(No Model.) 3 Sheets—Sheet 1.

O. GASSETT.

HYDRAULIC AND ELECTRIC INTERLOCKING APPARATUS.

No. 266,957. Patented Oct. 31, 1882.

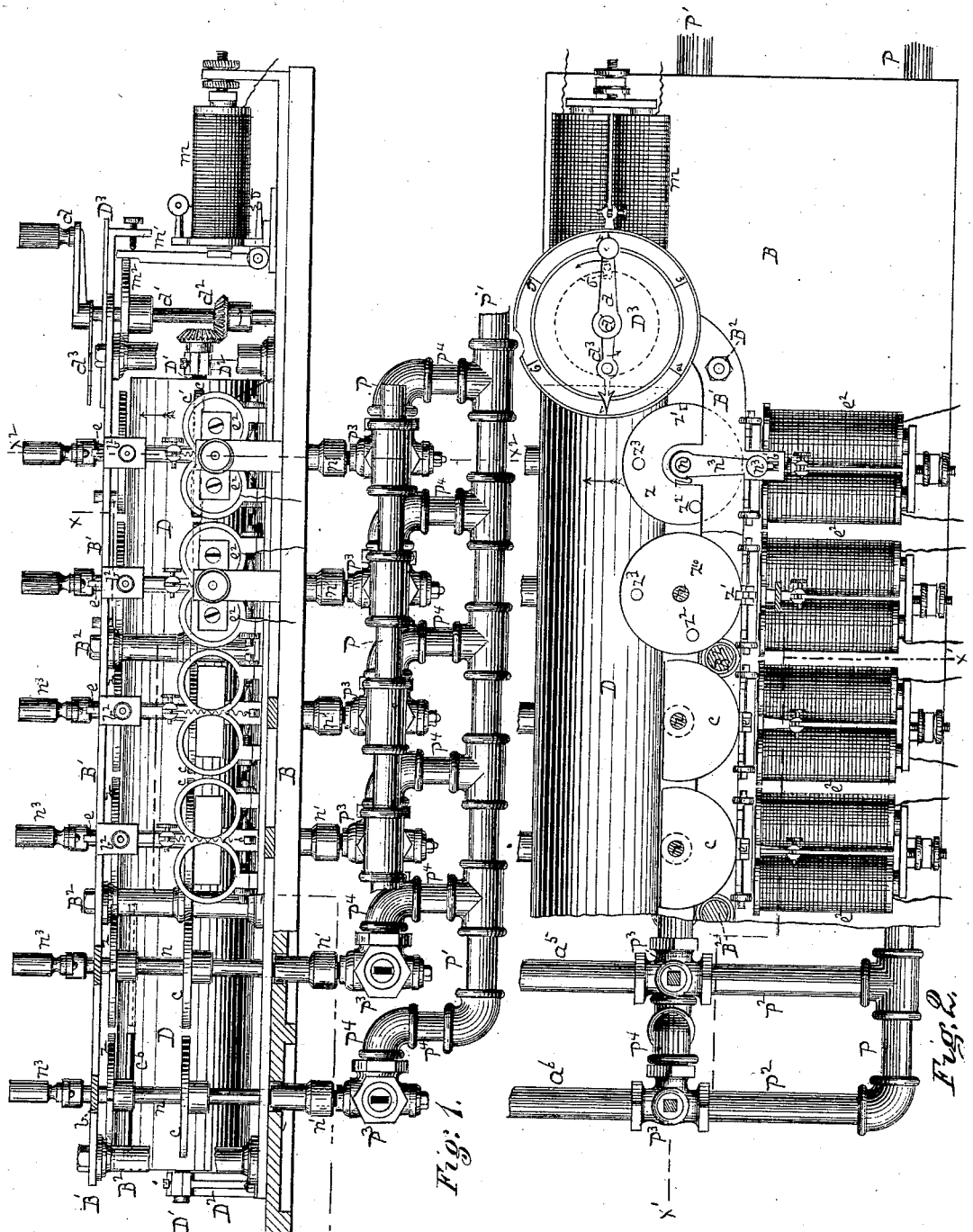

Fig. 1.

Fig. 2.

Witnesses.
R. F. Whittlesey
H. C. Potter

Inventor Oscar Gassett
By Attorney George H. Christy.

(No Model.) 3 Sheets—Sheet 2.

