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GRAND CENTRAL DEPOT SIGNAL SYSTEM.

Three great railroads have their termini in the Grand Central Depot, located on 42d street, in New York city. An illustration and description of this immense structure have already appeared in these columns. With the exception of the interval between 1:10 and 3:40 in the morning, and of fifty minutes at noon, no period of fifteen minutes elapses in which some train does not depart or arrive *via* the Harlem, the Hudson River, or the New York, Hartford and New Haven road. One hundred and eighteen regular, and from ten to fifteen extra, trains daily pass, in one direction or the other over the tracks on the underground road between 53d street and Harlem bridge, a distance of nearly four and a half miles. Barely two minutes sometimes intervenes between the departure of one train and the incoming of another, and three trains often start at intervals of five minutes apart.

It is obvious that, in order to prevent confusion and accident, the movements of each and every one of these trains, while traveling between the points named, must be governed with absolute certainty. Add to this that crowd after crowd of passengers must be admitted from the reception room to the outgoing cars at exactly the proper time, and the checking of their baggage must be stopped in time to insure its despatch by the proper trains; and the reader will have formed some faint idea of the perfect system which must exist for the management of the machinery of the great depot and its approaches. To indicate the salient points of this system is the object of the present article; and in the accompanying illustrations are represented such devices pertaining thereto as are interesting, both in respect to ingenuity of design and mechanical novelty.

The system as a whole may be divided into three really distinct though closely interwoven parts: first, the means whereby trains are received and despatched, and also the internal operations of the depot controlled; second, the electro-magnetic way signals; and third, the novel interlocking apparatus for switches and crossings. For the sake of clearness, we shall begin with the first, mentioning merely results, and leaving the explanation of the same to consideration in connection with the other two topics.

