REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS ON AINSWORTH'S AUTOMATIC SAFETY-SWITCH FOR RAILROADS.

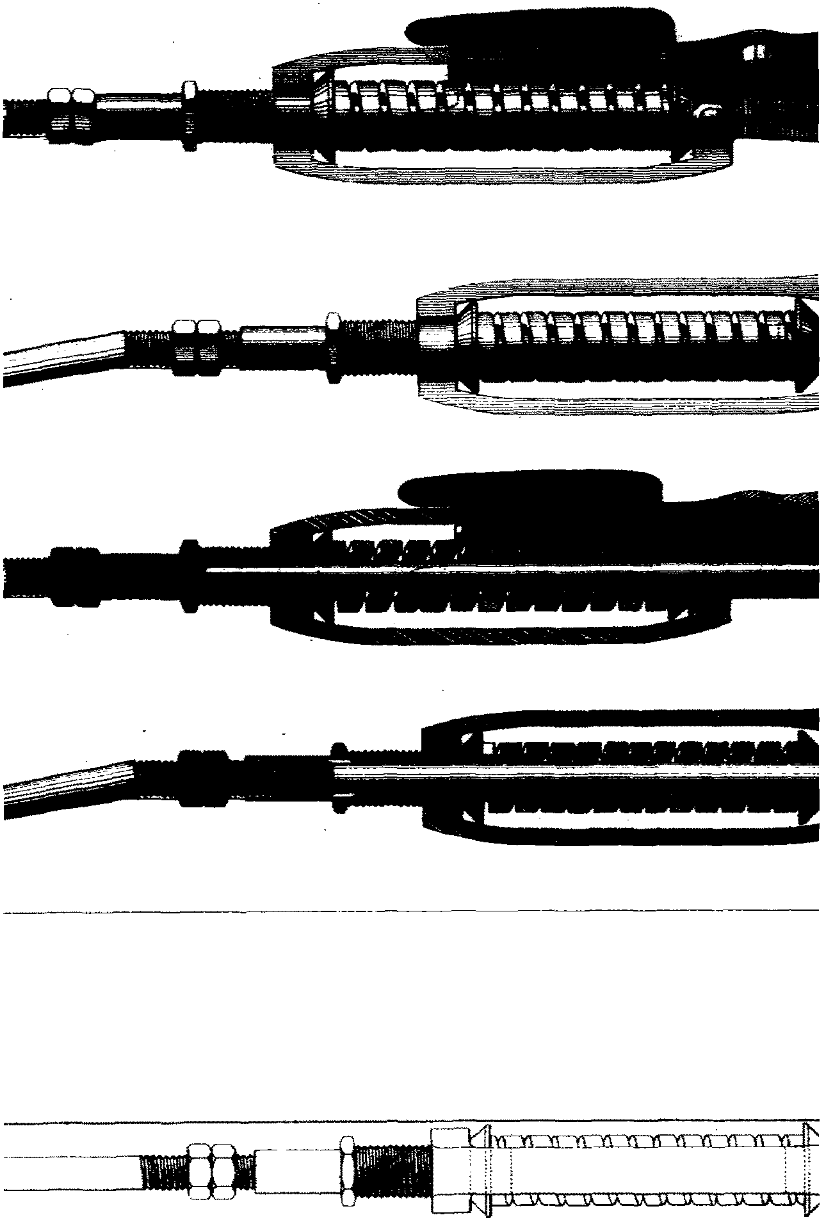
HALL OF THE FRANKLIN INSTITUTE,
PHILADELPHIA, Nov. 29th, 1878.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, to whom was referred for examination Ainsworth's Automatic Safety-switch for Railroads, report that they have carefully examined the switch itself and the inventor's plans, specifications and model, and find that this switch belongs, generally speaking, to the same class as the Lorenz or English switch, but differs from all other switches known to your committee in several important respects. The invention may be divided, for the purposes of this report, into two separate parts: the switch proper and the switch stand, or mechanism for moving the switch. Referring to the accompanying cut (No. 1), it will be seen that in this switch the outer rail of the main line, *A A* (the rail farthest from the siding), is unbroken or continuous; while the inner rail of the main line, A^2B^1, is bent slightly at d, resumes its former course at d^1, and continues to d^2, the amount of the deflection, $d\ d^1$, being equal to the width of the head of the rail. At d^2 the rail bends again, and from thence continues in a long curve, forming the inner rail of the siding. These rails ($A\ A^1$ and $A^2\ B^1$) are fixed and continuous; but between them are two pointed rails ($C\ B$ and $A^3\ E^1$), joined rigidly together by proper rods, so that when one point is against the nearest rail the other point will stand off from its rail a distance of four (4″) inches. These moveable rails or points are so placed that E^1 is considerably in advance of C, and both are shaped to fit against the fixed rails at one extremity, and are secured at their other ends by fish plates, so that a movement of these rails in one direction or the other will cause an approaching train to continue on the main line or be shunted into the siding.

