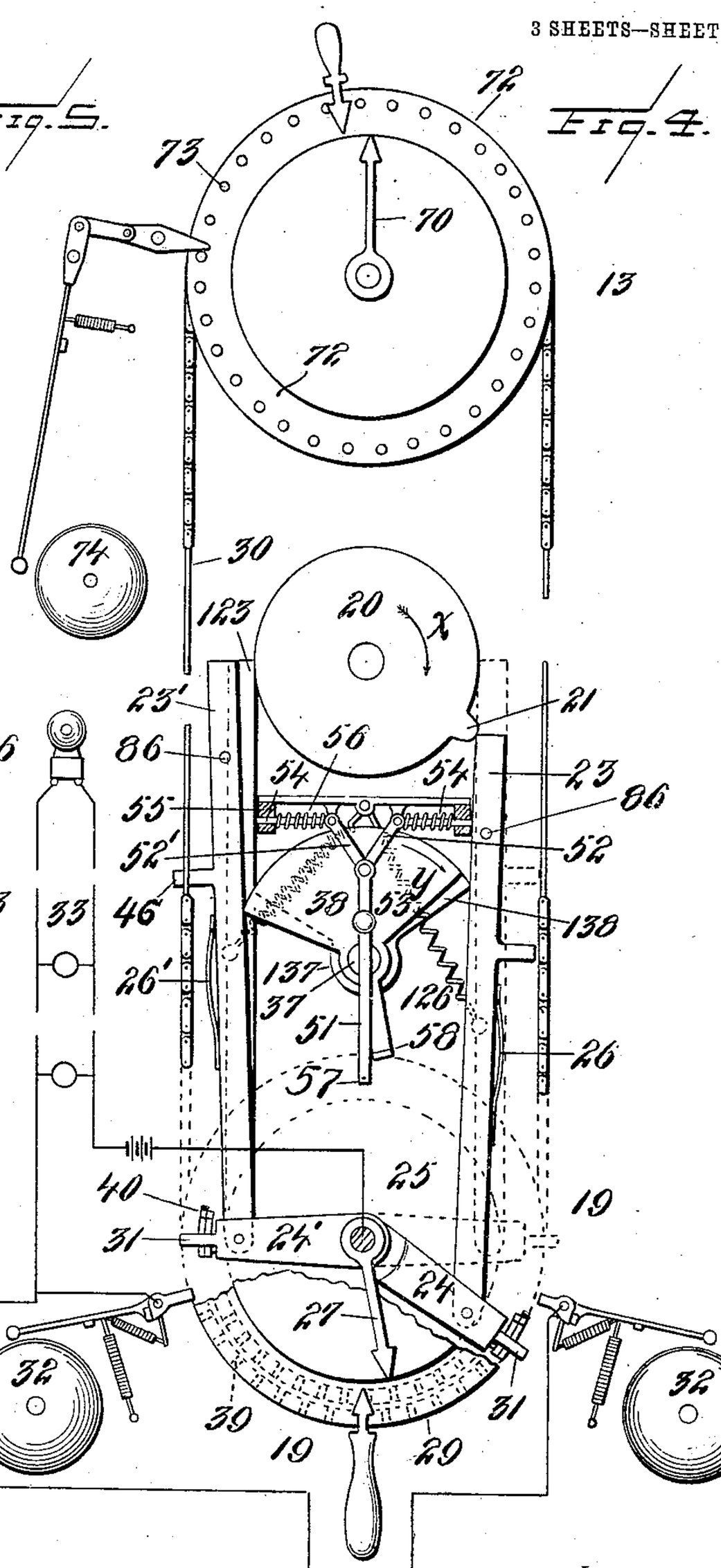


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 11.

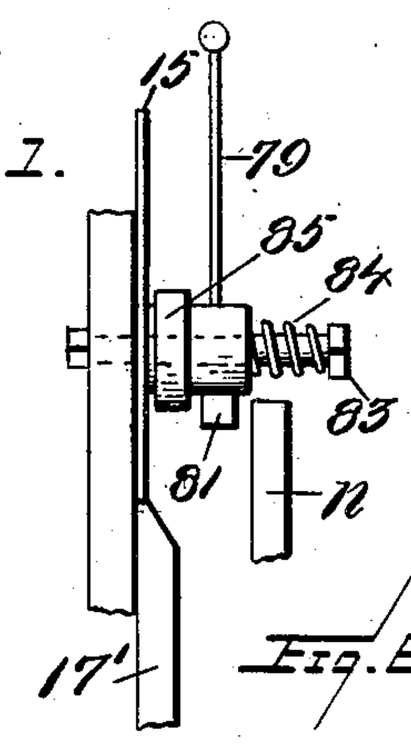


Fig. 6.