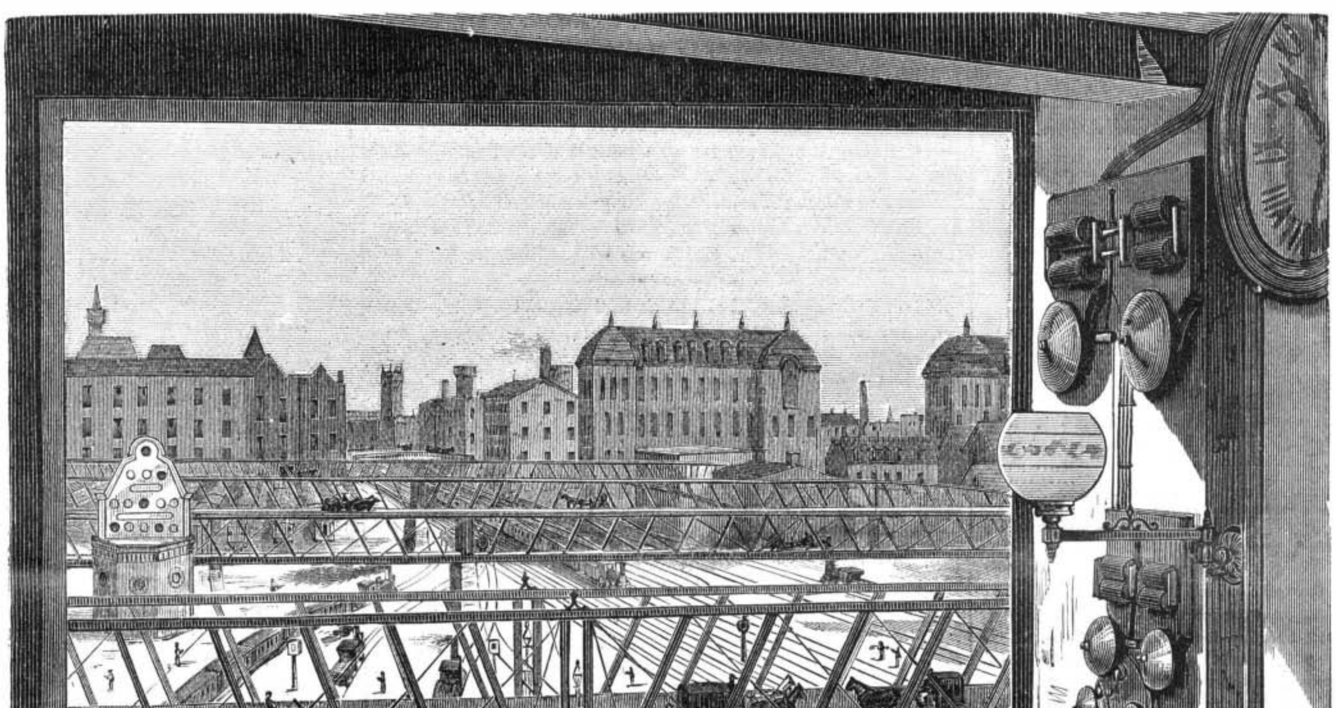
Located far up on the north wall of the depot, the view from its broad window extending over the intricate network of rails into which the various tracks diverge, is a small cabin, the interior appearance of which the reader has before him in the largest of the engravings herewith given, Fig. 1. On the wall hang signal indicators and bells, time tables, and a huge clock. On the table before the single occupant are a telegraph instrument, a record book, and three rows of ivory buttons, twenty in all. This is the despatcher's office, and here, by pressing the buttons or manipulating the telegraph key, he controls the movement of every train going or coming, the buttons, through simple electric bells, governing everything near and about the depot, the key transmitting instructions to far-off points. By way of illustration, we suppose that one train is to start at 4:30, and that another will arrive at 4:31 o'clock. It is now just 4:10, the passengers are congregated in the waiting room, the cars are in place; and the engine, with steam up, is standing outside, not yet attached. The despatcher touches a button, the sound of a bell is heard, the heavy doors of the waiting room fly open, and the passengers crowd upon the cars. Fifteen minutes elapse: the operator presses another button, a gong strikes in the baggage room, and the checking is stopped. Belated individuals who wish to depart by that train must go *minus* their baggage. Now the operator watches the clock closely; three minutes pass, and then a sharp peal rings out from a bell close beside him. The minute hand points to 4:28, and the incoming train has reached 64th street and is signaling its own approach. The sound continues for half a minute, then stops; the train is at 55th street, and the finger of the despatcher at once presses another button. If we were on the arriving locomotive, we should see a green disk before us, or at night the flash of a green light, meaning that everything is ready for the flying switch just outside the depot, by which the engine is to clear itself from the train, the cars entering the depot by their own momentum. Now it is 4:29; down goes another button; a bell on a post beside the locomotive waiting outside rings for the engineer to back in and couple on. Hardly ten seconds elapse before a sharp "ting" calls the operator's attention to the fact that the pointer arm of the indicator on the wall has swung over from "clear" to "block." The arriving train is on the 53d street crossing. The clock says 4:30; again a button is pressed, the doors of the waiting room are slammed shut, there is a few seconds' delay for the tardy ones on the platforms to board the cars, and then the train moves slowly out of the depot. The indicator pointer still shows "block," and if the outgoing train continues its course a disastrous meeting on the crossing may result. The despatcher remains passive, however, for he knows that the signal between that train and the crossing is normally at "danger," and that the engineer will certainly come to a stop, and wait until the red disk is turned. The delay is but for a second, for the indicator bell almost instantly sounds again, the arm swings over to "clear," and the proper button is immediately touched. A distant cloud of steam can be seen for a moment, and the outgoing train is off again. Pressing another button, the operator restores the danger signal. The arriving train now rushes in, its passengers disembark, and at the sound of the bell from the despatcher, a locomotive kept for the purpose, couples on and drags the empty cars out of the depot.