In addition to the principal parts already enumerated, there is also furnished a guard rail, $C^1\ D$. It will be seen that the switch rail, $E\ E^1$, has its point advanced such a distance before the point of the other switch rail ($C\ c$), that it will catch the flange of an approaching wheel and determine its direction before the other wheel on the same axle has reached the other point; and, moreover, as this projecting rail is comparatively blunt, and has its base but little diminished in breadth, it presents a good bearing for trains passing on the main line, and as its inside edge coincides with the inside edge of the main line, and its height is the same, trains pass the switch without jar. When the switch is set for the siding, the advanced point of $E\ E^1$ catches the flange of the approaching wheel, and, acting as a guard rail, forces it into the siding, but, at the same time, prevents the opposite wheel from striking the other point, and thus relieves that point of all work at its extreme end; while, in the case of trains leaving the siding, the guard rail, $C^1 D$, catches the flange, and, guiding the wheels, prevents the flange from striking the offset, $d\ d^1$, in the rail, $A^2\ B^1$, which might otherwise suffer from the work that would be put upon it. The rail $E\ E^1$ is rolled $\frac{1}{4}''$ less in height than the other rails of the switch, and its flange is curved by the smith to fit on the upper surface of the flange or base of the fixed rail $A^2\ B^1$, so that, without diminishing materially the width of the base of $E\ E^1$ the two rails are brought together, and the base of $E\ E^1$, riding up on that of $A^2\ B^1$, distributes the weight of the train partly over the base of the fixed rail ($A^2 B^1$) and partly over the iron plates upon which the moving rail $E\ E^1$ slides. In order that the point $E^1\ H$ may retain its position with reference to the offset in $A^2 B^1$, regardless of changes of temperature, these two rails are bolted at one end to the same iron casting (a), and are thus compelled to expand and contract together.

The switch-stand (shown in cut No. 2) contains a cranked shaft operated by a weighted lever and joined by a suitable connecting rod with the moveable switch points. A movement, therefore, of the weighted lever through a semicircular arc serves to open or shut the switch, and the connecting rod contains an adjustable spring which will permit a train leaving the siding to spring the rails over sufficiently to pass, and yet has tension enough to draw the points back into position to leave the main line clear. In these respects it is similar to the Lorenz switch-stand; but, furthermore, it is so arranged that when it is set for the siding, and a train passes on the main line in the direction towards which the points open, the wheels will not simply force the switch shut by compressing the spring, but will cause a friction roller on the extremity of the switch or connecting rod to move up an inclined plane, bringing a second friction roller under the crank, and thus lifting it over the centre. The counterweight on the lever, by its weight and momentum, completes the movement with some force, and thus, by