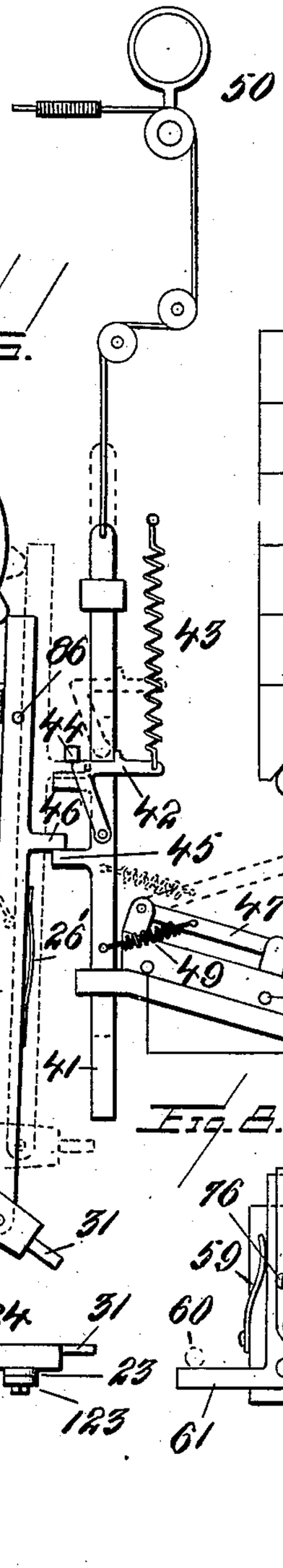
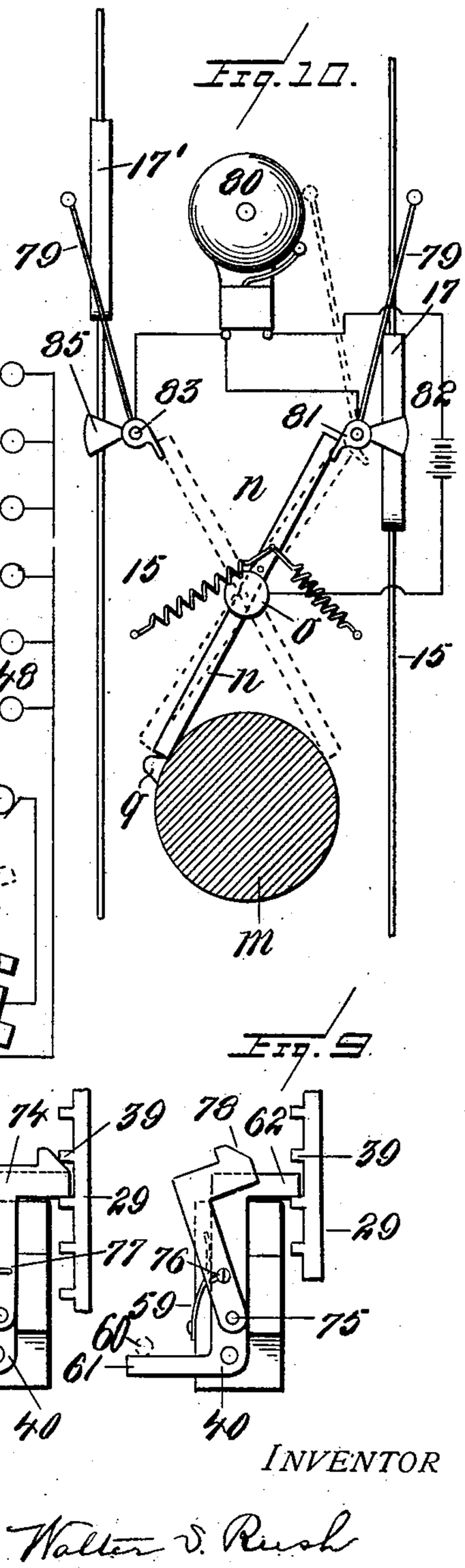


Fig. 10.



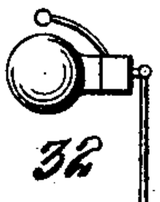


Fig. 7.

Fig. 8.

Fig. 9.

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ALARM OR SIGNAL SYSTEM FOR ENGINES AND MOTORS.

No. 900,428. Specification of Letters Patent. Patented Oct. 6, 1908.

Application filed October 4, 1907. Serial No. 395,972.

To all whom it may concern:

Be it known that I, WALTER S. RUSH, a citizen of the United States, residing at Stillwater, in the county of Payne and State of Oklahoma, have invented new and useful Improvements in Alarm or Signal Systems for Engines and Motors, of which the following is a specification.

This invention relates to mechanism such as is employed in ships to transmit signals between the pilot house or bridge and the engine room, and has for its object to combine therewith alarm or indicating devices that will at once indicate the fact, should the execution by the engineer of an order given be nonresponsive, or contrary to the order.

The invention therefore relates to such alarm or indicating mechanism and the apparatus by which its working is controlled and to such improvements in the apparatus as will be hereinafter described.

In the accompanying drawings, Figure 1 is an elevation of apparatus embodying my invention illustrated as being used in connection with an upright reciprocating marine engine and with a ship's telegraph of well known or usual construction. Fig. 2 is a sectional view taken on the line II—II, of Fig. 1. Fig. 3 is a view illustrating one manner of connecting up the apparatus so that an alarm will be operated directly from the main shaft of a ship. Fig. 4 is a front view of sufficient parts of another form of apparatus embodying my invention to illustrate its construction and method of operation. Fig. 5 is an edge view of the parts represented in Fig. 4. Fig. 6 is a vertical sectional view taken on the line VI—VI of Fig. 5, certain features of construction being there shown which are for the sake of clearness omitted from the other views. Fig. 7 is a bottom plan view of Fig. 6. Figs. 8 and 9 are detail views showing in different positions certain of the operative parts of the apparatus. Fig. 10 is a view somewhat diagrammatic in character, illustrating a different embodiment of my invention, from what is shown in the other views. Fig. 11 is an edge view of some of the parts illustrated in Fig. 10.

The mechanism embodying my improvements comprises signal or alarm devices, mechanism controlled from the engine or a part driven thereby and arranged to cause the signal or alarm devices to operate under certain conditions, as when the response of the engineer does not correspond with the order transmitted by the pilot, and means controlled by the order-transmitting devices arranged to set the apparatus so that no signals shall be given should the order transmitted be correctly responded to.

I will first describe the means controlled by the engine or some part driven thereby, and as these may be of various constructions and arrangements, I have in the drawings, illustrated several forms of such devices.

In the form of my invention illustrated in Figs. 1 and 2, the alarm mechanism is shown as being combined with a visual indicator, that is arranged to be operated in such manner as to indicate by its position the direction of movement of the engine, that is, whether it is set to move forward or backward, and which besides is arranged to indicate the speed of the engine through short vibrations or reciprocations imparted thereto. An indicating apparatus of this character is shown and claimed in my application No. 370,874, filed April 29, 1907; and the specific form of indicating apparatus shown in these views is illustrated in connection with an apparatus for making records of signals given the engineer and of the movements of the engineer made in response thereto, in my Patent No. 885,529 dated April 21, 1908.

Broadly stated, the indicating mechanism consists of a pointer or hand suitably connected with a movable part of the engine and arranged to have imparted to it relatively long shift movements so that when in one position it indicates that the engine is to move forward, and when in any other position that it is to move backward. The indicator is so connected up that, whether in one position or the other, it is vibrated or reciprocated through a relatively short path in consonance with the movements of the shaft of the engine. It thus indicates by its main position the direction in which the engine is moving or is set to move, and by its vibrations the speed at which it is moving.

