open-circuited as it should be, but it will not provide any indication that an inductor is properly close-circuited as it should be when the signal is clear. However, an in-

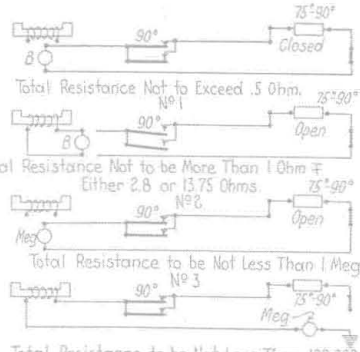


Fig. 1

Test of Inductor Circuits

Date	Signal Number	Total Res. of Inductor Leads	Res. of Inductor Winding	Cross Test of Inductor Leads	Ground Test of Inductor Circuit

Fig. 2

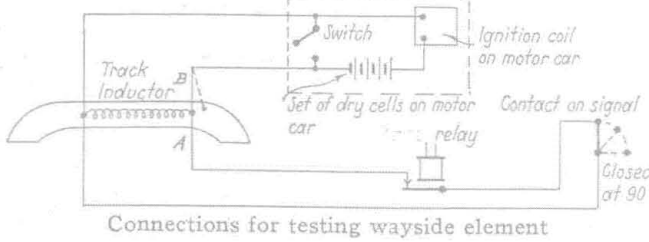
Circuit hook-up for making resistance and insulation measurements together with report forms used in checking wayside inductors

dication would be received by the head engine if such a false stop signal were received.

Albany, N. Y. A. H. RICE,
Signal Engineer, Delaware & Hudson.

Motor Car Ignition Coil Used in Testing Train Stop Inductors

ON the Atlanta divisoin of the Southern, we have developed a scheme for testing the G-R-S wayside elements of the intermittent auto-manual train stop system, using the regular ignition circuit of a motor car. After removing the cover of the terminal



Connections for testing wayside element

box on the wayside element long jumpers from the switch or battery box on the motor car are connected to the terminals of the coil on the inductor. When the circuit is closed to the signals, that is, the *HD* relay is up and the signal clear, the buzzer on the motor car will operate, but when the circuit to the signal is opened the buzzer stops on account of the inductance in the wayside element coil being too high. Therefore, we have a check on the circuit from the inductor through the relay and signal contact. The next test is to determine that the coil in the inductor is not open. We found that although the buzzer would not work when the circuit to the signal was open, a spark would be made when touching the jumper to the terminal of the inductor coil, which indicated that the coil winding was complete. A test to see if the inductor coil is grounded can be made by disconnecting wires *A* and *B* and touching wire *B* to a cleaned spot on the metal frame of the inductor as shown by the dotted line. These tests are made once a month.

Rome, Ga. J. WALLER,
Assistant Signal Supervisor, Southern.

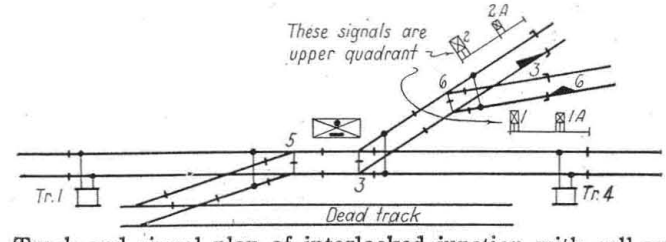
Additional Solutions to Call-On Signal Circuit Problem

"Can you design a circuit to obtain the desired operation of the call-on arms as indicated in the sketch below?"

Information Desired in Question No. 4

I would like to install a circuit to clear signal *1* and prevent call-on signal *1A* from clearing when a train passes No. *1*, such a circuit to use the same signal lever in the tower but not a middle position on the segement, using only the full normal and full reverse position. The same requisite applys to signals *2* and *2A*.

The present condition allows the operator to use the



Track and signal plan of interlocked junction with call-on signals at two locations

call-on signal under all conditions and I would like to change it so that when he pulls lever *1* or *2* (which ever route is set up) the train will receive full protection from the high signal. Signal *1A* must not be allowed to bob. I would also like to include signal repeaters for the call-on arms. Note that I do not want to use push buttons to clear the call-on signals, but want the same lever to clear both signals.