We have accounted for twenty-one minutes, during which one train has left and one arrived; the reader may imagine the celerity and certainty of the work when we add that, within the fifteen minutes which we recently spent in the despatcher's cabin, three trains on three different roads were started and three received, all at different times and without the slightest confusion.

The electric bells about the depot being of simple and well known construction, and sounded by the establishing of the current when the buttons are pressed, need no elucidation; and therefore the points remaining which require explanation are those relative to the movement of the flying switch and danger signals by the despatcher, and also as regards the indicator which announced the passage of the train over the crossing. This brings us to the second branch of our subject.

The electro-magnetic way signals and their operations are represented in Fig. 3. The signal is a disk made of metal, painted red, and inclosing a circle of red glass. This is supported on a shaft, shown upright (it may be horizontal, or in fact in any position), which, by the gearing and weight shown at A, is rotated through the unwinding of the cord wound about the barrel of the larger gear wheel. The disk may be turned to present its full face or only its edge in any direction, in one case showing its full color and signaling "danger," in the other being almost invisible and allowing the aperture of the frame or box in which it is placed to appear empty, meaning the reverse, or "clear road." It is obvious that, in order to govern the disk so that it must always appear in one of the two positions—that is, full face or on edge—mechanism is required which will allow it to be rotated by the weight exactly one quarter revolution at a time, and no more nor less. This apparatus is found in the simple electro-magnetic device shown. Just below the disk, and rigidly secured to the shaft, are four arms having downward end projections, B. Also fixed on the shaft and further down is a cam, carrying beneath it two short vertical pins. The latter, as the shaft revolves, strike certain leaf springs, which will be seen on the circular stage, C, which is located just above the frame which carries the electro-magnet, D. The armature, E, of the magnet is hinged at one side, and so placed that, when not attracted by the magnet, and consequently held outward by a suitable spring, the projections, B, strike against it as shown in the engraving, so holding the disk stationary. The construction is such, however, that when the circuit is closed by any means, through one of the springs on the circular stage, C, and the pin on the cam of the disk shaft, then the magnet will become active, the armature be drawn in, and the projection freed, when of course the action of the weight will revolve the disk. But as the latter revolves, the pin on the cam will pass clear of the spring on the stage; the current will then be broken, and the armature will fly back in time to intercept the next projection, B, preventing further movement of the disk, which

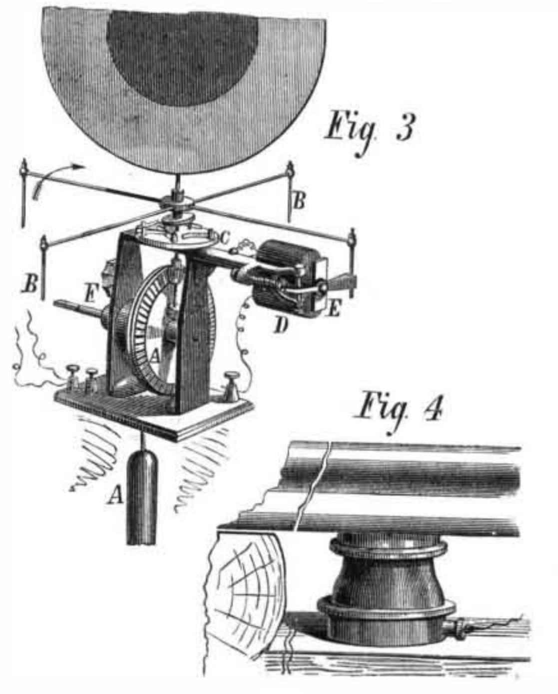
(*Continued on page* 402.)



GRAND CENTRAL DEPOT.—TRAIN DESPATCHER'S OFFICE.