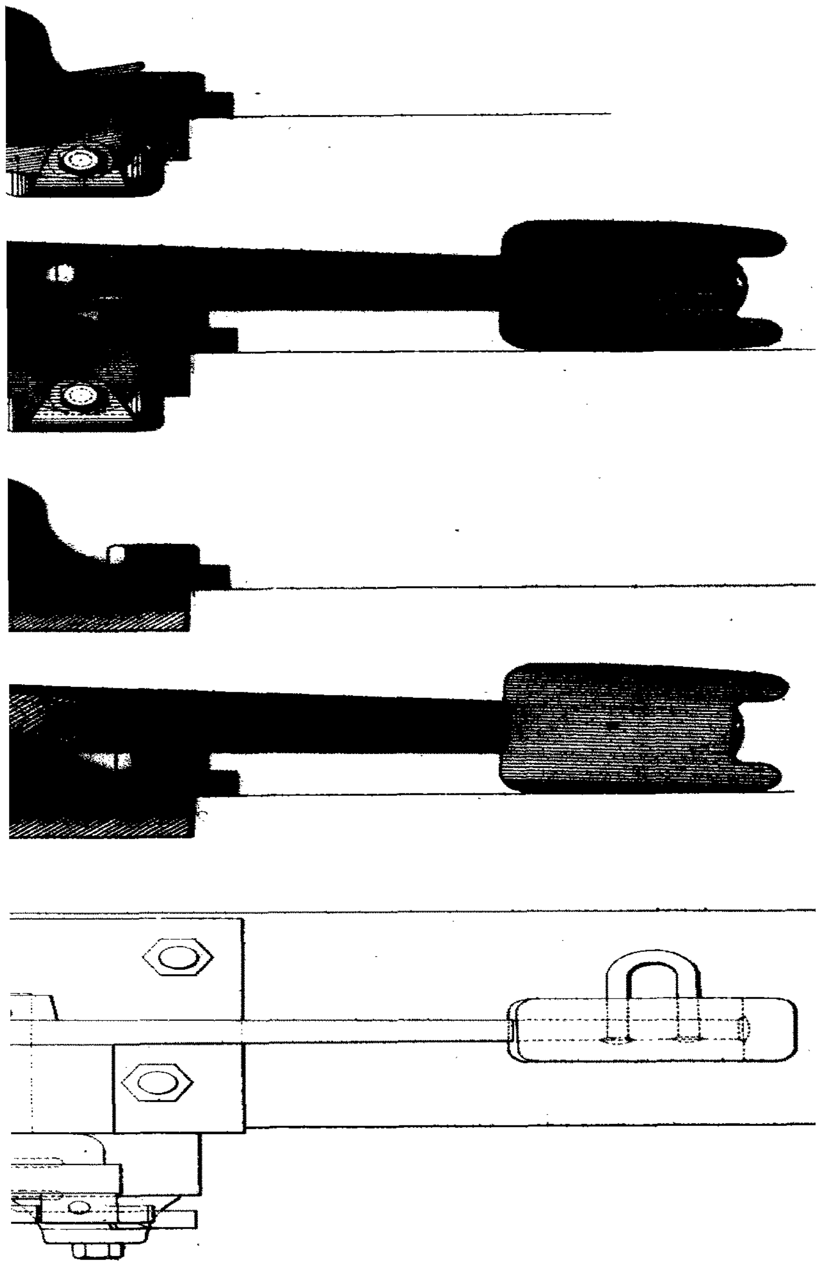
AINSWORTH'S AUTOMATIC SAFETY



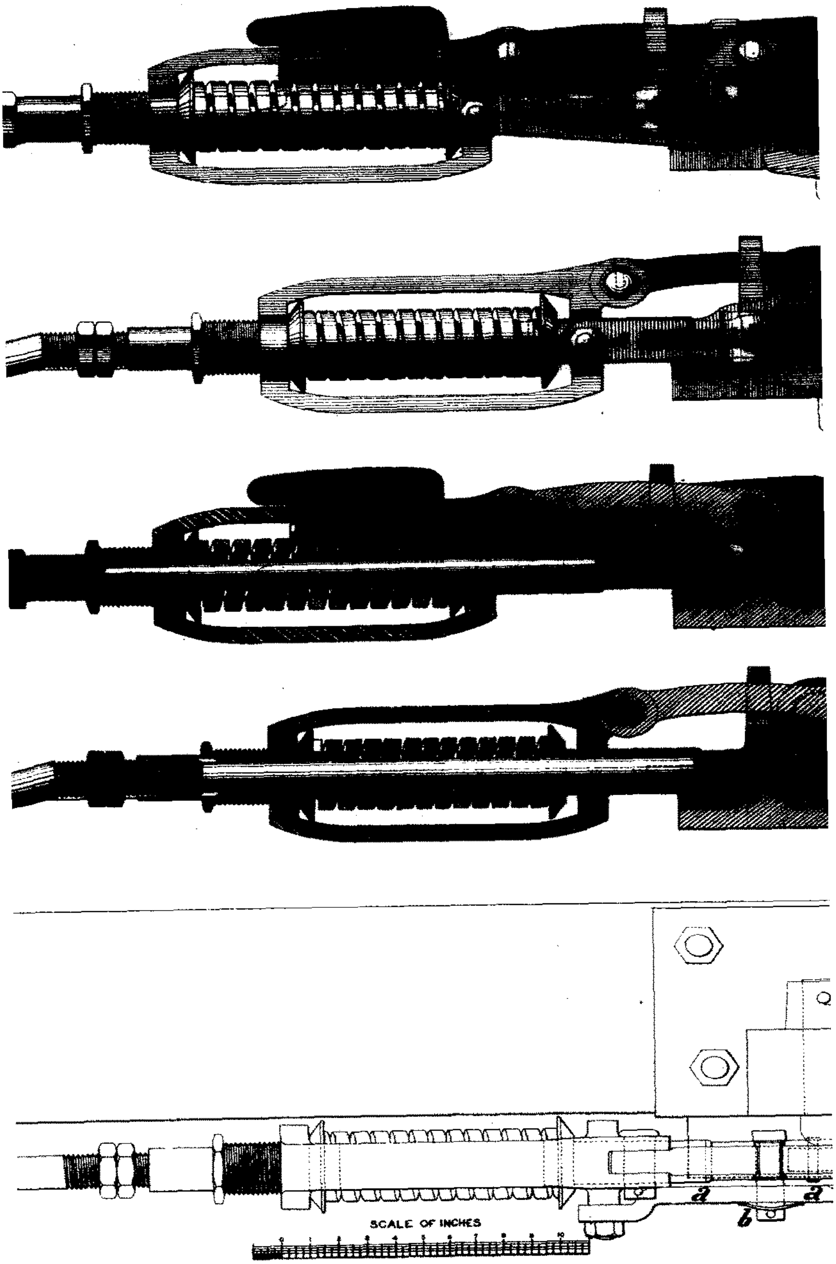
SCALE OF INCHES

D. A. PARTRIDGE, PHOTO-LITH 21 S SEVENTH ST., PHILA

SHEET 2



AINSWORTH'S AUTOMATIC SAFETY SWITCH.