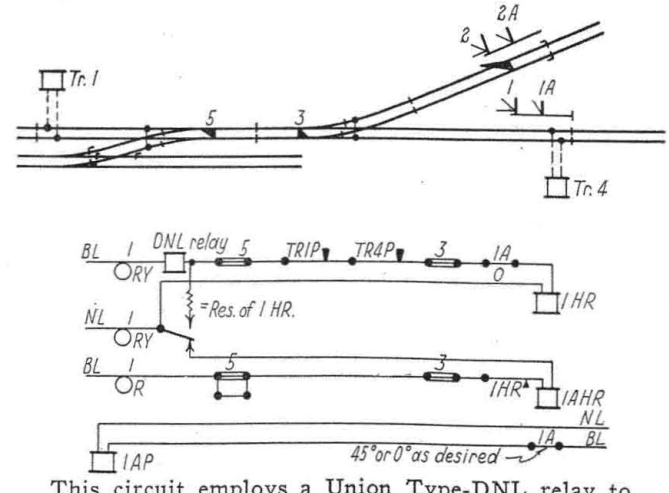
If a train approaches and passes either high signal and opens the track circuit, putting the high arm at stop I do not want the call-on arm to clear immediately.—P. H. W.

Some More Prize Winners

(This concludes the publication of solutions received in response to the foregoing question. Several others were received too late to be considered, or in the opinion of the judges did not conform to the conditions specified in the question.—EDITOR.)

Uses a DNL Relay in Addition to H Control Relay

IT is interesting to note that all of the circuits submitted in response to question No. 4 in the April issue of *Railway Signaling,* are dependent on the track relays for selection of the two arms. Herewith is a



This circuit employs a Union Type-DNL relay to accomplish desired results

sketch of a circuit designed to provide the desired indications which is dependent only on the integrity of the circuit of the *IHR* relay for selection. The relay used in series with the *IHR* relay is a Union Switch & Signal Company's Type-DNL relay. The *RY* contacts are used to give the *IHR* relay a slight lead over the *IAHR* relay.

Circuits for signals *2* and *2A* would be identical except for the selection through the track relays and switches.

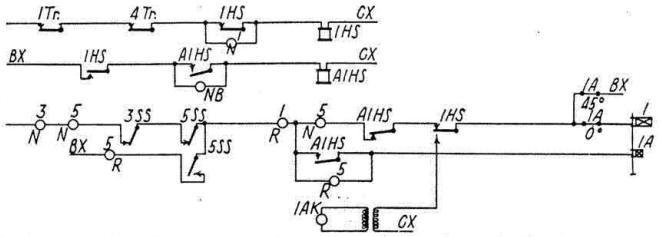
Detroit, Mich. LOUIS RUPERT,
General Signal Inspector, Michigan Central.

(After relay *IHR* has been picked up which also picks up the *DNL* relay, it is necessary to put the lever normal in order to break down the *DNL* relay. Again reversing the lever will pick up relay *IAHR*.—JUDGE.)

This Scheme Uses Only Two Control Relays Both Having a Stick Feature

THE accompanying sketch outlines a scheme of circuits for the call-on signals of question No. 4. After the top arm has gone to the stop position because of a passing train the call-on arm can be cleared by operation of the signal lever to the normal or normal indication position and then to reverse. The circuits as shown are for signals *1* and *1A* but could be similar for signals *2* and *2A*. Relay *1HS* is controlled over all track sections in the route of signal *1* and through its own stick contact in multiple with a normal contact on lever *1*. Relay *A1HS* is controlled over a back contact of *1HS* and through its own stick contact and a normal to normal indication contact on lever *1*.