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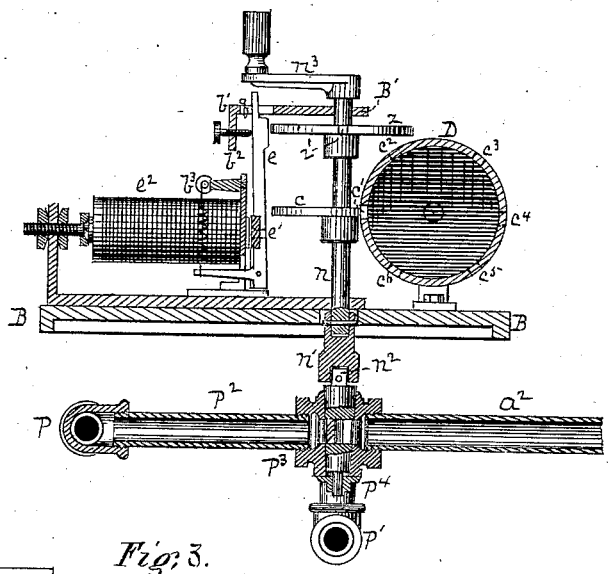

Fig. 3.

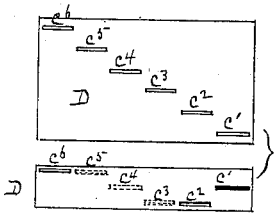

Fig. 5.

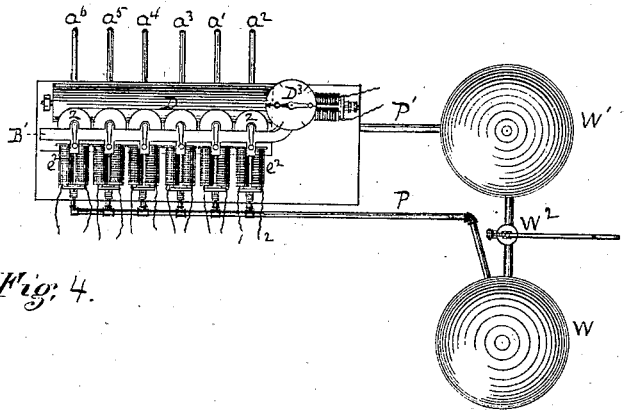

Fig. 4.

Witnesses
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H. C. Potter

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(No Model.)

3 Sheets—Sheet 3.

O. GASSETT.

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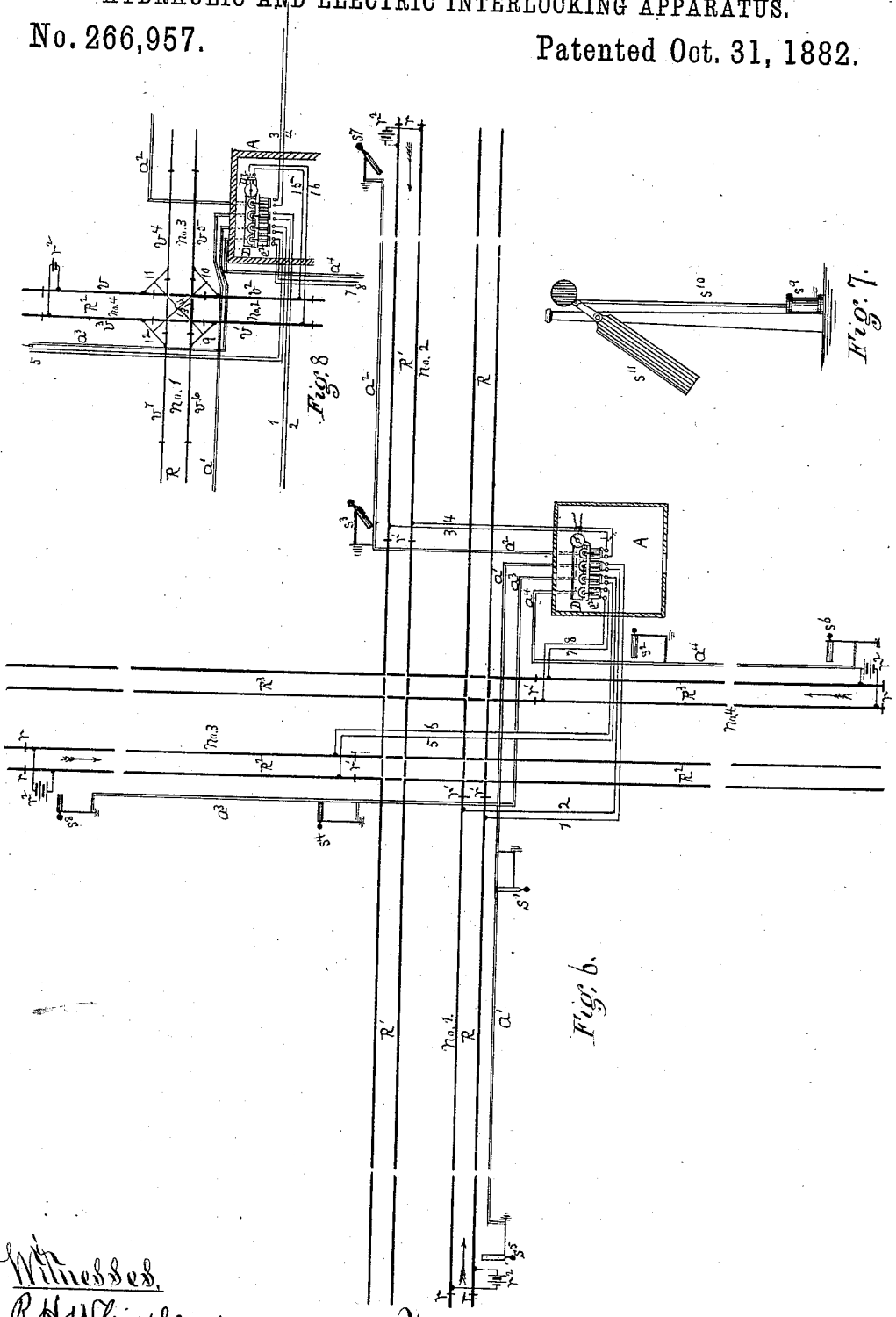