(*Continued from first page.*)

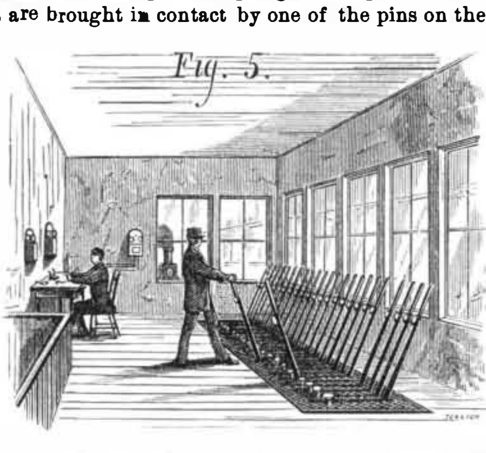
will thus have completed exactly one quarter revolution, changing for a given location from an edge view to full face, or *vice versâ*. The reader has doubtless ere this divined that the despatcher, in raising a danger signal to release the outgoing train, or in setting the flying switch signal, simply pressed a button which established an electric current, and thus charged the disks as was necessary. From the foregoing also it will be obvious how this signal is worked on the block plan from two different points. As soon, for example, as a train passes a given location, an operator there



posted, by the means described, sets the danger signal. When the train reaches another point a safe distance away, it may itself, by pressing on a simple and delicate circuit closer, arranged, as shown in Fig. 4, under the rails, again establish the current, which will free the disk arm a second time and turn the disk to safety for following trains. Or, as it is easy to see, by the use of two circuit closers properly disposed, the train might set its own danger signal and then reverse it when a suitable distance has been traversed.

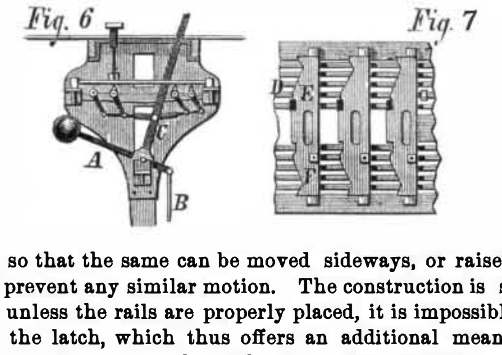
But it is not enough that the signals should be set. The people in charge of them must also be infallibly informed of that fact, as well as of any failure in the working. For this purpose the tell-tale shown in Fig. 2 is used. This is the machine which announced that the incoming train, in one example, was coming over the 53d street crossing; or more properly, it first showed that a block signal had there been set and afterwards reversed; for through that signal it was operated, as we now proceed to show.

By examining the circular stage, C, in Fig. 3, a pair of springs at the left hand side, placed so as to overlap, will be noticed. There are two pairs of these springs, arranged diametrically opposite to each other on the circle, and hence between the two similarly disposed single springs, through which the circuit, as before explained, is established. The members of each pair of springs overlap without touching, but are brought in contact by one of the pins on the cam on



the disk shaft, during the revolution of the latter. Without entering into further detail, we may state that this contact must necessarily be caused with one or the other pair of springs whenever the disk changes position, and the effect of such contact is to send a current to the electro-magnet in the indicator, Fig. 2. The armature of this magnet is connected with the index clapper, and the general construction is such that, whenever the magnet is excited, the clapper will be thrown over to a position opposite to that in which it happens to be. The relation between indicator and signal is so adjusted that whenever the signal shows "danger," the clapper, which has a weighted extremity to aid its motion and to strike a gong at each end of its course, and so to give warning, swings over to "block;" when the signal is reversed the arm swings back to "clear." During its travel it strikes a suspended ball, and this, vibrating, shows to ano perator, who may have several indicators before him, which one has just become reversed. By this arrangement, it will be evident that when the signal moves the indicator must show it, and *vice versâ*; so that the operator always has accurate knowledge of the state of the sections of line under his charge, no matter how far distant from him, or how widely separated the same may be. There are many ingenious points about the system, which lack of space forbids our describing. We may mention, however, the device partially shown at F, in Fig. 3, which consists of the winding stem for the signal weight, and also other mechanism, which compels the turning of the stem and the consequent winding of the cord, before the door of the case in which the signal is contained can be unlocked to admit of the insertion of the lamp at night. Another ingenious device is that used for drawbridges, which consists of a lock on the crank, which withdraws the locking pin of the bridge. It is impossible to do this until a button is pressed, which sets a danger signal for approaching trains, nor can that signal be reversed or tampered with until the bridge is again securely locked in place.

