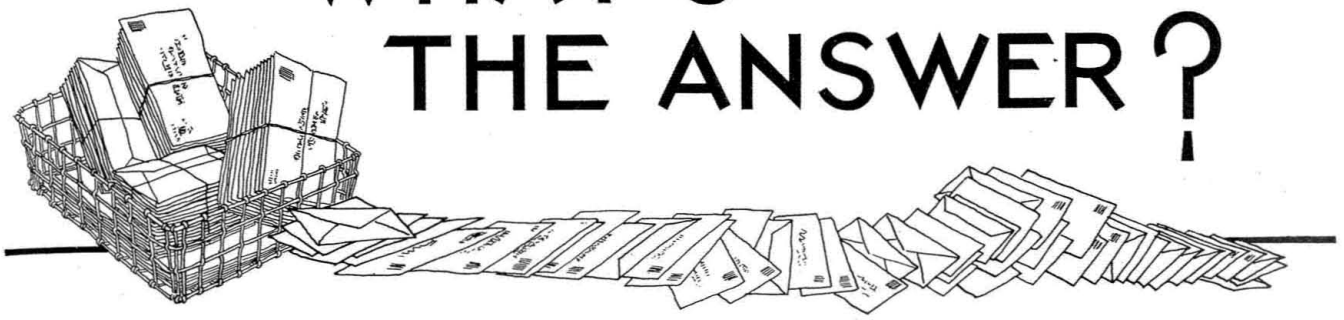
WHAT'S THE ANSWER?



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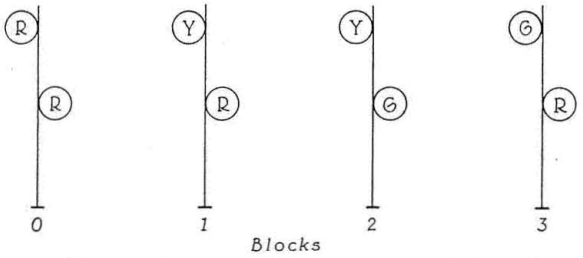
Signal Aspects for A Four-Block System

"In the A.R.A. code, the color-light signal indications for four-block systems are: Red-over-red for stop; yellow-over-red for one-block clear; yellow-over-green



for two blocks clear; and green-over-red for three or more blocks clear. What improvement of this arrangement can you suggest to secure better light-out protection and to eliminate the use of red for the higher-speed indications?"

Outlines System of Color-Light Aspects for Both Three-Block and Four-Block Signaling

By F. B. WIEGAND
Signal Engineer, New York Central, Cleveland Ohio

WHAT I am suggesting might be termed an improvement with respect to the elimination of the use of red for the higher-speed indications, but it at the same time provides adequate light-out protection. I suggest the use of two greens for "Proceed," as with the lower quadrant signals (with home and distant blade), a large number of which are still in use. The set-up as given in the question has heretofore been referred to as a three-block system:

Red-over-red indicating stop.
Yellow-over-red indicating stop at next signal and an immediate reduction to medium speed.
Yellow-over-green indicating pass next signal at not exceeding medium speed, and
Green-over-red indicating proceed.

Without the radical change in the typical aspects as they appear in the Standard Code, and perfectly consistent therewith, as the Code specifically states that the aspects shown are typical and that each road should show the aspects it uses; the following, with some slight modification at interlockings, can be used:

Red-over-red = Stop
Yellow-over-red = Stop at next signal
Green-over-red = Prepare to pass next signal at not exceeding medium speed
Green-over-green = Proceed

By such an arrangement it will be noted that the lower light in each case repeats the upper light of the signal ahead. By adding yellow-over-yellow, a four-block system can be provided, the lower light still repeating the upper light ahead, the arrangement being:

Red-over-red = Stop
Yellow-over-red = Stop at next signal
Yellow-over-yellow = Stop at second signal
Green-over-yellow = Prepare to pass next signal at not exceeding medium speed
Green-over-green = Proceed

By this arrangement, light-out protection is provided as the proceed indication is always given by two green lights, a single green being regarded as an imperfectly displayed signal, Rule 27 of the Standard Code always governing.

It should be noted that red in combination with yellow is displayed only in advance of a signal indicating stop.