Fig. 8

Fig. 7.

Fig. 6.

Witnesses,
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H. D. Potter

Inventor Oscar Gassett
By Attorney George H. Christy

UNITED STATES PATENT OFFICE.

OSCAR GASSETT, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE UNION SWITCH AND SIGNAL COMPANY, OF PITTSBURG, PENNSYLVANIA.

HYDRAULIC AND ELECTRIC INTERLOCKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 266,957, dated October 31, 1882.

Application filed May 6, 1882. (No model.)

To all whom it may concern:

Be it known that I, OSCAR GASSETT, of Boston, county of Suffolk, State of Massachusetts, temporarily a resident of Sewickley, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Hydraulic and Electric Interlocking Apparatus; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a view in elevation, partly sectioned, in the plane of the line x' x' of Fig. 2, illustrative of the main operative parts of my improved mechanism. Fig. 2 is a top or plan view of the same apparatus, but sectioned in part, in the plane of the line $x\,x$ of Fig. 1. Fig. 3, Sheet 2, is a transverse sectional view in the plane of the line x^2 x^2, Fig. 1. Fig. 4 is a plan view, to a reduced scale, of the apparatus of Sheet 1, and showing the same in its relationship to the fluid-pressure supply and discharge. Fig. 5 is a detached view of the slotted rotating cylinder employed, said cylinder being drawn to the same scale as in Fig. 4, and being represented in elevation and diagrammatically unfolded, as on a plane. Fig. 6, Sheet 3, is a diagrammatic view of the apparatus complete, as organized for operating the signals of a double-track crossing. Fig. 7 is a view in elevation of signal-post suitable for use in this organization, with its signal and operative mechanism; and Fig. 8 illustrates a modified organization, such as is suitable for a single-track crossing.

My present invention relates, in general terms, to the construction of an improved apparatus for employing fluid-pressure in the operation of railway and other like signals, whereby, among other things, it is impossible to set one signal at "safety" until all other signals, which ought to be at "danger," are properly set, and also when a signal is set at "safety" all or any desired number of danger-signals are locked at "danger." In like manner, also, safety or "go-ahead" signals may be locked in that position by a starting-signal, and the latter be incapable of being set in a "starting" position until the go-ahead or safety signals are properly set; and my invention also includes, as a part of the system, an arrangement of track-circuits, by which any desired signal—as, for example, the signal the setting of which makes a lock—is itself automatically locked and kept locked so long as such position or condition is desirable or essential to safety.