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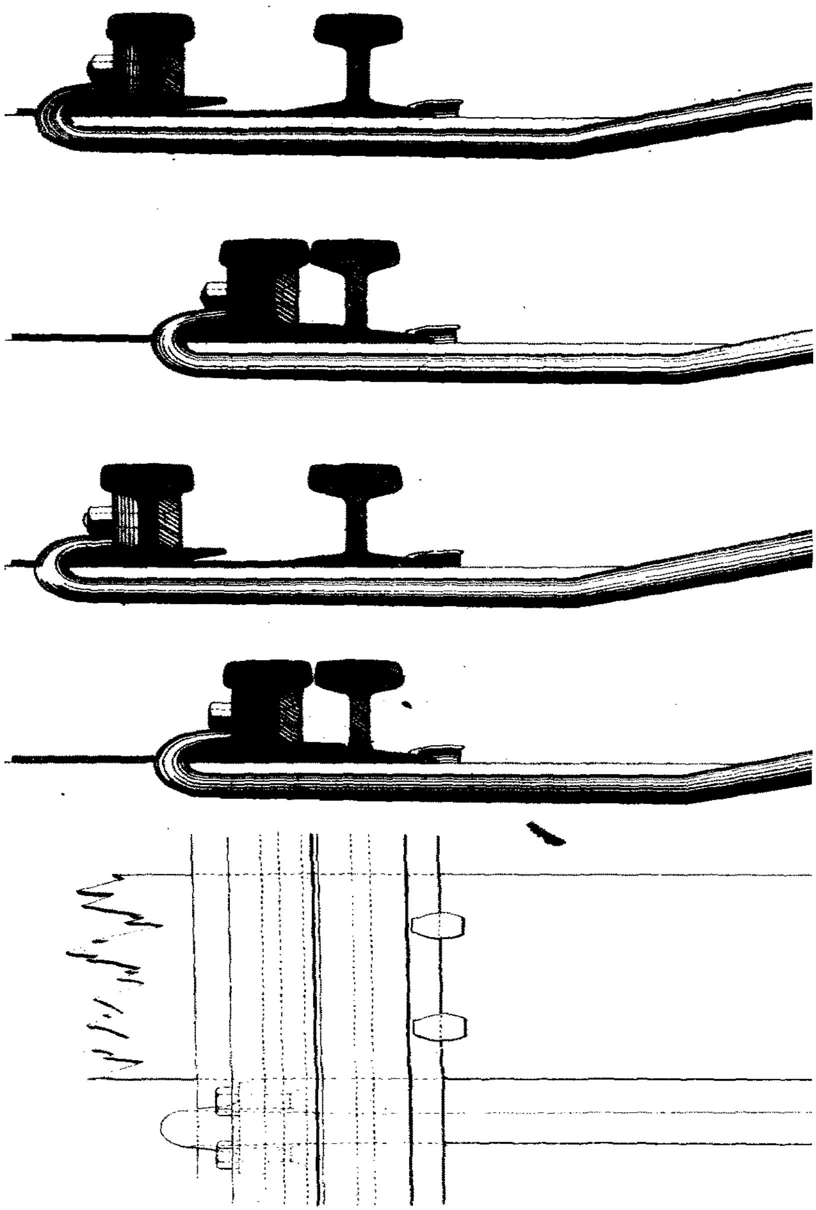

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a positive motion, the first pair of wheels of a train on the main line moving in the proper direction of travel, closes the switch, that is, sets it for the main line.

This switch has also another essential peculiarity. In other similar stands the elasticity of the connections remains constant, and is sufficient to enable the switch-tender to throw the lever into place although the switch-points may be held from the rail by accumulations of snow or ice, or by stones from the ballasting, and the switch may thus be left in a most dangerous condition; but Ainsworth's switch is so made that during the act of closing or opening it, and until the points are moved quite into place, the connections between the stand and the points become, for the time being, rigid, or non-elastic, and it is impossible to shove down the ball on the switch-lever until the points are entirely home; and the throw of the crank is great enough to permit the switch to be moved before the end of the arc is reached. This important result is accomplished (as shown in cut No. 2 herewith) by means of a slotted plate (*a*) in which works a pin (*b*) attached to the end of the switch-rod: During the act of shifting the switch, this pin remains against a shoulder in the slot, and any change of length in the switch-rod is prevented; but, at the conclusion of the movement, the plate is moved by a positive motion into such a position that the pin may move along one of the slots to permit the points of the switch to be sprung over. It is thus rendered impossible for the switch-tender to leave the switch half open, if he puts the ball down and locks it in place, for, in order to do this, it is necessary that the switch be either open or shut.