Referring to the drawings, *a* indicates the indicator hand mounted in proximity to a sight opening *b* in a suitable case *c*, a small part only of which is shown. The indicator is mounted upon or connected with a bar *d* mounted in guides *e* and suitably connected to some part of the engine or machinery whose movements are to be represented. In Fig. 1 this bar is shown as being connected with an upright reciprocating marine engine

F. The connection is preferably mechanical in its nature, a line of wire *h* being represented, one end of which is connected to the bar and the other end to a tappet or finger *i* arranged to be struck by a projection carried by the slide *j*, or some other part of the engine that is reciprocated, vibrated or recurrently moved in harmony or consonance with the revolutions of the engine shaft. A coiled spring *k* acts to maintain the tappet *i* in proper position to be engaged by the said projection.

g indicates a coiled spring connected with the sliding bar *d* and operating to move it and the indicator hand carried thereby in one direction.

1 indicates the hand lever of the reversing gear mechanism of the engine F. To this is connected a branch *h'* of the connection *h*.

It will be seen from this description and the drawings that whenever the lever is shifted to the right, the position occupied for forward movements of the engine, the connections *h* are drawn upon, and the rod *d* is moved so as to bring the indicator to the "ahead" position at the sight opening; and that when the lever is moved to the left, to set the engine for "astern" movements and relieving the connections, *h*, *h'*, of tension, the spring *g* moves the bar in the opposite direction bringing the indicator to the "astern" position.

In Fig. 3 I have illustrated how the indicator may receive its movements directly from the main propeller shaft *m*. In this view the wire connections *h''* are represented as being united to a bar *n* near one of its ends. The other end of this bar is adapted to bear upon the shaft *m*, and intermediate its ends the bar is mounted in a rocker bearing *o* in which it is fitted to move longitudinally to a limited extent. The longer arm of the bar, the one that rests upon the shaft *m*, lies in the path of projection *q* that stands out from the periphery of the shaft and operates to reciprocate the bar at each revolution, and through connections between the bar and the indicator to reciprocate or vibrate the latter in harmony with the revolutions of the shaft.

p indicates a spring, one end of which is attached to the outer end of the bar *n* and the other end to some fixed support. Under the tension of this spring the bar is maintained in normal working position with respect to the projection *q*, so that while the shaft continues to revolve in the direction indicated by the arrow in Fig. 3, the bar will be lifted and dropped as the abutment passes it, and thus through the connections, operating as stated to vibrate the indicator. On the other hand, when a reverse motion of the shaft takes place, the abutment *q* will be carried against the end of the bar and will push it longitudinally through its bearing *o*, distending the spring *p* in so doing, and as the shaft continues to turn the projection will carry the bar to the dotted line position of Fig. 3, its longer arm being then below the shaft instead of above it. This change in the position of the bar operates to effect the relatively long shift of the indicator, the spring *g* maintaining at all times proper tension upon the connections *h*, *h'* and insuring that the bar *d* shall be moved when the bar *n* changes from the full to the dotted line position.

The mechanism for operating the indicator just described and illustrated in Fig. 3, is shown and claimed in my application Ser. No. 370,874, filed April 29, 1907.

The indicator *a* is represented as fixed to or forming a part of a sleeve 2 mounted upon the movable bar *d* and held in engagement therewith by a friction clutch 3 of such construction that it will allow the sleeve to be moved along the bar if sufficient force be applied thereto, but will so connect them that they will move together under normal conditions. This allows of the indicator being readily set with reference to the sight opening.

It sometimes happens that an engineer, on receiving an order from the pilot, will move his engine contrary to such order and an accident is liable to occur from such oversight. It is one of the objects of my present invention to give an alarm or warning signal should the engineer fail to correctly respond to an order given, thus giving notice that a mistake has been made.

Still referring to Fig. 1, in which the alarm or signal is represented as electrically operated, 6 indicates a bell included in an electric circuit, comprising a battery 7, conducting wire 8 and contacts 9, 9', both these latter being connected to the same side of the battery. The other side of the battery is connected with one of the guides or supports *e* for the sliding bar *d* so that the latter and the sleeve 2 are included in the said circuit.

10, 10' indicate circuit closing or contact pins carried by and projecting outward from the sleeve 2 and arranged to respectively engage with the terminal contacts 9, 9'. These latter are movable, being represented as pivoted arms mounted on insulated supports 11, and held in normal position to be engaged by the contact pins 10, 10', respectively, by means of springs 12. They are so located that the pins 10, 10' come into engagement therewith, thereby closing the electric circuit and causing an alarm or signal to be given, as the sleeve 2 arrives at the limits of its shift movements respectively; and it will be thus understood, considering only the parts so far described, that there would be a signal given each time the direction of the engine or the parts driven thereby is changed. But this is not desirable, and accordingly I have combined with the alarm devices and the parts

controlled or moved by the engine, other means that are connected with the order-giving devices, and these I will now describe.

13 indicates a ship's telegraph instrument such as is commonly located in the pilot house or on the bridge. It is connected in the usual manner, by wires or flexible connections 14, with the telegraph instrument 19 in the engine room; and also, by a line of suitable connections 15, with devices for controlling or setting the alarm system. The connections 15 may be of any usual or approved character and arrangement, and are represented as passing around a turning wheel 16 located near the contacts of the alarm system already described so that the connections have two branches or legs oppositely movable, and preferably located parallel with and adjacent each other at this point.

17, 17′ designate blocks or contact pieces carried respectively by the opposite legs or branches of the said connection 15. These are located so as to be movable, respectively, into engagement with the movable contacts 9, 9′, and operate to move the latter out of the paths of the contact pins 10, 10′, carried by the sleeve 2 on the engine-operated bar *d*. They are so disposed that the block 17 will be moved into engagement with the movable contact 9, forcing it out of the path of the pin 10 as shown in Fig. 2, whenever the telegraph instrument is set to transmit a go-ahead order, the block 17′ being at the same time moved away from the contact 9, leaving that in normal position; and that the relative positions of these parts are reversed when an astern order is transmitted. It accordingly follows that whenever the order transmitted is correctly executed the electric circuit remains open and no signal or alarm is given; but should the engineer, through an advertance or mistake, cause his engine to turn in the direction opposite to that ordered—reversing it under the order conditions just supposed, and causing the bar *d* to be moved upward—then the electric circuit will be completed by the engagement of the contact parts 9′ and 10′ and the signal 6 will at once give notice that a mistake has been made in the execution of the order given. A signal or signals corresponding with that presented at 6 can be located in different parts of the ship, and I have represented, at 18, a lamp located adjacent to the telegraph instrument 13, to inform the pilot that his order has been improperly executed.