Referring, for the present, to Figs. 1 to 5, I will first describe my fluid-pressure interlocking apparatus.

P represents a main supply-pipe which takes its supply from any suitable tank or accumulator, W, Fig. 4, and P′ is a main discharge-pipe, through which waste water or other liquid is run into a tank, W′, Fig. 4, and from which it may be pumped back into W by any suitable pump, W^2. Assuming, for the present, that six signals or sets of signals are to be operated, branch pipes P^2, six in number, lead from the main supply-pipe P through cocks and cases P^3, and from the opposite ports of these cock-cases the signal-pipes a' to a^6 lead off to the signal-cylinders, so that when fluid-pressure of any one is turned on the signal will be set, say, at "safety," and when turned off it will take a reverse position, as presently to be explained. From a side port in each cock-case a discharge-branch, P^4, leads to the main discharge-pipe P′. Understanding that the cock in each cock-case P^3 is a three-way cock, the skilled constructor will readily know how to make and fit or adjust it so that fluid-pressure from P may be applied in the signal-cylinders to set the signals at "safety," (the waste through P^4 and P′ being then cut off,) or so that the fluid-pressure from P may be cut off and the waste opened through P^4 and P′ in order to let the signals go to "danger." These and the other parts of the machine may be supported on any suitable base or pedestal, B, and a plate, B′, supported on posts B^2, constitutes a means of supporting other devices, as presently to be described.

The rectangular head n^2, Fig. 3, of each cock has a socketed wrench-head, n', fitted thereon, and through this a rotary motion is imparted to the cock from a shaft, n, and rotary motion is given to the shaft by a handle, n^3, or other suitable contrivance. In this manner the cocks are turned so as to apply and release fluid-pressure, as may be desired. The upper ends

of the shafts *n* pass through eyes in projections *b*, made on the edge of the plate B′, Fig. 2. It will be observed that these cock shafts or stems *n* are arranged side by side in a row, and the number may be varied at pleasure, or as the work to be done may require.

In order now to provide for interlocking, so that the setting of any one cock so as to set a signal, say, at "safety," may lock the cocks of any or all other signal-pipes, I arrange on each cock-stem *n* a disk, *c*, Figs. 1, 2, and 3, flattened or cut away on one side, and assuming the flattened or cut-away sides of all the disks to be outward, as in Fig. 3, I mount a rotary cylinder, D, along opposite to such disks, and so that its periphery shall be in close proximity to the cut-away sides of the disks. This cylinder is preferably made hollow and of sheet metal, and is mounted on a shaft, D′, which rests on suitable bearings, D^2. Then in this cylinder I make a series of slots, c' to c^6, each of such size that, when in the rotation of the cylinder D, a slot comes opposite to and level with its corresponding disk, such disk may then be rotated with its full side into the slot, and thereby lock the cylinder as against any further motion on its axis; but ordinarily no two slots are made in line with each other. Hence a full or unslotted part of the cylinder will, in the case supposed, be opposite to each of the other disks, and the cylinder being locked, as already stated, all other disks will be locked, as a result of which all other cocks will be locked and the signals corresponding thereto will be locked. Or, to illustrate further, assume all signals to be at "danger" and that the cock of Fig. 3 operates the signal or signals for "line clear" or "go ahead" on any predetermined line of track. The cylinder D is then to be turned until the slot c', appropriate for the disk on that cock-stem, shall be opposite such disk. The slots c^2 to c^6 appropriate to all other disks are then away from a position opposite their respective disks, and the full face of the cylinder, coming opposite the flattened or cut-away sides of such other disks, locks them as against a rotary movement, and the corresponding signals are locked at "danger;" but the disk *c* of Fig. 3 is then unlocked, so that its full side may be turned into the slot c', and thereby lock the cylinder, and the same motion which does this opens the cock below, so as to let on fluid-pressure and put the corresponding signal at "safety." Reversing this motion unlocks the cylinder D, puts the signal or signals back to "danger," after which the cylinder can be again rotated so as to bring some other slot in the series—say c^2, Figs. 3 to 5—opposite to its disk, in which case the latter is unlocked and all the rest are locked.