At interlockings at which three light units are in use, there must be some modification. It is possible that three greens may be used for proceed, or perhaps two greens over red; then again, it may be advisable to put out the bottom light of a three-unit signal, when the top and middle unit display green. There must also be some modification with respect to the display of the middle and slow-speed indications. This requires careful study and no one should jump at conclusions. Another scheme which perhaps

Questions To Be Answered

(1) *At drawbridges do you provide interlocking protection between the bridge mechanism (wedge-driving apparatus and turning mechanism) and the interlocking machine? If so, what kind of checks are used and how is a conflict in the operation of the bridge mechanism and interlocking machine prevented?*

(2) *What advantages accrue from the elimination of indication locking on switch control levers? Are there any serious disadvantages?*

(3) *What practical applications of graphic recording instruments have you made to keep a performance check on certain signaling facilities?*

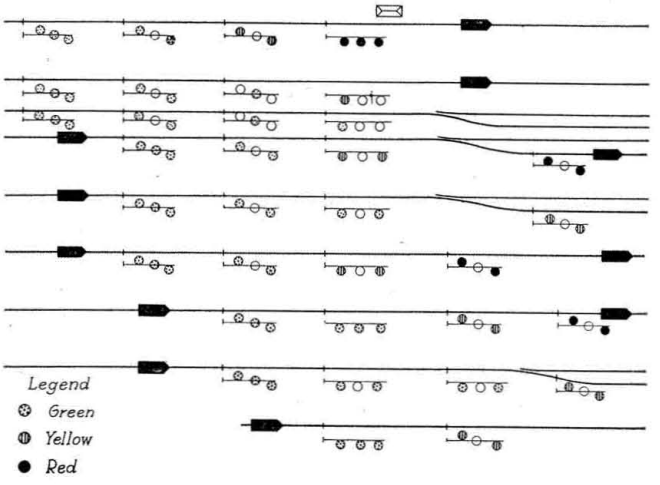
(4) *What are some of the best ways to ferret out troubles from grounds at an electric interlocking plant and on automatic signal circuits?*

(5) *In preparing rules for the operation of trains by signal indication, using the centralized-dispatcher controlled system, is it desirable to leave the time table in effect, or should the signal indications supersede all other rights?*

might be considered at variance with the Standard Code, but which in my opinion is worthy of consideration, is as follows:

Three greens = Proceed
Two greens = Proceed at medium speed
One green = Proceed at slow speed
Two yellows = Medium speed prepared to stop at next signal
One yellow = Slow speed prepared to stop at next signal
Red-over-yellow = Proceed at restricted speed

With this system, red is displayed only when the signal indicates "stop," except in combination with yellow, when the signal indicates "proceed at restricted speed." With the display of these indications, the speed at which the train movements are to



Scheme of signal aspects where three-light units are used

be made can be displayed in automatic territory, between interlockings, as well as at interlockings. In this system of indication, the light-out feature has been objected to; however, this should not be objectionable as a light-out results in the display of a lower-speed indication than the one which is permissible. With the color-light, position-light and color-position-light signal, the lights burn only behind such lenses as give the indication. The light-out feature is merely a matter of education.

Not Necessary Always to Use Same Number of Lamps for Signal Aspects

By J. E. Saunders
Signal Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

THE block signal and interlocking rules, adopted as part of the Standard Code of the A.R.A. on January 17, 1928, allows considerable latitude in the selection of signal aspects to provide certain standard indications. It is a fallacy to assume that color-light signals need bear any relation whatsoever to a single system of semaphore blade aspects. It is much better to provide simpler and more readily comprehended aspects, even though the number of lamps may vary, than always to use a given number of lamps even though certain of these are not required for the aspect displayed. For instance, the color-light signal aspects and indications for a three-block indication (four-block system) might better be: Red for "Stop"; yellow for "Prepare to stop at next signal"; yellow-over-green for "Approach next signal at not exceeding medium speed"; and green for "Proceed." When an automatic signal is concerned, the red for "Stop" may be supplemented by a number blade to indicate "Stop, then proceed."

The above is in compliance with the Code. A possible improvement on this is to substitute yellow-over-yellow for the yellow-over-green approach-medium signal. A light-out relay has served for some time as a certain protection against improper display of indication caused by a lamp burning out. It should be noted that both of the above schemes eliminate the red, excepting only when a stop is required. When it is more generally realized that the stop at a "stop, then proceed" signal is only a disciplinary measure, that has little bearing on the safety to the train after passing the signal, the red-over-yellow aspect can be substituted for red at an automatic signal. Protection can be provided against a lamp burning out under all conditions as stated, by the use of a single light-out relay at each signal location.

