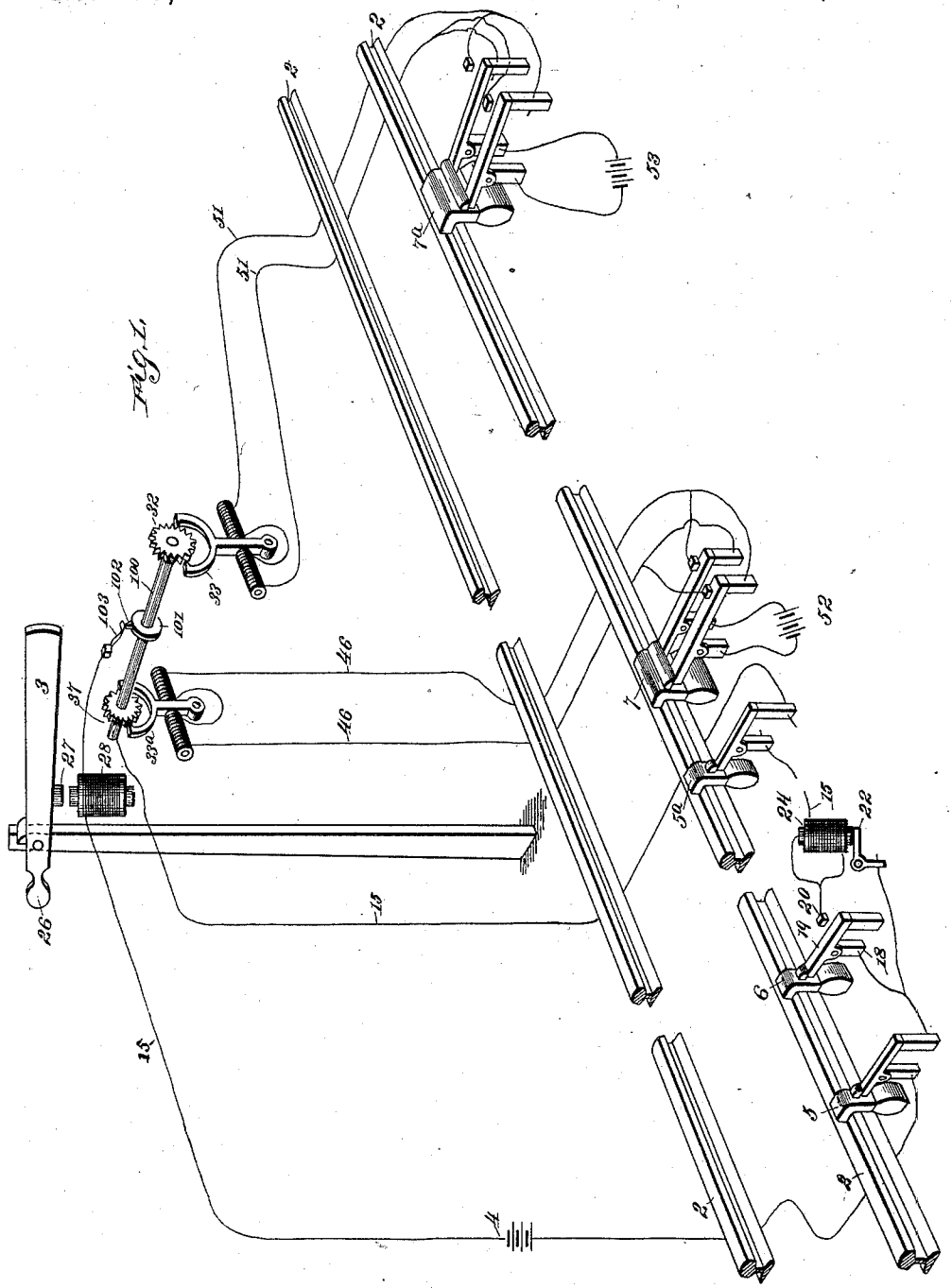
(No Model.) 2 Sheets—Sheet 1.

F. P. BENJAMIN.

RAILWAY SIGNALING SYSTEM.