One of the most important localities where that system is necessary is at the crossing of several tracks, similar to that at 53d street; and here also is used the new switch apparatus, which forms the third and last portion of our subject. Fig. 5 shows the interior of the switch house with the working levers. Each lever is connected to a weighted arm, A, Fig. 6, and also, by suitable interposing connections, through the rod, B, to the locks, the signals, or switches. Attached to the shank of the lever, at C, are jointed rods, which are secured to a series of square shafts, D, Fig. 7. Just above the shafts are the locking plates, E. These are flat iron plates hung in journals at each end. In the edge of each are notches, which hold the levers and prevent them from moving from the ends of the slots in which they work when the latches lay flat, as shown. If, however, a latch be tipped by pressing on a foot piece in front of the lever, the rod of which bears against the point, F, Fig. 7, the lever will be freed from the notch. The interlocking arrangement is found in cams on the square shafts, D. These are so disposed as to be immediately under the edge of the latch plates. When a shaft is so turned that the cam presses on the plate from below up, then, obviously, the plate cannot be tipped by the foot piece, nor the lever disengaged; so that the latter is thus securely locked. It is impossible to set a signal at safety if the switch points are not properly placed and locked, nor can the latter be altered after the signal is set. Any combination of interlocking is possible: in other words, any lever can be made to lock any other lever, so that it becomes a simple problem to adjust the apparatus in conformity with the number of track requirements at any particular situation. The lock for the rails consists of a hollow cast iron sleeper placed under the ends of the switch rails, and having other two crescent-shaped pivoted latches connected by a rod. By moving the latter, the points of the latches are lowered beyond the bottom of the



rails, so that the same can be moved sideways, or raised so as to prevent any similar motion. The construction is such that, unless the rails are properly placed, it is impossible to raise the latch, which thus offers an additional means of safety. Taken as a whole, the ingenuity, simplicity, and utility of this perfect system of communication, and the contrivances invented to accomplish it, are truly wonderful. The mechanical appliances are the joint inventions of Mr. J. M. Toucey, the General Superintendent, and Mr. William Buchanan, Superintendent of Machinery, of the Hudson River Railroad.

The electro-magnetic signals are the invention of Mr. Daniel Rousseau of this city, and are the subjects of several very recent patents. The depot arrangements are the results of the combined skill of Superintendent Toucey and Depot Master Franklin. To all the above named gentlemen we are indebted for much courtesy in facilitating our obtaining the interesting facts here presented.

ACIDEMETRY APPLIED TO THE TESTING OF VINEGAR.

In order to determine the value of a vinegar, it is necessary to discover in what proportion acetic acid is present and to assure oneself that no foreign mineral acids are contained. The chemist executes these various operations with acidimetric liquors, reagents, and apparatus; but there has been for some time needed a simple and practical process available to those who may not have at their command the resources of a laboratory. MM. Reveil and Salleron have recently devised an acidimeter, the use of which is illustrated in the annexed engravings (taken from *La Nature*), and which can be readily understood and the directions for its manufacture and employment followed.