As a means of rotatating the cylinder D, I have shown in Fig. 1 a crank, *d*, shaft *d′*, and bevel-gearing d^2, though other suitable means may be employed; also, each cock may be numbered, and a corresponding number be arranged on a dial-plate, D^3, so that by the use of a pointer, d^3, fixed on the shaft *d′*, the operator may be guided in rotating the cylinder. Thus, for example, these parts may be so combined that when the pointer comes to No. 1 it indicates that the proper slot, c', in the cylinder is opposite to the disk *c* of cock and signal No. 1, and so on for other numbers. The relative arrangement or spacing of the slots c' to c^6 is more particularly illustrated in Fig. 5, those which are shown by dotted lines being on the back side of the cylinder; also, in Fig. 3 I have illustrated the spacing by showing them in dotted lines; but for some purpose it may be desirable to have two disks unlocked at the same time. In such case the two slots corresponding thereto may be made in line with each other, so that both shall at the same time come each opposite its respective disk; but the operation of locking the other disks will still remain the same. The arrangement of such an apparatus, together with an electrical locking and unlocking mechanism, is more particularly shown in Fig. 6, where A represents a cabin in convenient proximity to a double-track crossing. As shown in this figure, the cylinder D and appliances belonging thereto are represented as organized for such a system of tracks, only four cocks, disks, slots, &c., here being necessary. This figure also shows in this organization the connections of the electrical features of the apparatus, as presently to be described.

The tracks are indicated at R to R^3, and the intended direction of regular trains thereon is indicated by arrows. Each track on the side of the crossing from which a train approaches has an insulated electrically-connected section, *r r′*, with its opposite rails connected to the opposite poles of a battery, r^2, at or near the outer end, and by wires 1 to 8 with a series of electro-magnets, e^2, in the cabin A. Home signals *s* to s^4 are put up at a suitable distance from the crossing on each track, and also distant signals s^5 to s^8. These signals are intended to be operated by fluid-pressure, and in the present case by hydraulic power. One convenient construction is shown in Fig. 7, where s^9 is the fluid-pressure cylinder, s^{10} the piston-rod, and s^{11} the semaphore-arm.

As shown in Fig. 6, the signals s^3 and s^7 on track-circuit No. 2 are represented as down and indicate safety. All the other signals are shown as "up," or in danger position; but other form or construction of signal may be employed, the one shown being simply adopted for convenience in illustration. Any suitable arrangement or construction of fluid-pressure pipes a' to a^4 may lead from the apparatus in the cabin A to the several signal-cylinders, such as will convey the pressure employed to the signal-cylinders and permit its reflow as the valves are set for one operation or the other.

The several rail-circuits I have marked respectively No. 1, No. 2, No. 3, and No. 4, and for convenience in further description will so designate them hereinafter.

The electrical part of my invention relates

to the combination, with the rotary cock stems or shafts, such as described, of closed track-circuits, such as described, so that such track-circuits being short-circuited by the approaching train electrical change will take place to cause the locking of the signal or signals by which the movement of that train is governed; or the apparatus may be organized to lock any desired one of a series of signals. To this end (referring again to Figs. 1 to 3) I affix on each cock-shaft *n* a disk, *z*, and notch the same, as at *z'*, Fig. 2, in such position that when the corresponding cock is set, say, for the passage of a train such notch will come opposite to the swinging end of an armature-lever *e*, Fig. 3. The armature *e'* of each lever is actuated by an electro-magnet, e^2, and the coils of such electro-magnets are included in the track-circuits of the rail-sections *r r'*, Fig. 6, through the wires 1 2, &c. Then it will be seen that so long a each such circuit is unbroken and no train or car is on such track-section the corresponding armature-lever, *e*, is held clear of the disk *z;* but when the disk *c* corresponding to any signal or line of signals is rotated so as to lock the cylinder D and give "line clear" to an approaching train, and the disk *z* is thereby rotated till its notch *z'* comes opposite the corresponding armature-lever, *e*, such approaching train, as soon as it enters on the track-section so cleared, will short-circuit the electric current thereof, so as to cut out the electro-magnet from the influence of its battery, and the armature-lever *e* will then enter the notch *z'* and all the signals will be locked and remain locked until the train has entirely left that track-section. Each track-section has, as illustrated in Fig. 6, its own electro-magnet, armature-lever, and electric-locking disk. It will then be impossible for the operator to reverse a signal after a train has entered a track-circuit.

It will be observed that the plate B' has a projection, *b'*, Figs. 2 and 3, at each armature, which is slotted, as at *q*, Fig. 3, for the projecting end of the armature-lever, and also that the downwardly-bent end b^2, Fig. 3, affords a bearing or support for the usual regulating-screw. Retractile springs b^3 are also to be added.