It will be understood that mechanically operated signals or alarms may be employed in lieu of electrically operated ones as I shall hereinafter show.

In Figs. 4 to 7, I have illustrated another form of my invention adapted to be located adjacent to the engineer's instrument, 19, of the ship's telegraph. This instrument may be of any usual or improved construction and is connected by the wires, cords or chains 14 with the instrument or instruments 13 in the pilot house and on the bridge. By this form of the invention I ill ustrate the fact that the parts of the apparatus that are moved by the engine are not necessarily connected directly with the latter, they being here represented as receiving their movements from a wheel 20 which carries a projection 21 on its periphery, and is connected by belting 22 or otherwise with some part that moves when the propeller or driven shaft of the steamer turns. The gearing, indicated in the drawings by the belt 22 and its pulley, is so timed as to give the proper relative speed of rotation to the wheel 20. Where rapidly rotating motors, such as turbine engines are employed, the gearing will slow down the motion imparted to the wheel 20, whereas if the connection be made with the shaft of a side wheel vessel, it will probably be advantageous to speed up the wheel 20.

23, 23′ are bars each pivotally connected at one end with a link or arm, 24, 24′, supported upon a shaft 25. The free ends of the bars, 23, 23′ bear against the periphery of the wheel 20 on opposite sides of the axis, being held in engagement therewith by springs 26, 26′, 126, 126′. These latter are arranged so as to raise the bars and normally hold the arms 24, 24′ extended in opposite directions from the shaft 25, as indicated in full lines in Fig. 7. The shaft 25 upon which the links or arms 24, 24′ are pivotally supported, is preferably the one that carries the pointer 27 of the engineer's telegraph instrument which is moved by the pilot, being operated directly from the instrument of the latter through the connections 14 and the wheel 28 mounted on the shaft 25, to which they are secured.

29 indicates the response wheel, of the engineer's telegraph instrument, 19, it being provided with a handle and a pointer, and connected by wire or chain, 30, with the index or pointer, 70, of the pilot's instrument, 13. It is to be understood that the engineer sets the response wheel, 29, with its pointer opposite the pointer 27 whenever he receives an order, thus indicating to the pilot that his order has been received and is understood.

Each of the arms, 24, 24′ is provided with a contact 31 adapted to operate an alarm whenever the arm is rocked, by reason of its bar, 23, or 23′, being forced downward or moved longitudinally, by the projection 21 on the wheel 20. This alarm may be mechanical, as indicated at 32, where a gong is represented, or it may be operated by electricity, as indicated at 33, where an electric circuit is arranged to be closed by the contact 31, the circuit including both visual signals, such as lamps, and audible signals, such as bells, these being suitably arranged and located in different parts of the vessel.

It will be observed that, with only the parts thus far described, whenever the wheel 20 rotates in the direction indicated by the arrow *x*, representing, let it be supposed, the astern movement of the engine, the rod 23 and the arm 24 connected therewith will be moved at each revolution of the shaft, by reason of the engagement of the tappet or contact 21 with the end of the bar, and a signal will be given for each rotation. But the arm 24′ will not be moved because the tappet 21 will engage the inner side of the bar 23′, merely moving the free end thereof outward, it rocking the pivot that connects it with the arm 24′, and no signal will be given. When the wheel rotates in the opposite direction the bar 23′ and the arm 24′ are active, that is give signals, while the corresponding parts on the other side of the wheel are inactive. I, however, provide means, operated by the ship's order-giving or telegraph apparatus, for setting the parts so that no alarm shall be given if the proper responses to the order transmitted, is made, and will now proceed to describe the apparatus for this purpose.

34 is a wheel mounted on the shaft 25 and connected by chain 36 with a wheel 35 mounted on a shaft 37. This shaft carries a segment 38 located between the two bars 23, 23′ with which its peripheral edges preferably engage when all the parts are in normal position and at rest. The wheel 34 being on that shaft of the engineer's telegraph instrument which receives motion from the pilot's instrument, it follows that the segment 38 is always rocked or oscillated when the order-sending instrument is moved to transmit a signal; and a movement of the segment operates to force one or the other of the bars, 23, 23′, to one side, as indicated in full lines at the left side of Figs. 4 and 6, carrying its free end outside the path of the tappet or projection 21. If in response to an order to go astern, which turns the segment in the direction of the arrow *y*, the engineer starts his engine backward, causing the wheel 20 to turn in the direction of the arrow *x*, the tappet or projection 21, will pass the end of the rod 23 without engaging therewith at all and will, as already described pass the bar 23′ forcing it to one side, but not moving it longitudinally, and therefore not moving the arm 24′; accordingly no alarm signal will be given, the response to the order having been correctly executed. On the other hand, if the engine has been moved ahead the wheel 20 moving in the direction contrary to that indicated by the arrow, would operate the bar 23′ and cause an alarm signal to be given at its first revolution.

In Fig. 6 I have illustrated an alarm system which may be supplemental to those already described, or employed in lieu of either or all of them or used in connection with them all, as may be desired. The parts about to be described are represented as being applied to the right hand only of the apparatus, being operated by the bar 23, but it should be understood that they are so far duplicated as to cause the signals to be operated also from the bar 23′.

41 is a sliding rod or bar suitably mounted in bearings so as to be substantially parallel with the bar 23. It carries a pivoted latch piece 42 to which is connected a spring 43 that operates both to lift the bar 41 and to hold the latch in position to engage with a stop 44.

45 is a finger or contact-piece carried by the bar 41 in position to be engaged by a contact finger or piece 46 carried by the bar 23.

47 is a knife snap switch arranged to open or close an electric circuit 48 containing alarm or signal devices. The contact blade of the switch is connected by a spring 49 with the sliding bar 41, the connections being such that the line of the spring crosses the pivot of the blade 47 as the bar moves from one extreme position to another. Thus when the bar is in normal position, that is, lifted by the spring 43, the line of the spring 49 is above the pivot of the switch blade and the latter is raised, breaking the circuit; whereas, when the bar is moved downward to its lowermost position, the line of the spring is below the pivot, with the result that the spring moves the blade so as to make contact and close the electric circuit 48.