As a train passes signal *1*, relay *1HS* opens its front contact, thereby putting signal *1* to stop. If the operator now desires to clear call-on signal *1A* while the route of signal *1* is occupied by a train and relay *1HS* is de-energized he will first return lever *1* to the normal or normal indication positions and so complete the circuit of relay *A1HS* through *1NB* contact in series with *1HS* back contact. Relay contact *A1HS* will then be closed in the control circuit of signal *1A* and hence the operator can now clear this signal by reversing lever *1*. Relay *1HS* will remain de-energized and *A1HS* will remain energized until the operator again places lever *1* normal and the route of signal *1* has been cleared and hence signal *1A* will remain clear as long as lever *1* is left in the reversed position.



Written circuit scheme for accomplishing desired operation of call-on signals

The purpose in using an *NB* instead of an *N* contact on the lever is to make it unnecessary to return the lever any further than to the *B* position when preparing to clear the call-on signal, especially if route locking is accomplished by controlling the signal lever lock through front contacts of the track relays.

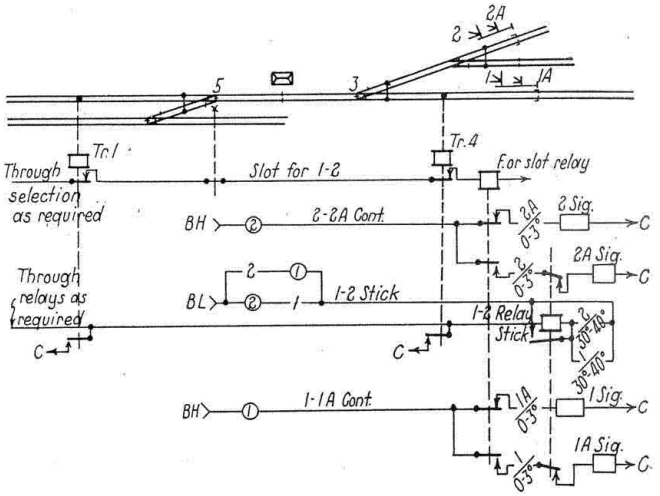
The sketch includes a call-on signal repeater that does not necessitate an additional line wire.

Swissvale, Pa. L. E. SPRAY,
Circuit Engineer, Union Switch & Signal Company.

(This solution is somewhat similar to Mr. Anderson's solution which was published in the May issue. The essential difference is in the stick control relay circuit for the lower signal, Mr. Spray providing a normally open circuit, whereas Mr. Anderson provided a normally closed relay circuit for this purpose. The signal repeater truly repeats the call-on arm and is controlled without an additional line wire.—JUDGE.)

Only Two Relays in This Solution—Stick Relay Picked Up By 30-40 Deg. Contact on Signal Controller

I HAVE not shown the lock circuits, etc., needed for the signal lever, only the circuit required to operate the signal. Reversing lever *1* feeds battery to signal *1* if the slot relay is energized and also feeds battery to pick up the stick relay. When a train passes the signal, the track relay and slot relay will drop. When the signal passes the 30-40 deg. position with the track relay on a back point, the stick relay picks up. This relay prevents signal *1A* from clearing until it is desired to have it clear. The stick relay sticks up through any number of relays as may be required.



Desired control of call-on signal is obtained with this circuit—High arm protection is effective when track is clear

If any track relay should fail to pick up after the train clears, the stick relay would remain energized, which in turn would prevent signal *1A* from clearing. To take care of this the towerman would put lever *1* normal and then reverse it after which signal *1A* would clear. When the train clears the slot circuit for the high arm, signal *1A* automatically goes to stop and No. *1* clears. This gives high arm protection at all times when the track is clear. Signal No. *2* works the same as No. *1*.

Chicago. LEROY CONE,
Circuit Designer.

(Control of signals is accomplished by using but two line relays. Tower indicator to repeat position of call-on signal is not provided for as requested.—JUDGE.)

This Circuit Provides Indicators for Top and Bottom Arms—Call-On Signal Can Be Cleared with Switch 5 Reversed

AFTER high signals *1* or *2* have been cleared and put to stop by a passing train, their respective levers have to be returned to the normal position by the operator and again reversed to clear a call-on signal. When a call-on signal has been cleared it will remain clear as long as its lever is in the reverse position regardless of whether the home track circuits are occupied or not.