No. 476,240. Patented June 7, 1892.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

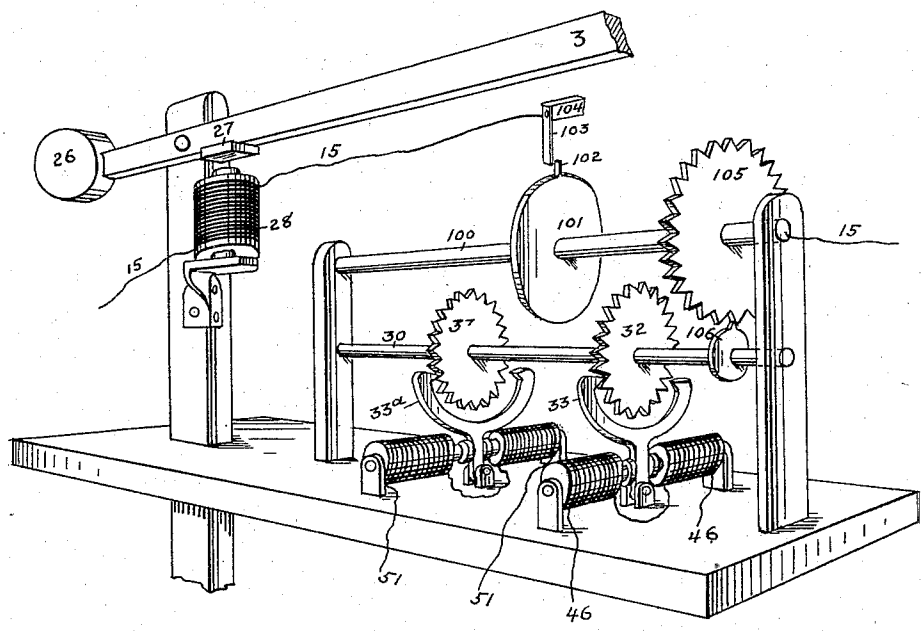
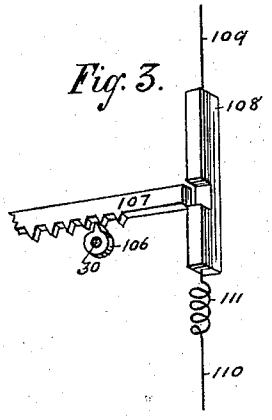


Fig. 3.



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RAILWAY SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 476,240, dated June 7, 1892.

Application filed September 5, 1891. Serial No. 404,813. (No model.)

To all whom it may concern:

Be it known that I, FRANK P. BENJAMIN, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Railway Signaling Systems, of which the following is a specification.

In a certain pending application for Letters Patent filed by me July 29, 1891, bearing Serial No. 401,024, I have described certain systems of railway signaling.

My present invention in its broader aspects includes the systems therein described.

It also consists of certain novel parts and combinations of parts pointed out in the claims concluding this specification.

The accompanying drawings illustrate a system substantially like that described in my said pending application, to which reference here is made for a fuller description thereof. They also illustrate other improvements (which are the subject-matter of this patent) embodied in forms which are at present preferred by me; but it will be understood that my invention is not limited to the particular form and location of the parts herein described, as these are for the most part symbolic, and various modifications and substitutions may be made without departing from the spirit of my invention and without exceeding the scope of the claims concluding this specification.

For the purpose of enabling others skilled in the art to understand my invention I will describe the structure illustrated in the accompanying drawings.

Figure 1 shows in perspective a track guarded by a semaphore worked by electric energy, the line-wires and the devices along the track being automatically operated by a passing train. Fig. 2 shows mechanism worked by electric energy, which controls the semaphore. Fig. 3 is a modified form of locking device worked either by electric or other suitable form of energy.

Referring to Fig. 1, 2 2 is a track.

3 is any suitable signaling apparatus, shown as a semaphore.

4 is any suitable source of electric energy.

5 5^a are any suitable circuit-breaking devices automatically operated by a passing train, included in the circuit 15 15 from the battery or other source of energy 4.