Again let it be supposed than an order to go ahead has been given, and that instead the engineer has started the engine backward. On the first revolution of the shaft 20, the projection 21 will engage the bar 23 and force it downward into the full line position indicated in Fig. 6. In moving downward the contact finger 46 of the bar 23 will engage with the contact 45 of the bar 41 and move the latter bodily downward, distending the spring 43, and carrying the latch past the stop or catch 44, with which it will engage and hold the bar 41 down. The bar in moving downward operates as above described to cause the closing of the circuit of the signal alarm system 48 and also to raise the semaphore 50. The parts will remain in the position in which they have been set, until the engineer corrects his mistake and reverses the engine, or the pilot shifts the order transmitting parts to the other position. If the motion of the engine is changed, the first revolution of the shaft 20 will cause contact 21 to rock the bar 23 into the position indicated by dotted lines, causing its contact finger 46 to engage with the rear or inner face of the pivoted catch, and force it laterally from engagement with the stop 44, whereupon the spring 43 will restore the parts to normal position, breaking the circuit 48 and cutting out the alarm signaling devices con-

trolled thereby and lowering the semaphore 50. If the pilot changes the order and rocks the segment 38 toward the bar 23 that will move the latter and trip the latch 42 as just described.

At 50 I have represented a signal in the form of a semaphore adapted to be operated by the sliding rod 41.

It frequently happens that the engineer desires to move his engine without having received an order from the pilot so to do, as for instance when "warming up", while tied up at the dock preparatory to starting on a trip. Under these circumstances the pilot's order giving apparatus is usually at rest in its mid, or "stop", position, which so sets the segment 38 between the bars 23, 23′ that they both rest upon the periphery of the wheel 20. I have, therefore, provided means under the control of the engineer for throwing out of action the devices connecting the engine or engine driven parts with the alarm system, and I combine with these throw-out devices means for restoring the connections the instant a signal or order is transmitted from the pilot to the engineer.

51 is a sliding bar suitably mounted, and provided with an operating handle 53. It is connected by bars or links 52, 52′ with push pins or rods 54, mounted in suitable guides 55, and arranged to bear against the inner face of the bars 23, 23′ (and 123, 123′). Coiled springs 56 surround the push pins or rods 54 and tend to move them back, that is, out of engagement with the said bars leaving the latter free to assume their normal positions. If the slide bar be moved upward, straightening the toggle formed by the links 52, 52′ the push pins will be forced outward into engagement with the bars 23, 23′ (and 123, 123′) swinging them out of the path of the contact projection 21. The slide bar is provided at its lower end with a flange or offset 57 that is adapted to rest upon a narrow ledge or flange 58, carried by the segment 38, when the slide bar is moved to disconnect the alarm apparatus from the engine.

Should the engineer fail to restore the parts to normal positions, after having disconnected the alarm devices from the engine driven parts, they will be restored the moment the segment 38 is shifted in one direction or the other, because the support that holds up the slide bar is carried by the segment, and the instant this is moved from under the bar, the springs 56 assisted by the springs 126, 126′ move it downward and restore the parts to normal position.

The rear face of the answering wheel 29 of the engineer's telegraph instrument may be provided with a series of teeth 39, with which the toothed ends of pivoted dogs 40 supported at the outer ends of the links or arms 24, 24′ are adapted to engage. These dogs are forced into engagement with the teeth by springs 59. Fixed stops preferably in the form of pins 60, are located in such position that the tails 61 of the dogs engage therewith when the arms 24 to which the dogs are pivoted stand in normal position. The engagement of a dog with a pin rocks the former on its pivot and moves it out of engagement with the teeth 39, thus leaving the answering wheel 29 free to be turned by hand in the usual manner. The pins 60 serve to not only move the dogs out of engagement with the teeth 39, but also serve as stops to limit the upward movements of the arms 24, 24′. Whenever one of the arms 24, 24′ is reciprocated by the wheel 20, the dog carried thereby engages with the teeth on the back of the wheel 29 and turns it.

If the tooth of the dog is beveled so that it rides over the teeth 39 when moving in one direction then it is adapted to impart to the wheel step by step movements from the improper position to which it may be set toward the position it should occupy to properly indicate the movement of the shaft; which movements being transmitted to the index 70 of the pilot's telegraph instrument, gives warning to him that a mistake has been made and that the engine is turning contrary to his orders. The toothed end of the dog may be shaped as represented at 62, Figs. 8 and 9, so that when set between two of the teeth 39 it will remain there until disengaged by the stop 60. When operating with a dog thus shaped the wheel 29 is not turned step by step, but will be oscillated only, giving, however, thereby notice that the parts are not properly set.

In Figs. 8 and 9 I have illustrated a form of dog so constructed that the operative tooth may be either angular, as presented at 62, in order to cause merely an oscillation of the wheel 29, or beveled to cause the wheel to be moved forward step by step. To effect this, I provide the dog with a supplemental piece 74 formed with a beveled edge 78 and adapted to overlie the angular tooth 62 of the dog. This part, 74, is pivoted to the dog at 75, and is provided with a slot, 77, concentric with the pivot. Set screw, 76, extends through the slot 77, and holds the part 74, either in working position as represented in Fig. 8, where it overlies the tooth 62, or swung back into inactive position, as represented in Fig. 9.

I have shown the part 20 as being provided with a single contact projection 21, which for most purposes is sufficient. However, the number of projections can be increased to any extent desired. With a larger number of projections the frequency of the operation of the alarm-causing devices will be in direct proportion to the number of projections 21 employed.

As stated, the movements of the wheel 29, imparted to it by the dog 40, are reproduced

at the pilot's instrument 13, and I avail myself of this to operate an alarm or signal for attracting the pilot's attention should he not at the instant be directly observing the telegraph instrument. 72 is a wheel to which is connected the hand 70, and 73 are projections extending out therefrom. These projections are arranged to serve as tappets to operate the striker of a bell 74, or other alarm, as the wheel 72 and index are moved.