If the home track circuits are clear as indicated to the operator by the track indicator, the high signals *1*

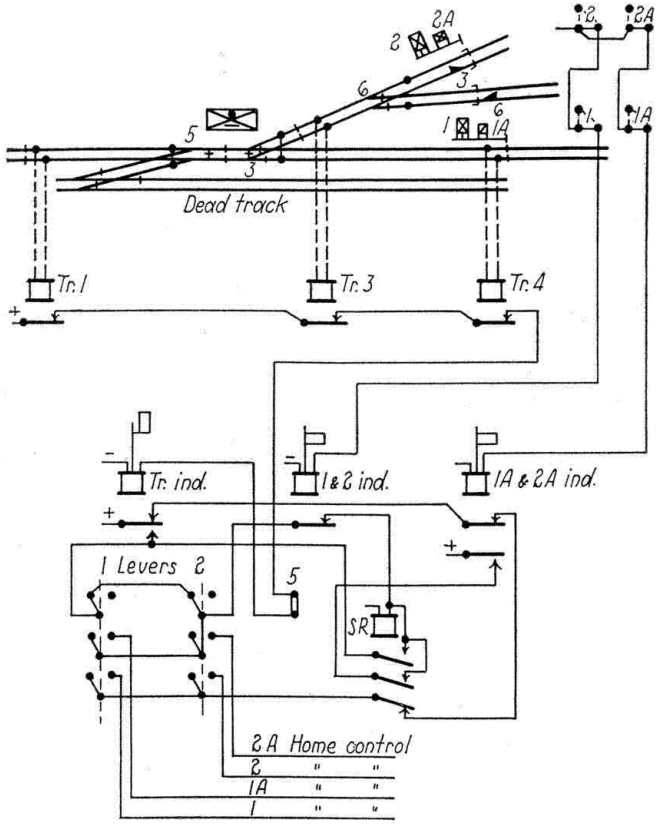
or 2 will be cleared when its lever is reversed, but if the track indicator shows the home track circuits occupied, reversing the signal lever will clear a call-on signal.

The selection between the high signals and the call-on signals is made by the stick relay *SR*. When the track indicator is down and levers 1 and 2 are normal, relay *SR* will pick up and hold up while the home track circuits are occupied or the lever is reversed holding the call-on signal clear. The track indicator control circuit is also broken through a circuit controller on the side track crossover lever 5 at normal so that when this crossover is reversed only a call-on signal will be cleared.

The 1 and 2 indicator and the *1A* and *2A* indicator have their banners connected so as to be down when their armatures are up. When signal 1 or 2 is cleared operating its mechanism circuit controller, 1 and 2 indicator will drop and its banner go up following the operation of the signal arm. Indicator *1A* and *2A* operates in the same way when one of the call-on signals is cleared. If it is so desired separate indicators can be used, one for each signal arm, but ordinarily one indicator for each set of signals gives the operator the information he requires as he knows which lever he has reversed.

If there is at present a lock circuit on high signals 1 and 2 the 1 and 2 indicator can be tapped onto it in the tower.

The question does not state whether any approach,



Circuit will operate to fulfill all conditions required in question No. 4

route or mechanical time locking is used on signal levers 1 and 2, but if such is the case then the additional time interval to operate these devices will be effective before a call-on signal can be cleared after a high signal has been put to stop by a train entering the home track circuits.

Pedro Miguel, C. Z. C. B. CARGILE,
Supervisor of Signals, Panama Railroad.