6 is any suitable circuit-closing device automatically operated by a passing train included in said circuit. The passage of the train causes the lever 19 to be thrown in contact with the contact-plate 20 when the circuit is established, and the current flows by 18, 19, 20, and 15 around the coils of the electro-magnet in circuit, by means of which it is energized and the armature 22 is attracted into contact with its core, when the contact flows also by way of said armature through the core 24 around the coils of the magnet and to the line 15. Hence the continuity of this circuit is maintained and the magnet continues to be energized after lever 19 falls away from contact 20 and until the circuit is somewhere along the line broken. When it is broken, the armature 22 falls away from contact with the core 24 and will not be brought in contact again until the device 6 is operated. A function of the devices 5, 5^a, and 7 is to break the circuit when a train passes them, and thus to release the armature 22 from the core 24 of its magnet.

7 7^a are any suitable devices automatically operated by a passing train for controlling the signal 3, so that when a train is between 7 and 7^a a train approaching the signal cannot bring it to or, if preferred, leave it in a position indicating a "clear track." Box 7 is contained in a circuit 46 46, connected with the generator 52, and box 7^a is contained in a circuit 51 51, connected with the generator 53. The block between 7 and 7^a may be of any desired length. I prefer to place the circuit-closing device 6 at such a distance from the signal that a train going at full speed may easily come to a dead-stop after it has passed the circuit-closing device 6 and before it has reached the signal.

In the accompanying drawings I have shown a semaphore standing normally at "danger," so that a train passing 7 will lock the mechanism working the signal or will cut off and render inefficient the force of energy designed under proper condition to bring it to "safety," thereby making it impossible to move it from the position indicating "danger" until the train leaves the block at 7^a, when it will un-

lock said mechanism and render the force operating it efficient again. A train passing 6 will energize the magnet 28, Figs. 1 and 2, and bring the semaphore to a position indicating "safety," if the mechanism to move it be not locked or be not disconnected. The semaphore will then remain at "safety" until the circuit 15 is broken. It may be broken by any suitable circuit-breaking device in this circuit, one such device being contained in box 5^a and another in the locking mechanism controlled by box 7. This is the form which I prefer. I may, however, as described in my said application, apply a lock directly to the semaphore itself, so that it cannot be brought to "safety," although the mechanism for operating it remains intact. As fully set forth in said pending application, I prefer to employ locking mechanism of such a character that it will be variously affected, according to the number of impulses transmitted to it by the train by which it is locked and which can only be unlocked by the same number of impulses which locked it. In such a system, if there be no train on the block between 7 and 7^a, a train approaching the signal will set it at "safety" when it passes box 6, containing a circuit-maker, and will set it at "danger" again when it passes a circuit-breaker. If there be a train or a part of a train on the block between 7 and 7^a, a following train cannot set the signal at "safety" when it approaches it, thereby being informed of the fact that a train is on the block ahead. Such is a brief description of the system illustrated in Fig. 4, (to which, among others, my present invention is adapted.) In my said pending application I have shown and described mechanism for locking the signal at "danger" when a train is between boxes 7 and 7^a. The locking mechanism is there shown in connection with the semaphore-bar.

My present invention, among other things, consists, broadly, of employing a locking device in connection with a semaphore or the mechanism or energy which controls the action of the semaphore or other signaling device, and a device which when operated causes the signal to indicate "danger" if the section be occupied by failing to bring the signal to "safety" if it normally stands at "danger" and a train entering the section locks it, or by bringing the signal to "danger" if it normally stands at "safety" and a train entering the section unlocks it, thus in its broader features including the invention described in my said pending application, for in this application I speak of a semaphore as the "typical signal," without intending thereby to limit the application of my invention in this particular form of signal, as many others are well known and may be employed for the same purpose.

Instead of applying the locking device to the semaphore-bar itself, as described in said pending application, I prefer to apply it to the mechanism or energy controlling the operation of the bar. It may be used in connection with any of the operating parts. I have shown it, however, in Figs. 2 and 4 connected with the magnet, which draws the semaphore-bar to "safety" when energized.

Referring to Fig. 2, 3 is a semaphore-bar pivoted on a standard and provided with a counterpoise-weight 26, which is heavy enough to keep the bar horizontal, except when the armature 27, which it carries, is attracted by the magnet 28 or the bar is moved by any force controlled by said magnet, for it is obvious that the magnet could be employed to call into operation an independent energy—as, for example, compressed air. This magnet 28 has its coils formed of a part of the line-wire 15 15, so that when current is flowing through the circuit 15 the core of the magnet is energized, its armature 27 is attracted, and the semaphore-bar 3 brought to a position indicating "safety."