I have thus far described but a single pair of bars, 23, 23′, together with the parts coöperating therewith, and have set forth their use and operation. I prefer, however, for some reasons, to duplicate these bars on each side of the axis of the disk or wheel 20 for purposes which I will shortly proceed to state. The duplicate bars are designated 123, 123′, and lie directly behind the bars 23, 23′, respectively, and are preferably connected with the arms 24, 24′ by the same pivots that connect the other pair of bars.

In using the ordinary form of ship's telegraph, the engineer, as has already been stated, is supposed to set his answering index or hand to correspond with the signal-giving index 27, that is controlled from the pilot's instrument. I have devised and already described apparatus that will operate to turn the answering wheel to indicate the correct movements of the driven shaft, should the engineer cause such shaft to be rotated in the wrong direction. And, I have also devised and shall now proceed to describe, means that will operate to set the answering parts of the telegraph instruments to indicate the true direction of rotation of the shaft, should the engineer fail to set these parts, or set them incorrectly, even though he should start his engine properly in response to the signal received by him.

As has been stated, a pair of bars 123, 123′, lie directly behind the bars 23, 23′, being at one end pivotally connected with the arms 24, 24′ and having their other ends resting upon the periphery of the wheel 20.

138 designates a sector-shaped plate carried by a sleeve 137 surrounding the shaft 37 and supported thereby. The sleeve 137 has secured to it a wheel 90, that is connected by a chain 91 with a wheel 92, which is mounted upon a sleeve 93, free to turn on the shaft 25, and to which sleeve the answering wheel 29 of the engineer's telegraph instrument is secured.

Referring to Fig. 4, let it be assumed that the pilot has given an order to turn the engine forward, and in so doing, has set the segment 38 into the position indicated, moving the bar 23′ out of the path of the projection 21; and let it be further assumed, that, while the engineer has started his engine forward in response to this signal, he has failed to move the pointer of the answering handle opposite to the order hand 27, leaving it in its mid-position, as indicated. This failure on his part leaves the sector-shaped plate 138, whose movements are controlled by the answering wheel 29, in its mid-position, as is indicated in the drawing, thus leaving both the bars, 123, 123′ in contact with the periphery of the disk or wheel 20. Accordingly as soon as this wheel begins to turn (in a direction opposite to that indicated by the arrow *x*) the projection 21 operates upon the bar 23′ to reciprocate it, and cause the arm 24′ to vibrate. This in turn, through the cog 40, operates to move the wheel 29 until the handle or pointer thereof is brought opposite the pointer 27, or to a position correctly indicating the direction in which the shaft is being turned. When this has occurred, the segment 138 will have been moved to a position throwing the arm 138′ out of the path of the projection of the disk 20.

In case it is not desired to use the two sets of bars, but to employ only the outer set, 23, 23′, then those bars of each pair may be united by a pin or bolt passing through apertures provided therefor, as at 86.

It is important, in maintaining the efficiency of the system, wherein long lines of mechanical connections such as indicated at *h*, 14 and 15, are employed that provision be made for indicating the fact should a break occur or the connection become undesirably slack. I therefore prefer to arrange in such lines of connections means which will operate to give an electric signal or alarm whenever a break occurs. Such means may be of any usual or preferred construction and need not be described herein, and I have therefore merely indicated at 63 a casing including circuit closing devices and wires 66 leading therefrom, and adapted to be connected with such alarm signal which may be located at any convenient place.

In Figs. 10 and 11, I have illustrated a somewhat different embodiment of my invention from what is shown in Fig. 3, although having a number of the characteristics of the arrangement illustrated in that view. Referring to these figures, *m* designates a propeller shaft from which extends a projection *q* that operates a bar *n* mounted in a rocking bar *o*. The end of the bar *n* that is remote from the shaft is utilized to serve as a striker or contact for operating the alarms, then being represented as arranged to operate the mechanical strikers 79 of a bell 80. The contact-pieces 81 with which the end of the bar engages are also the terminals of an electric circuit 82, that is adapted to operate the bell 80 electrically, if desired.

The contact-piece 81 is carried by a sleeve mounted to a shaft 83, a coiled spring, 84, surrounding this shaft being adapted to force the contact out to one side and out of line with the end of the bar *n*, as clearly indicated in Fig. 11. When in this position, a

projection 85 carried by the sleeve is in the line of movement of the striker 17′ carried by the wire 15, whose movements are controlled by the pilot's telegraph instrument, as has already been described.

The description of the apparatus already given, will make the operation of this form of my invention perfectly clear, without further explanation.

Some forms of motors, such as gas engines, are arranged always themselves to run in one direction, although they are connected with the driven shafts so as to turn them in either direction as desired. Therefore, when I herein refer to moving or turning the engine backward, I wish it to be understood as referring by that expression to such movements as will impart a backward movement to the driven shaft whether the motor itself actually turns backward or not.

In my aforesaid patent No. 885,529, I illustrate one form of apparatus in which the means for setting the alarm operating devices are operated by record making devices, which latter, in turn, are operated or controlled by the order transmitting mechanism or ship's telegraph. Therefore, when I refer in this case to the order transmitting mechanism or ship's telegraph as setting or controlling the alarm operating devices, I wish to be understood as including apparatus where the control is remote, as in the apparatus described in my said patent and above referred to, as well as where the control is more direct, as in the construction illustrated and described in this case.

I claim

1. In an alarm system, the combination with an engine driven shaft, of mechanism for giving orders for driving the said shaft, alarm or signal devices, and means for controlling the alarm or signal devices from the order transmitting mechanism arranged to operate whenever the said shaft is turned in a direction contrary to that ordered, substantially as set forth.

2. In a signal system, the combination with an engine-driven shaft, of signal or alarm devices, means operated by the turning of the shaft for causing the signal or alarm devices to operate, order transmitting mechanism, and means controlled by the order transmitting mechanism arranged to set the alarm operating devices out of operative relation with the said shaft, whereby the turning of the shaft does not cause a signal to be given when the shaft is properly turned in response to the signal transmitted.

3. The combination of signal or alarm devices, means operated from an engine for causing the signal or alarm devices to operate when the engine moves, order transmitting mechanism, and means controlled by the order transmitting mechanism for setting the alarm operating devices to operate if the movements of the engine do not correspond with the signal transmitted, substantially as set forth.