Returning, now, to Fig. 6, assume that a train is approaching on track wherein is the rail-circuit No. 2. Normally all signals are at "danger," all circuits are closed, so as to keep the disks *z* electrically unlocked, and all the disks *c* are clear of the cylinder-slots. The operator then turns the cylinder D till slot *c'*, Fig. 5, comes opposite the corresponding disk, *c*, and then the latter is unlocked and all other disks are locked. He then turns the shaft *n* of such unlocked disk, so as to turn the disk *c* into its slot *c'*, and so lock all the other connections and secure their signals at "danger;" and in so doing he turns the cock P^3, so as to let fluid-pressure on by the line a^2, Fig. 6, and set the signals s^3 and s^7 at "safety." The train then approaches, and as soon as the first pair of wheels and axle pass the outer insulated point of track-circuit No. 2 it short-circuits the same, so that the corresponding armature-lever, being freed from electrical action, shall enter the notch *z'* of the corresponding disk *z*, and thereby the signals s^3 and s^7 will be locked at "safety," and will remain so until the train shall have entirely left track-circuit No. 2. From this explanation it will be readily understood how to clear any of the other tracks and lock the signals in proper position.

In the arrangement of the apparatus for the uses contemplated in Fig. 6 slots *c'* and c^3 may be in line with each other, or in the same plane and on the same side of the cylinder, and the third and fourth may in like manner be in line with each other, but out of line with the first and second, and this results from the fact that trains may be run over both R and R' at the same time, the signals on R^2 R^3 being set at "danger," or vice versa.

As regards the disks *z*, it should also be noted that each disk is provided with two stop-pins, z^2 z^3, Fig. 2, suitably arranged to provide for the proper movement of its corresponding locking-disk, *c*, or, in other words, so that when the disk *c* is rotated out of its slot one pin—say z^2—will come against the edge of the bar or plate B', and when rotated into the slot and the notch *z'* is brought opposite its armature-lever the other pin, z^3, will engage the edge of the plate B'. In this way, or by other suitable means, I provide for giving to each stem or shaft *n* the proper motion, and no more; but the apparatus may, if desired, be so organized that the electric locking, instead of being applied to the disk *z*, which governs the movement of the train, may be applied to any other disk, so as to lock the signal corresponding thereto at "danger," but leave the disk the signal of which governs the movement of the train free to be turned at pleasure, so as to stop the train when necessary. To illustrate this I have specially marked one of the *z* disks in Fig. 2 with the letter z^{10}, and the notch *z'* in this disk is to be so arranged that it will come opposite to its armature-lever when the corresponding signals on track R^2, Fig. 6, are at "danger." If, now, the corresponding electro-magnet be electrically connected with rail-circuit No. 2, the train, when it enters on such circuit, will demagnetize such electro-magnet and lock the signals s^4 and s^8 at "danger" independently of any locking action of any disk *c*. Other changes or arrangements of circuits may be made at pleasure with reference to electrically locking, through armature-levers and disks, as described, any one or more of the fluid-pressure cocks P^3, as the work to be done may render desirable; but instead of providing a separate electro-magnet, armature, and locking-disk for each signal or set of signals, or for each operating-cock, as thus explained, the same result of locking the signals when properly set may be performed on a single-track crossing by the use of a single electro-magnet, as illustrated in Fig. 8. Here R and R^2 represent two crossing tracks, and the apparatus is organized so that a train approaching or

standing on either track or across or near to the crossing will demagnetize the electro-magnet the armature-lever of which makes the lock. To this end I arrange the insulated track-sections Nos. 1, 2, 3, and 4 with their inner ends so near to the crossing that the rear truck of a car of ordinary length cannot leave one until its forward truck has run onto another. The adjacent rails of track-circuits Nos. 1 and 2 are connected electrically by wire 9, Nos. 2 and 3 by wire 10, Nos. 3 and 4 by wire 11, and Nos. 4 and 1 by wire 12; also, wires 9 and 11 are connected together electrically by wire 13, and wires 10 and 12 by wire 14. In this organization and use of the apparatus wires 1 to 8 may run to distant circuits or signals for special uses, or they may, with the electro-magnets e^2, disks z, and other connected electrical appliances, be dispensed with. The pipes a' to a^4 may lead to home and distant signals, as illustrated in Fig. 6.