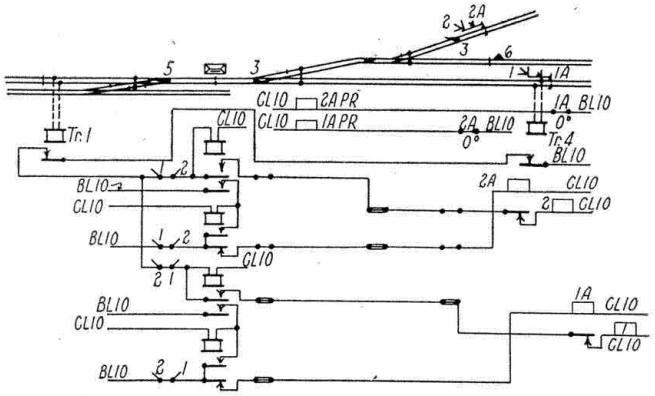
(Signal cannot "pump" because it is necessary to restore the lever to normal before the call-on signal will clear. The *SR* relay operates from the signal battery.—JUDGE.)

Circuit Scheme Does Not Control High Arm Through Switch *S* Allowing It to Clear When This Switch Is Reversed

THE circuit shown herewith was recently used to overcome the difficulty mentioned by your correspondent. It has proved entirely satisfactory in use.

In case of a track circuit failure the call-on signal only will clear. No "pumping action" of signals will be possible because of the relay control scheme. Signal repeating indicators have been provided to repeat the call-on and high signals in the tower.

(The top arm is not controlled through switch 5 and hence if a movement over switch 5 is contemplated, the high arm (instead of the call-on) would clear when lever 1 is reversed. With track circuits unoccupied this would be effected by relay *CL1O* picking up, which in turn



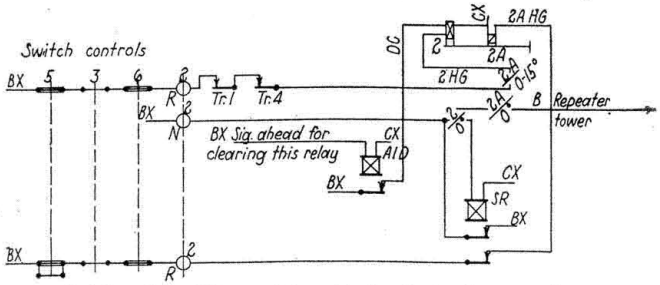
Another circuit intended to accomplish desired result

would pick up the stick relay, thus breaking the back contact which controls signal *1A*. Also the top and bottom arms are not "interlocked electrically" in both directions, that is the control is "biased" by reason of the fact that the call-on signal only is checked through the top arm at stop. Had the high signal been checked through the lower arm at stop, then complete assurance of proper operation would be secured.—JUDGE.)

Detroit, Mich. W. L. DAYTON,
Superintendent of Signals, Grand Trunk.

Circuit Uses Only One Control Relay

WITH a semaphore signal, a line relay can be used in connection with the slot coil to control the operation of the call-on signal. The circuit shown herewith requires but one relay, namely the stick relay *SR*.



Stick relay *SR* used to obtain desired operation

It is necessary to return the signal lever normal to pick up the *SR* relay after which the call-on signal can be cleared.

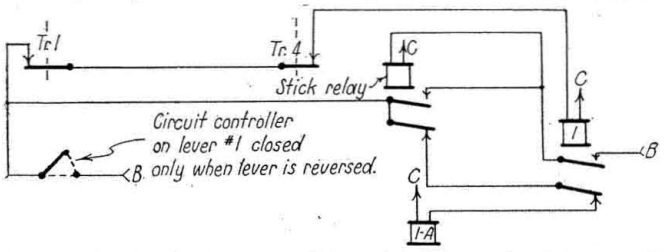
Fredericksburg, Va. S. F. ARDEL,
Signal Foreman, Union Switch & Signal Company.

Other Replies Received

Control of Call-On Signals Effected by Track Relay Position

THE problem in question No. 4 involves the control of two signals from one lever, the variable factor in the control being the position of track relays *1* and *4*. When these relays are picked up signal *1* only must clear when lever *1* is reversed.

When either or both of these relays are open, signal *1A* only must clear when lever *1* is reversed. Therefore the selection of the control of the signal to be cleared involves the use of a stick relay. A simplified circuit showing the control is submitted herewith. The same circuit will apply to signals *2* and *2A*. The control through switch circuit controllers is omitted but, of course, may be inserted if desired. With this circuit



Schematic circuit for controlling signals *1* and *1A* by track relay selection

arrangement only one signal will be clear at a time so that signal repeaters may be installed in the usual manner.