4. The combination of signal or alarm devices, order transmitting mechanism, and means for operating the said signal or alarm devices, including two co-acting members, one of which is operated from the engine when it moves and the other is set into active or inactive position accordingly as the order transmitting mechanism is set, substantially as set forth.

5. The combination of signal or alarm devices, two separate sets of devices for causing the signal or alarm to operate, one set to operate when the engine turns forward and the other when it turns backward, order transmitting mechanism, and means controlled by the order transmitting mechanism for setting one of the sets of alarm operating devices when one order is given, and for setting the other set when a contrary order is given, substantially as set forth.

6. The combination of signal or alarm devices, order transmitting mechanism, and means for operating the said signal or alarm devices, including two sets of coöperating members, one set for making signals when the engine turns forward and the other when it turns backward, one member of each of said sets being operated from the engine, and the other being put into active or inactive position accordingly as the order transmitting mechanism is set, substantially as set forth.

7. The combination with an engine driven shaft, of alarm or signal devices, mechanism for transmitting orders to govern the direction in which the shaft shall be driven, and means for operating the said signal or alarm devices comprising a member operated when the said shaft is driven, and a set of two members adapted to coöperate respectively with the said engine driven member, and controlled by the order transmitting mechanism, one of the members of the said set being put into position to coöperate with the engine driven member when the shaft turns in one direction and when one order is transmitted, and the other member of said set being put into coöperative position when the shaft turns in the other direction and when another order is transmitted, substantially as set forth.

8. The combination with an engine driven shaft, of mechanism for giving orders for driving the said shaft, alarm or signal devices, means arranged to operate the alarm when the shaft turns in one direction, means arranged to operate the alarm when the shaft turns in the opposite direction, and means controlled by the order-giving mechanism for setting out of working position those alarm operating means that are operated

when the shaft turns in a direction corresponding with the order given, substantially as set forth.

9. The combination with an engine, of mechanism for transmitting orders to control the movements of the engine, alarm devices, means operated from the engine for causing an alarm to be given, comprising parts adapted to have to and fro movements when the engine is in motion, and means controlled by the order transmitting mechanism for setting the signal giving parts to operate when the engine is turned in a direction contrary to the order transmitted, substantially as set forth.

10. The combination with an engine, of mechanism for transmitting orders to control the movements of the engine, alarm devices, means operated from the engine for causing an alarm to be given, comprising parts adapted to have to and fro movements at one place to operate the alarm signal when the engine is turning in one direction, and to have to and fro movements at another place to operate the alarm signals when the engine is turning in the opposite direction, and means controlled by the order transmitting mechanism for setting the signal-giving means in operative position at one place when one order is given and at the other place when a contrary order is given, substantially as set forth.

11. The combination with an engine-driven shaft, of a ship's telegraph comprising the pilot's and the engineer's instruments, alarm signal devices, arranged to be operated when the said shaft is being driven, and means located at the engineer's instrument for controlling the alarm devices arranged to set them in position to operate whenever the said shaft is turned in a direction contrary to that ordered, substantially as set forth.

12. The combination with an engine-driven shaft, of a ship's telegraph comprising the pilot's and the engineer's instruments, having order sending and response giving parts, transmitting connections located between the said shaft and the response-giving parts of the telegraph and arranged to be put in motion when the said shaft is being driven for moving the said response giving parts in accord with the movements of the shaft, and means controlled by the order sending parts of the said telegraph for connecting up the said transmitting connections whenever the shaft is turned in a direction contrary to the order transmitted by the telegraph, substantially as set forth.

13. The combination with an engine, of a ship's telegraph, alarm devices adapted to be operated when the engine is in motion, means operated by the order transmitting parts of the said telegraph for controlling the said alarm devices and putting them out of operation when the engine is turning in response to the order transmitted, means under the control of the engineer for putting the alarm devices out of operation whenever the telegraph instrument is set to "stop" position, and means for restoring said devices to operative positions whenever the telegraph instrument is moved from the "stop" position, substantially as set forth.

14. The combination with an engine-driven shaft, of a ship's telegraph comprising the pilot's and the engineer's instruments, having order sending and response giving parts, transmitting connections located between the said shaft and the response-giving parts of the ship's telegraph and arranged to move the said response giving parts when the shaft is rotated comprising an adjustable power transmitting member arranged to give a step by step motion to the said response devices when adjusted to one position, or a vibratory motion, when adjusted in another position, substantially as set forth.

15. In a signaling apparatus, the combination with a ship's telegraph, of a rotatable contact-piece, a pair of bars disposed on opposite sides of the axis of the said contact-piece and in the path of rotation thereof, the bars being so arranged that when the contact-piece turns in one direction one of them is vibrated and when it turns in the other direction the other is vibrated, signal devices, connections located between the said bars and the signal devices for causing the signal devices to operate, controlled by the vibrations of the said bars and means operated from the ship's telegraph for moving one or the other of the said bars out of the path of the contact-piece accordingly as the telegraph instrument is set, substantially as set forth.

16. In a signaling apparatus, the combination of a rotatable contact-piece, a pair of bars disposed on opposite sides of the axis of the said contact-piece and in the path of rotation thereof, the bars being so arranged that when the contact-piece turns in one direction one of them is vibrated and when it turns in the other direction the other is vibrated, signal devices, connections located between the said bars and the signal devices for causing the signal devices to operate, controlled by the vibrations of the said bars, and means for moving at will one or the other of the said bars out of the path of the contact-piece, substantially as set forth.

17. The combination with an engine-driven shaft, of a rotatable contact arranged to have movements corresponding with those of the shaft, a bar located in the path of rotation of the said projection and arranged to be longitudinally reciprocated when the shaft turns in one direction and to be laterally vibrated when it turns in the op-

posite direction, signal devices, connections located between said bars and the signal devices and operated by the movements of the said bars for controlling the said signal devices, order transmitting devices for governing the movements of the shaft, and means controlled by the order transmitting devices for setting the said bar into or out of position to be engaged by the contact device, substantially as set forth.

18. The combination with an engine-driven shaft, of a rotatable contact arranged to have movements corresponding with those of the shaft, a pair of bars arranged on opposite sides of the axis of rotation of the said contact projection and in its path of movement and arranged so that one of the bars will be vibrated when the shaft turns in one direction and the other vibrated when it turns in the other direction, alarm signal devices, means operated by the vibrations of the said bars to control the giving of the alarm signals, order transmitting devices for governing the movements of the said shaft, and means controlled by the order giving devices for putting one or the other of the said bars out of the path of the contact projection accordingly as the order transmitting mechanism is set, substantially as set forth.