In the apparatus of Fig. 8 I make use of a single electro-magnet, m, which, in its relationship to the cylinder D, is shown in Figs. 1 and 2. It is arranged opposite the end of the cylinder, and so that its armature-lever m' may, when its circuit is closed or unbroken, stand clear of a disk, m^2, arranged on the shaft d', through the agency of which the cylinder D is rotated, as already described, and also so that when the circuit of electro-magnet m is short-circuited by an incoming train, or by a train standing on the crossing, the armature-lever m', acted on by a spring, o, will enter a notch, o', made in the periphery of the disk m^2, said notch being indicated by dotted lines in Fig. 2. The electro-magnet m is to be electrically connected with any of the track-circuits—say No. 2, Fig. 8—by wires 15 and 16. Assuming, now, all signals to be at "danger," electrical action will take place from battery r^2, Fig. 8, through rails v, wires 11 13 9, rails v', wire 16, electro-magnet m, wire 15, rails v^2, wires 10 14 12, and rails v^3, back to battery r^2. The armature-lever m' will now stand clear of the disk m^2, and the cylinder D will be unlocked. The operator, by turning the handle d, can bring any one of the cylinder-slots—say slot c', Fig. 5—opposite its disk c, and then by turning this disk into its slot he will open the proper cock P^3 to set the proper signals at "safety"—say on line R. This movement of the handle d will bring the notch o' of the disk into position opposite the armature-lever m'. Then as soon as the incoming train enters on track-circuit No. 3, or while any part of it remains on No. 3, the electro-magnet m will be cut out from battery-influence, and its armature-lever m' will enter the notch o', and so lock the disk m^2, and thereby lock the cylinder D, and all cocks P^3, and all signals. Electrical action will then be from battery r^2 through rails v, wire 11, rails v^4, wheels and axle to v^5, thence by wires 10, 14, and 12 to rails v^3, and to the battery. If a truck be standing on track-circuit No. 1, the electro-magnet m will be cut out, as before, and electrical action will be from r^2 by v^3, 12, v^7, wheels and axle v^6, 9, 13, 11, and v to battery. The same will be true as regards the other two track-circuits, except that if a truck be on No. 2 electrical action from r^2 will be by v^3, 12, 14, 10, v^2, wheels and axle v', 9, 13, 11, and v to battery; but if on No. 4, then by v^3, wheels and axle and v, to battery. In any case all signals will be locked so long as a train or any part thereof remains on or near the crossing, and the apparatus will be so locked that no collision can occur, unless it be by a following train.

The cylinder D may be made in sections, or of a series of notched or recessed rings arranged on a common shaft, and such construction is included herein as the mechanical equivalent of the cylinder D in the combinations set forth, but as a separate construction it will form the subject-matter of a separate application.

I claim herein as my invention—

1. In an interlocking railway signaling apparatus, a rotary cylinder having in its periphery a series of two or more slots or recesses arranged out of line with each other, both circumferentially and longitudinally, in combination with a corresponding number of rotary disks adapted to be rotated into and out of the cylinder-slots, substantially as set forth.

2. The combination of slotted cylinder D, two or more locking-disks, c, and two or more fluid-pressure cocks, P^3, substantially as set forth.

3. In combination with slotted cylinder, locking-disks, and fluid-pressure cocks, a fluid-pressure-supply pipe, P, a waste-pipe, P', and a series of two or more transmitting-pipes leading to the signals to be actuated, substantially as set forth.

4. In combination with a slotted rotating cylinder, two or more locking-disks, c, and cocks P^3, a notched disk, z, on the shaft of one or more of the disks c, and an armature-lever and electro-magnet for each disk z, the same being included in a train-actuated electric circuit, substantially as set forth.

5. A system of apparatus for railway-crossing signals, having, in combination, a slotted rotary cylinder, a series of two or more rotary disks to enter or clear the slots of the same, fluid-pressure cocks with pipe-connections to actuate the signals, and one or more electro-magnets, the circuit-wires of which are connected with an insulated track section or sections, substantially as set forth, whereby the short-circuiting of a track-section shall drop an armature-lever and lock the cylinder.

In testimony whereof I have hereunto set my hand.

OSCAR GASSETT.

Witnesses:
GEORGE H. CHRISTY,
R. H. WHITTLESEY.