New York. G. HANCOCK.
Representative, E. A. Lundy Co.

(Schematic circuit does not show if signals are checked against the possibility of top arm sticking clear and lower arm clearing at same time.—JUDGE.)

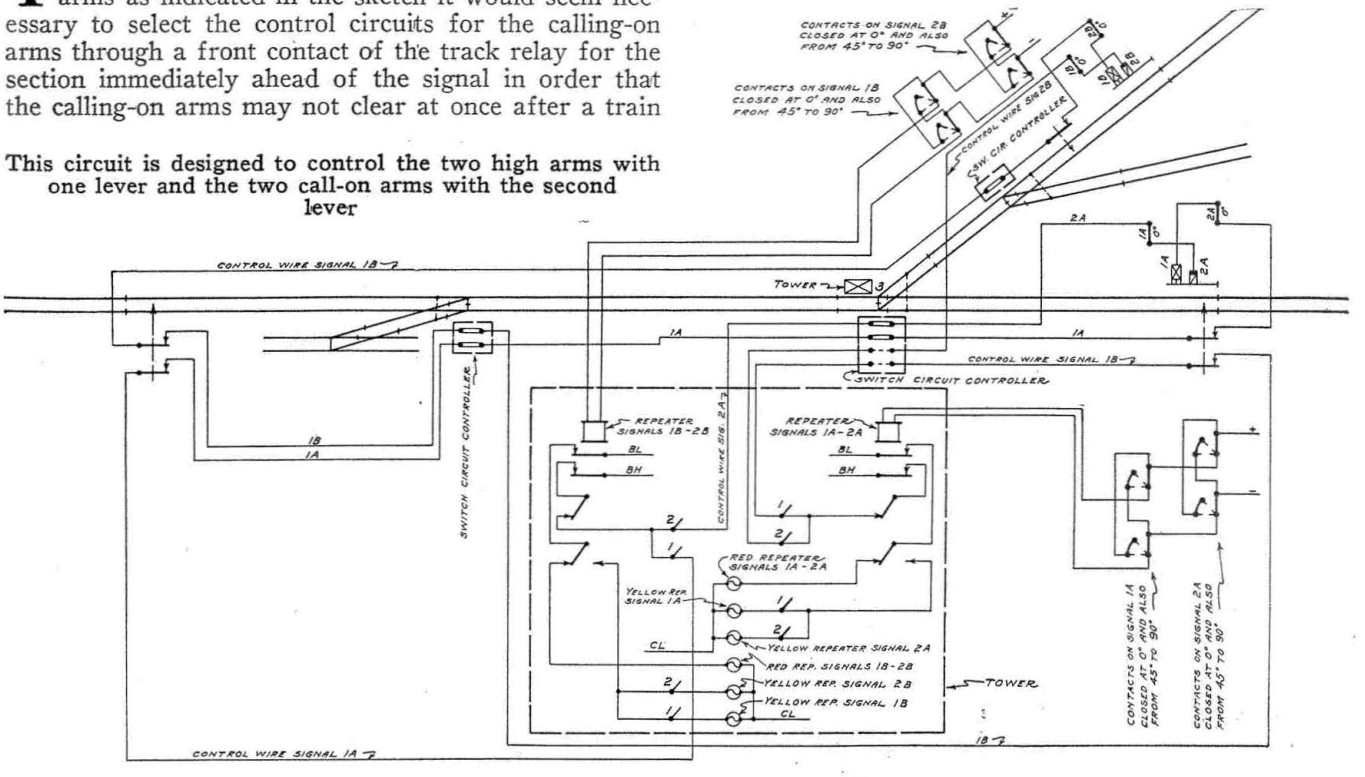
Recommends Operating Both High Arms with One Lever and the Two Call-On Arms with the Other Lever

TO obtain the desired operation of the calling-on arms as indicated in the sketch it would seem necessary to select the control circuits for the calling-on arms through a front contact of the track relay for the section immediately ahead of the signal in order that the calling-on arms may not clear at once after a train opens the track circuit, putting the high arm at stop. The necessary selection between the high arms and the calling-on arms can be obtained by breaking the control of the calling-on arms through a contact closed only when the high arm is at stop.