19. The combination with an engine driven shaft, of a rotatable contact device arranged to have movements corresponding with those of the shaft, a set of bars arranged on opposite sides of the axis of rotation of the said contact device and in its path of movement, and arranged so that one of the bars is given a to and fro movement when the shaft turns in one direction, and the other bar a similar movement when the shaft moves in the opposite direction, alarm signal devices, means operated by the said bars when moved as stated to control the operation of the alarm signals, a ship's telegraph comprising devices for answering the orders given, and means controlled by the said answering devices for rendering one or the other of the said bars inoperative, with reference to the contact device, accordingly as the answering devices are set, substantially as set forth.

20. The combination with a ship's telegraph, having order sending and answer giving devices, of a driven shaft, alarm signal devices, means operated when the said shaft is in motion and arranged to cause alarm signals to be given, means controlled by the answering devices of the telegraph for throwing the said signal causing devices out of action or into inoperative positions when the answering devices are properly set in response to a signal, and connections between the devices that control the alarm signals and the answering devices of the telegraph arranged to automatically set the latter to position to indicate the true direction of movement of the shaft, substantially as set forth.

21. The combination with a ship's telegraph having order giving and answering devices, of a driven shaft, means for rotating the shaft to correspond with the movements of the engine and means operated by the movements of the shaft for automatically setting the answering parts of the ship's telegraph to position to indicate the true direction of the shaft's movements should the said parts not be set by hand, substantially as set forth.

22. The combination with a ship's telegraph having order giving and answering devices, of a driven shaft, means operated by the movements of the shaft for automatically setting the answering parts of the ship's telegraph to position to indicate the true direction of the shaft's movements should the said parts not be set by hand, and means controlled by the said answering devices for putting into inoperative position the said automatic setting devices whenever the answering devices come to positions to indicate the true direction of movement of the shaft, substantially as set forth.

23. The combination with an engine driven shaft, of a ship's telegraph having order sending, and answering devices, of a rotary contact device arranged to have movements similar to those of the shaft, alarm devices, and two sets of devices arranged to be operated by the said rotary contact device and to control the alarm devices, one of the said sets of devices being set, with reference to the contact device, by the order giving parts of the ship's telegraph, and the other set being controlled by the answering devices of the ship's telegraph, substantially as set forth.

24. The combination with an engine driven shaft, of a ship's telegraph having order sending, and response, devices, a rotatable contact device arranged to have movements similar to those of the shaft, two sets of bars, the bars of each being arranged on the opposite sides of the axis of rotation of the shaft of the said projection and lying normally in its path of movement, the bars on one side of the axis being arranged to be operated when the contact device turns one way, and those of the other side when it turns the other way, alarm signal devices controlled by the said bars, means controlled by the signal giving parts of the telegraph for governing the operative position of the bars of one set, and means controlled by the answering devices of the telegraph for governing the bars of the other set, substantially as set forth.

25. The combination with an engine driven shaft, of a ship's telegraph having order sending, and response, devices, a rotatable contact device arranged to have movements similar to those of the shaft, two sets of bars, the bars of each being arranged on the opposite sides of the axis of rotation of the said projection and ling normally in its path of

movement, the bars on one side of the axis being arranged to be operated when the contact device turns one way, and those on the other side when it turns the other way, means controlled by the signal giving parts of the telegraph for governing the operative position of the bars of one set, means controlled by the answering devices of the telegraph for governing the bars of the other set, and means operated by the bars of each set for moving the answering devices to position to indicate the true direction of rotation of the shaft, substantially as set forth.

26. The combination with a driven shaft, a rotatable contact piece arranged to have movements corresponding to those of the shaft, a pair of bars disposed on opposite sides of the axis of rotation of the said contact piece and in the path of movement thereof, the bar on one side being operated when the contact piece turns one way and that on the other side being operated when it turns the opposite way, alarm signal devices controlled by the said bars, a ship's telegraph, and a movable member arranged between the said bars and connected with the moving parts of the ship's telegraph and arranged, when an order to turn the shaft in one direction is given, to throw one of the bars into inoperative position, leaving the other bar in the path of the said contact piece, and when an order is given for turning the shaft in the opposite direction to reverse the positions of the said bars, substantially as set forth.

27. In an alarm system, the combination with a driven piece of mechanism, of alarm devices, order-transmitting apparatus, devices through which the alarm devices may be operated when the said mechanism is in motion, and means controlled by the order-transmitting apparatus arranged to set the said interposed devices into operative or inoperative positions accordingly as the order-transmitting apparatus is set.

28. In an alarm system, the combination with a driven piece of mechanism, of alarm devices, order-transmitting apparatus, devices interposed between the driven mechanism and the alarm devices arranged to operate the alarms through one portion thereof when the apparatus moves in one direction and through another portion when it moves in the opposite direction, and means controlled by the order-transmitting apparatus arranged to set one or the other of the aforementioned portions of the said interposed devices into operative position accordingly as the order-transmitting apparatus is set.

29. In combination, a driven piece of mechanism, order-transmitting apparatus, and means operated from the driven mechanism for giving an alarm and arranged to operate when the motion of the mechanism does not correspond with the order transmitted and to be inactive when the order is properly obeyed.

30. In combination, a driven piece of mechanism, order-transmitting apparatus, means operated from the driven mechanism for giving an alarm when the motion of the mechanism does not correspond with the order transmitted, and devices controlled by the order-transmitting apparatus for setting the alarm-giving means into inoperative relations whenever the order transmitted is obeyed.

31. In combination, a driven piece of mechanism, an answer or response-transmitting apparatus, and alarm giving mechanism operated by the said driven mechanism for giving an alarm whenever the movement of the mechanism does not correspond with the response transmitted.

32. In combination, a driven piece of mechanism, answer or response transmitting apparatus, and means operated by the said mechanism for moving the said response apparatus to indicate the true direction of movement of the mechanism if the latter is moved contrary to the response transmitted.

WALTER S. RUSH.

Witnesses:
GEO. B. PITTS,
J. S. BARKER.