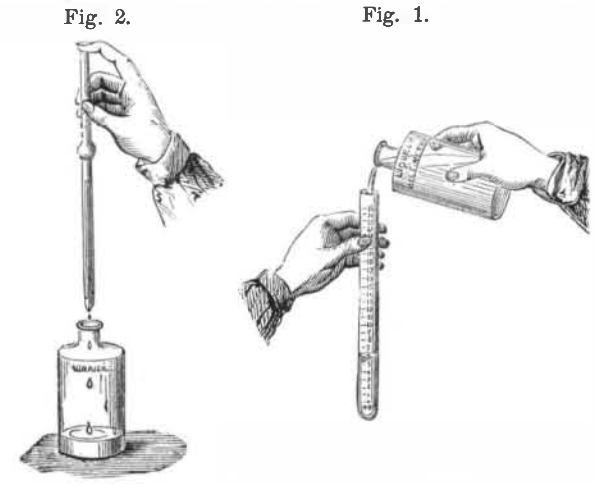
The necessary apparatus consists, first, in a tube of glass closed at one end as shown in Fig. 1; near said extremity, at the zero mark, the word "vinegar" is inscribed to indicate the amount of vinegar to be employed. Above the zero, the tube is divided off, and the divisions are marked 1, 2, 3, etc., so as to show the richness in acid, as will be described below. Second, there is a small sponge attached to a whalebone to be used to clean the tube after each experiment. Third, a pipette (Fig. 2), is marked to show a quantity of 0·25 cubic inch of liquid, so that the amount of vinegar for each test can be accurately measured. Lastly a flask of liquor, used as a standard acidimetric reagent, is added.

One fourth of an inch of vinegar is taken into the pipette and retained therein by the finger, as shown in Fig. 2. This is allowed to flow into the graduated tube and the acidimetric liquid, colored blue, is slowly poured in. The fluid soon becomes red when the tube is agitated by being turned over, the thumb stopping the opening. More of the test liquid is added, the mixture a second time shaken, and so on until the fluid in the tube becomes of the color of the red outer skin of an onion. The graduation on the tube, corresponding to the level of the liquid, is then read off, and this shows the centesimal proportion of acetic acid contained in the vinegar.

The reaction can easily be followed. The acidimetric liquor, prepared in advance, is a solution of borax and caustic soda. The proportion of these ingredients is calculated to correspond to a certain quantity of crystalizable acetic acid. The liquor is colored blue by litmus, and indicates by its change to violet red the moment when the saturation of the acid by the base is effected.

Vinegars are sometimes adulterated with sulphuric and other mineral acids, which may be detected as follows: The vinegar to be tested is boiled with a few fragments of starch.

Fig. 2. Fig. 1.



It is then cooled, diluted, and a few drops of iodine tincture dropped in. With pure vinegar, the blue color of iodide of starch should show itself; if no coloration ensues, a foreign mineral acid is present. Wine vinegars are frequently falsified with wood vinegars (pyroligneous acid): this last product almost invariably contains small quantities of sulphate of soda, the presence of which may be detected by the addition of chloride of barium, which yields a white precipitate, sulphate of baryta.

KING'S IMPROVED SUPPORT FOR PRINTERS' GALLEYS.

The annexed engraving represents a simple little device designed to support a printer's galley when the same rests upon the case, during the process of making corrections in the type or during the transfer thereinto of type from the stick. Ordinarily the galley is rested against the ledge of the case or else placed diagonally across the latter, thus covering several letter boxes and necessitating its being moved whenever the types contained in such receptacles are required. The present device sustains the galley in such a position that none of the boxes are wholly closed, so that access into any one of them may easily be had.

As shown iu the engraving, it consists simply of a meta casting, forming a straight grooved piece between two parallel pieces, disposed at the ends and at right angles thereto. The groove in the central portion and notches in the cross pieces fit over the transverse partitions of the case, and the galley rests against one crosspiece while the other presses against the longitudinal partition or edge. The invention is a handy convenience for compositors.

Patent now pending through the Scientific American Patent Agency. For further particulars address Messrs. Johnson & King, 100 11th street, Brooklyn (E. D.), N. Y.

The hydraulic ram is especially useful where there is a small stream of water and only a slight fall. A fall of two feet, and a flow of 1½ cubic feet of water—93¾ lbs.—per minute, will deliver 0·010 of a cubic foot of water per minute at a hight of 38 feet.