Following this scheme as outlined, when lever *1* or *2* is reversed (which ever route is set up) and all track sections in the block are clear, the high arm will clear. If the high arm goes to stop or does not clear due to a train in the block or some other reason, the calling-on arm will clear, provided the first track section immediately ahead of the signal is unoccupied. Such an arrangement, however, is open to many objections. It is not sufficiently flexible, and the leverman has little choice as to when he can clear the calling-on arms and therefore the advantages to be gained by having four separate signal arms are reduced considerably.

If, instead of this arrangement, one lever is used to operate both high signal arms, using the other lever to control the two calling-on arms, a much better working of the signals can be obtained. Control circuits for these signals under this suggested arrangement are shown herewith, having assumed that the change in the use of the two existing levers can be made. When lever *1* is reversed, the necessary selection to clear either one of the high signal arms is obtained over switch *3* normal or reverse. This also applies to the selection of the calling-on arms. When lever *2* is reversed, only the calling-on arm governing over the route set up is the one that can clear. The locking, of course, may have to be changed so that levers *1* and *2* lock switch *3* both normal and reverse. Under this scheme the leverman has at all times complete control over the signals. But just reversing the lever when conditions are right, he can clear any one of the four signal arms, and therefore can use his judgment as to when to clear a signal for a train and which signal to clear. Whenever he deems it proper to advance a train at slow speed, using the calling-on arm, he can do so. Full protection from the high signals is maintained, and in cases of track circuit failure, the calling-on arms are always available to keep trains moving.

This circuit is designed to control the two high arms with one lever and the two call-on arms with the second lever



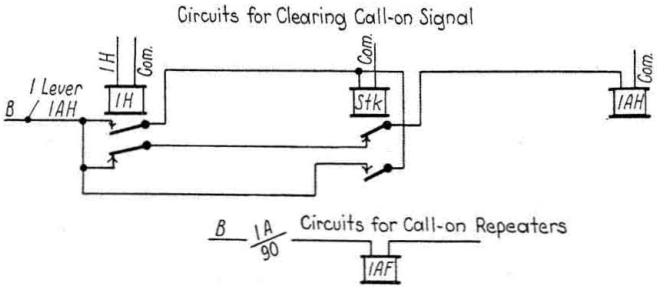
Two polarized relays are shown each to repeat in the tower both the high arm and calling-on arm on the same mast. The signals are interlocked electrically and in order to clear any one arm, the other three arms are checked in the stop position. It will be seen that energy to all four signals would be cut off at the tower before two conflicting signals could clear. The repeaters would also allow the leverman to check on the proper operation of the signals.

Washington, D. C. R. A. PLA,
Signal and Electrical Inspector, Southern.

(Suggested control arrangement does not answer the question published in the April issue, because it fails to consider the limitations there specified. Although the above circuit is workable, using one lever for the two high signals and a second lever for two lower signals, it cannot properly be classed as a solution of the problem, because the other replies have been confined to the specific requirements of the question that the "same signal lever" be used for the top and bottom arms at each location.—JUDGE.)

Simple Stick Relay Control Scheme

I ASSUME that the circuits for the top arms *1* and *2*, use an H control relay in each case. This circuit works as follows when everything is "o. k." for the top arm: From battery through reverse contact lever *1*, front point relay *1H*, to stick relay, to common. This picks stick relay up preventing the call-on from clearing as relay *1AH* breaks through back point of stick relay. With relay *1H* picked up battery is cut off relay *1AH* as this wire is broken through back point of relay *1H*. When train passes signal, top arm goes to danger. Call-on arm will not clear as the stick relay will remain picked up on account of taking battery through its own front point. If another train is to



Addition of a stick relay controlled through lever contact will effect the desired operation

follow the first one before first train clears circuit, operator can clear call-on by putting lever normal and reversing lever again, because when lever is put normal, the stick relay opens. Then by reversing the lever, the call-on arm will clear, the circuit being established through battery, reverse contact of lever, back point of relay *1H*, back point of stick relay to relay *1AH*. Relay *1AH* then picks up clearing the call-on signal.