In examining and testing this switch, your committee have had in view the fact that there are, generally speaking, four different conditions under which a "safety-switch" is tried in practice, and which it must fulfill in order to establish its claim of "safety." These conditions may be stated thus:—When the switch is set for the main track, it is essential, first, that it be safe for trains passing in either direction on that track, and, secondly, that trains must also be able to pass in safety from the siding to the main line. When the switch is set for the siding, trains must be able, thirdly, to pass into or out of the siding, and, fourthly, to pass along the main line in the direction towards which the switch opens. Your committee were enabled to test the Ainsworth Automatic Safety-switch in all of these particulars, and in every case found it to give most excellent results. In the first case just stated, trains must pass in either direction with perfect safety, for one rail remains entirely unbroken, and the flange of the wheel is compelled to follow it by the guard-rail, and by the outer switch-rail acting as a guard-rail to prevent wear on the points; and the inside-track rail also offers a practically continuous and sufficient bearing for the tread of the wheels. In the second case, the spring in the "switch" or "connecting" rod, acting as in the Lorenz and English switches, permits the outgoing train to move the points sufficiently to pass, and, after the passage of the train, the spring restores the points to their proper positions. This the committee tested repeatedly, by running trains through the switch at high and slow speeds, and with perfectly satisfactory results.

Under the the third head, that is, with switch set for siding, trains are permitted to pass safely in either direction. When they *enter* the siding, the advancing flange on the switch side of the track enters the four-inch aperture between the point and the rail; is diverted by the projecting point, and, before the opposite wheel has reached the other point, the inside wheels will have obtained a good bearing on the bent or continuous switch-rail, and the open main-track rail acts as a guard to prevent wear on the point of the open switch-rail; while, in case of trains leaving the siding, the flange is caught by the guard-rail, and the wheel is diverted on to the main-line unbroken rail before the opposite flange has reached the bend in the continuous switch-rail. And, fourthly, trains passing against the points will, of course, enter the switch, while trains passing with the points, or in the proper direction of travel, will continue on their course, and continue without interruption or jar; but the first pair of wheels to enter the switch will close it, and the train will leave it set for the main line by the mechanism previously described.

As this is a feature possessed by no other switch known to your committee, especial pains were taken to note its action under repeated experiments, and the committee are satisfied that it is certain in its operation and fully sustained the inventor's claims. But, besides the foregoing legitimate cases, we must consider the possibility of maliciously or accidentally setting the switch wrong. As we have seen, it is impossible that the switch be left in a dangerous position if the lever be put in either of its extreme positions; but, suppose the lever not pushed to place, but standing upright or blocked in some intermediate place, will it cause a train to leave the track? To try the effect of this, the switch-lever was raised to about a central position, and the train was run at the points. Under these circumstances it was found that the wheels would invariably take one side or the other of the point, and turn into the siding or continue on main track. If the flange of the wheel be as sharp as usual, it follows that the wheel must take one side or the other of the point; but if the flange be sufficiently broad, it is possible that it might strike the point so directly that the wheel might ride up on the point; but, even if it should, no harm could result, because the opposite flange would be guided by the guard-rail and the other point. The working parts of the stand are protected from the weather or from mischievous interference by a stout wooden cover, and, as we have already seen, it is impossible for the switch-tender to set the switch-lever "home" in either position unless the points are also in their proper positions. In all of these respects the switch worked admirably, and there does not appear reason why it should not be at least as durable as any other safety-switch in the market. It is sufficiently simple in its construction, and may be manufactured quite as cheaply as other switches of its class, especially as it requires but little machine-shop work or fitting to construct it. Its most complex part (the stand) consists chiefly of steel castings, which may be put together with scarcely any finishing. In conclusion, your committee have to report that they find that the Ainsworth switch sustains fully the claims made for it; that it performs its work surely and satisfactorily, and seems to possess reasonable durability; and they welcome it as a successful effort to diminish the danger of what has proved the most prolific source of railway accidents.

O. B. Colton.
Thos. Shaw.
Wm. D. Marks.
Coleman Sellers, Jr.,
Chairman.

Approved by the Committee on Science and the Arts, March 5, 1879.

Henry Cartwright,
Chairman pro tem.

Air-tight Corks.—Plunge the corks in melted paraffine and keep them there for about five minutes. Corks thus prepared can be easily cut and bored, and easily inserted or withdrawn from the bottles. They are both air-tight and water-tight.—*Der Techniker.* C.