100 is a shaft, on which is rigidly mounted a wheel 101, partially or wholly made of a conducting material and provided with a projection 102.

103 is a metal spring attached to a support 104, the lower end of this spring being in the path of the projection 102 on the wheel 101, so that the spring and projection may form electrical contact when the wheel is in one position. The shaft 100 also has attached to it rigidly a toothed wheel 105. 30 is a shaft also held in suitable supports, having rigidly attached to it stepping-wheels 32 and 37. It also carries rigidly attached to it a wheel 106 with one tooth.

33 and 33^a are Y-arms provided with pawls. The lower limbs of these arms are polarized armatures of electro-magnets and are pivoted to suitable supports. The pawls carried on the Y-arms and the teeth of the wheels in which they engage are fashioned so that the vibration of the arm 33 turns the shaft 30 in one direction and the vibration of 33^a turns it in the opposite direction, the distance turned in each case being dependent upon the number of vibrations of the arm operating at the time. The electro-magnets controlling the armature 33 are included in circuit 46, and the electro-magnets controlling the armature 33^a are included in circuit 51. A train passing box 7 reverses the current flowing through circuit 46, causing it to alternate, and thus vibrates the Y-arm 33 and causes the shaft 30 to turn on its axis. The one-toothed wheel 106 turns the shaft 100, disrupting contact of pin 102 with spring 103, and breaks circuit 15. A train passing box 7 breaks circuit 15, and hence performs the same function as to breaking circuit 15 at 5^a, which may therefore, if preferred, be omitted. This, however, is only true in a system in which the line 15 15 is broken in the act of locking the semaphore. If the line 15 15 were not broken at 102 103, as shown, the circuit-breaker 5^a would be necessary to break the circuit which was made in box 6, and so release the semaphore-arm. A

train approaching the signal passing box 6 cannot now energize magnet 28 to bring the signal to "safety." When the train on the block, however, passes box 7^a, it causes the current to alternate in circuit 51, and the Y-arms 33^a turn shaft 30 and shaft 100 the same number of steps in the reverse direction, bringing pin 102 in contact with spring 103, thereby making the circuit 15 at this point complete, so that a train passing box 6 can energize magnet 28 and bring the signal to a position indicating "safety." It will be seen that each wheel of the train passing boxes 7 and 7^a will cause the polarized armatures to vibrate, so that the shaft 30 will be turned more or less, depending upon the number of wheels which have passed. It will also be seen that the same number of wheels which locked the signal must pass the box 7^a to unlock it. The wheels 101 might be set directly on the shaft 30; but I prefer to interpose the gearing 105 106, so that the mechanism will receive a larger number of impulses. The impulses might of course be caused by other means than the wheels.

My present invention in some of its features is not limited in its application to systems in which the signal is either worked or locked by electric means. The general principles remain the same whether electricity or other form of energy be employed to do the work. This is indicated in Fig. 3, which shows a device worked directly by the energy of the moving train; but the invention is not limited to this device nor to the method of working the signal, which may be worked by any device or force adapted to the purpose. In said figure 106 is the same one-toothed wheel set upon the shaft 30. (Shown in Fig. 2.) 107 is a stepping-bar sliding in suitable ways, in which the tooth on the wheel 106 engages. 108 is a bar provided with a slot in which the bar 107 when projected enters. 109 is a wire leading to the semaphore-arm, and 110 is a wire connected with any suitable device along the track to be moved by the passing train or other force. The wire 110 is connected to the bar 108 by a spring 111. When wire 110 is pulled, if bar 107 be in the position indicated in the drawings it will bring the signal to "safety." If, on the other hand, the bar 107 be projected in the slot 108 when wire 110 is pulled, it cannot depress the semaphore-bar, but will only elongate the spring 111. This form of locking device is adapted, like the other, for use in any part of the system in connection with the energy or mechanism which directly or indirectly operates the signal. Any other form of energy—as, for example, compressed air—might be applied to do the work, as is now well understood in the arts. In the case of using compressed air the shaft 30 or shaft 100 could be so geared as to turn or close a valve controlling the flow of air when a train is on the block between 7 and 7^a, so that the signal could not be brought to "safety," or any other suitable contrivance effecting substantially the same end might be employed.