The repeaters for call-on arms work as follows: From battery through a spring on signal *1A* or *2A* (which makes when the signal is clear) to the indicator in the tower, to common. The indicator will clear when the signal is clear. Repeater circuits for *1A* to *2A* would be similar.

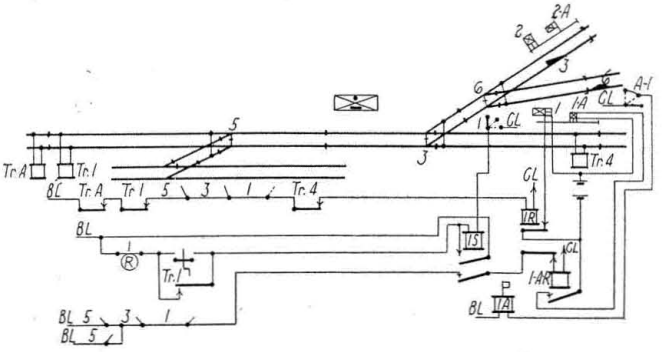
Garfield, N. J. WM. H. ARDEL,
Signal Maintainer, Erie.

(If lever *1* is put back to normal position and top arm sticks clear, for some reason or other, call-on arm will immediately clear up, thus having both arms clear with a train in the track section.—JUDGE.)

Stick Relays Used to Control Call-On Arms—Advocates Operation of Lower Arms Independently of Track Circuit

IN this plan written circuits are used to cover the general wiring, the local signal circuits and the stick relay circuits, being shown in full, except the battery. Symbol *1R* on the stick relay circuit indicates that the controller is open when lever *1* is reversed, being closed in normal position only. The circuit controllers on the signals are shown to correspond with the position of the arm as illustrated. The call-on arm is supposed to be used when any route over the plant is properly set up regardless of the condition of the track circuits, and the plan is made accordingly.

The plan for signals *1* and *1A* shows route set up and signal *1* in clear position. Signal *1A* is controlled by relay *1AR*, which is wired through front contact of stick relay *1S;* back contact of *1R* and proper circuit



Circuit scheme suggested for controlling call-on signals

controllers. As signal *1* begins to clear it breaks the contact on circuit controller for stick relay *1S*, causing same to open. Before *1S* will pick up signal *1* must be normal, lever *1* returned to normal position (which closes controller *1R)* and track relay *TR1* must be down or the time release used. Therefore, after signal *1* is cleared, and returned to normal position, before call-on signal *1A* can be cleared it will be necessary to return lever *1* to normal position while a train is occupying track circuit *TR1*, or else to use the time release.

Plan for signals *2* and *2A* shows through route set up, but signal *2* is not clear on account track *A* beyond the limits of the interlocker being occupied by a train, and it is assumed necessery to send an engine over this route. Therefore, lever *2* is reversed and as relay *2R* does not pick up, relay *2AR* picks up and clears signal *2A*. This signal can also be cleared with switch *5* reversed, or with cars occupying any of the track circuits, providing the switches and derails are properly lined.

If it is desired to have the stick relays that control the call-on arms restored to normal before track circuit *TR1* is reached, the other track relays can be used for that purpose. If it is not desired to have call-on arms clear while the track within interlocking limits is occupied, wire relays, *1AR* and *2AR* through front contacts of track relays involved.

Forrest, Ill. H. W. COOPER,
Signal Maintainer, Wabash.

(Signal *1A* should break through circuit controller contact on signal *1* as a check, so that top arm cannot stick clear and allow bottom arm to clear also. Circuit controller contacts not shown in proper relation to position of signal arms. Lower quadrant symbols for controllers are shown while upper quadrant signals are used which makes it hard to grasp readily. Also signal *2A* is improperly shown as clear.—JUDGE.)