In the foregoing specification I have incidentally referred to a few of the devices which may be employed and the modifications which may be adopted in practicing my invention; but I have not endeavored to specify all the devices and modifications which might be employed, the object of this specification being to instruct others skilled in the art to practice the several novel features of my invention in forms at present preferred by me and to enable them to understand its nature; and I desire it to be distinctly understood that mention by me of a few devices and modifications is not in any way intended to exclude others not referred to, but which are within the spirit and scope of my invention.

Many of the combinations and details illustrated and above described are not essential to the several features of my invention separately and broadly considered. All this will be indicated in the concluding claims, as in any given claim the omission of an element or the omission of reference to the particular features of the elements mentioned is intended to be a formal declaration of the fact that the omitted elements or features are not essential to the invention therein covered.

In the claims I use the terms "lock," "locking mechanism," "locking device," or terms of similar import to include not only a lock, strictly speaking, applied to the semaphore or mechanism, but any suitable contrivance which will render the mechanism for bringing the signal to "safety" inoperative for that purpose.

Having thus described the structures which embody the novel features of my present invention, what I claim, and desire to secure by Letters Patent, is—

1. In a system of railway signaling, the following elements in combination: a signal, a locking device, and devices along the track at opposite ends of a section, automatically operated by a passing train to work said lock without changing the position of the signal when a train enters and leaves said section, so that the signal cannot be made to indicate "safety" while the train is on said section.

2. In a system of railway signaling, the following elements in combination: a signal, a locking device, devices along the tracks at opposite ends of the section, automatically operated by a passing train to work said lock without changing the position of the signal when the train enters and leaves said section, so that the signal cannot be made to indicate "safety" while a train is on said section, and means, substantially as described, for causing said signal to indicate "safety" if no train is on said section.

3. In a system of railway signaling, the following elements in combination: a signal, a locking device, devices arranged along the track at opposite ends of the section, auto-

matically operated by a passing train to work said lock when a train enters and leaves said section, so that it cannot be made to indicate "safety" while a train is on said section, and a device along the track passed by the train before reaching said signal, automatically operated by a passing train for causing said signal to indicate "safety" if no train is on said section.

4. In a system of railway signaling, the following elements in combination: a signal, a locking device, said locking device being variously affected, according to the number of impulses transmitted to it, and being locked and unlocked by the same number of impulses, and devices along the track at opposite ends of a section, automatically operated by a passing train to work said lock when the train enters and leaves said section, and a device which when operated causes the signal to indicate "safety" if no train is on said section.

5. In a system of railway signaling, the following elements in combination: a signal, a locking device, devices arranged along the track at opposite ends of the section, automatically operated by a passing train to work said lock when it enters and leaves said section, and a device which when operated causes the signal to indicate "safety" if no train is on said section.

6. In an electric system of railway signaling, the following elements in combination: a signal, a locking device, devices along the track at opposite ends of the section, automatically operated by a passing train, and circuits connected with a suitable source of electric energy and with said locking devices and with said track devices to work said lock when a train enters and leaves said section, and a device which when operated causes the signal to indicate "safety" if no train is on said section.

7. In an electric system of railway signaling, the following elements in combination: a signal, a locking device, devices along the track at opposite ends of the section, automatically operated by a passing train, circuits connected with a suitable source of electric energy and with said locking device and with said track devices to work said lock when a train enters and leaves said section, so that the signal cannot be made to indicate "safety" while a train is on said section, a device along the track passed and automatically operated by a train before reaching said signal, and a circuit connected with a suitable source of electric energy and with the mechanism operating the signal and with said track device in front of said signal for bringing said signal to "safety" if no train is on said section.

8. In a system of railway signaling, the following elements in combination: a signal, devices along the track at opposite ends of a section, automatically operated by a passing train, a lock interposed between said signal and said track devices by which the lock is worked, and a device which when operated causes the signal to indicate "safety" if no train is on said section.

9. In a system of railway signaling, the following elements in combination: a signal normally standing at "danger," a locking device, and devices along the track at opposite ends of the section, automatically operated by a passing train to work said lock without changing the position of said signal when a train enters and leaves said section, so that the signal cannot be brought to "safety" while a train is on said section.

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