Reviews Progress That Has Been Made in Direction of Simplified Aspects—Presents Several Good Examples

By Henry M. Sperry
Consulting Engineer, New York

THE question asked in the January issue of *Railway Signaling* is a most important one in the operation of our railways, because it relates to the use of the red light in the aspects of color-light signals. The diagram used in explanation of the question shows that the aspects of the proceed indication is a green light over a red light. The question is "how to eliminate the use of red for the higher-speed indications." This question has been so fully answered by the present-day practice of a number of important roads, both here and abroad and so fully discussed, that all I can do is to call attention to these discussions and briefly sum up the efforts that have been made to eliminate the red light in the aspects of proceed signals. First I will sum up by quoting the salient points of the many discussions of this subject. From the Railway Age editorial of March 5, 1929:

"An ideal arrangement of simplified signal aspects is that which will permit an engineman to concentrate on the one unit which gives him authority to proceed, or directs him to reduce speed as the case may be. If an engineman must pick out a green light, shown simultaneously with one or more red lights, more time is required for him to catch the indication. Likewise, red lights lose their significance when he is passing them frequently. The solution is to provide aspects such that an engineman never has authority to pass a red light at speed. * * *

"For those roads which are adopting light signals extensively, the fundamental difference which can be used to advantage is that a light can be extinguished when not needed in an aspect, whereas a semaphore arm, together with its accompanying light, cannot be so disposed of temporarily. For example, with the position-light signal used on the Pennsylvania, the lights in the second arm or unit are not illuminated except when required in the aspect. The same effect is secured with the color-position light signals used on the Baltimore & Ohio. With a color-light signal, when the light is out there is no signal, while with a position-light signal when one light burns out, two lamps are left to give the indication. For example, in a color-light signal, with a "red" over a "green" to indicate proceed not to exceed minimum speed, if

the red light burns out, the green light, remaining alone, indicates "proceed." With the position-light signal, this hazard of a burned out light does not exist, for there are three lights in a row for each indication. Likewise with the color-position-light signal, as used on the B. & O., extra protection is provided by using two lights in each row, and if one light goes out the color still remains. * * *

"It may be seen, therefore, that means are available to take advantage of this characteristic of light signals to secure simplification of signal aspects as compared with semaphores. The railroads of England, in designing their four-aspect color-light system, did not follow the aspects of semaphores used previously. * * * "

FIG.	COLOR GIVEN BY	INTERLOCKING SIGNALS NAME	INTERLOCKING SIGNALS INDICATION	AUTOMATIC BLOCK SIGNALS NAME	AUTOMATIC BLOCK SIGNALS INDICATION
1	One green light	Clear signal	Proceed	Clear signal	Proceed
2	Yellow light over green light	Approach restricting signal	Approach next signal at restricted speed	Approach restricting signal	Approach next signal at restricted speed
3	Red light over green light	Clear Restricting signal	Proceed at restricted speed		
4	One yellow light	Approach signal	Approach next signal prepared to stop	Approach signal	Approach next signal prepared to stop
5	Red light over yellow light	Slow speed signal	Proceed at slow speed prepared to stop	Stop and proceed signal	Stop and proceed (under limitation given in book of rules)
6	One yellow light	Slow speed signal	Proceed at slow speed prepared to stop	Legend: Out; Green; Yellow; Red	
7	One red light	Stop signal	Stop		
8	One red light	Stop signal	Stop	*An automatic block signal is distinguished from an interlocking signal by a number plate*	

D. L. & W. signal aspect and indication diagram rearranged so as to place the aspects in the order given in the A. R. A. Code, wherein proceed is placed first

This editorial develops a strong case against the present practice of using the combination aspect of green and red for the proceed indication. This use of green and red is equivalent to the command "GO-STOP," which, to say the least, is a confusing order. From *Railway Signaling* of June, 1926, I quote the following:

" * * * In a study of the signal indication diagrams shown in the operating rule books of ten prominent American roads, we find different night indications of a green light over a red, a green over two reds, and, in one case, a yellow over a green, over a red. Red marker lights on automatic signals only tend to extend the complications.

"It is quite generally conceded that with equal illumination, a red light penetrates to a greater distance than green. With combinations of colored lights, an engineman on a train traveling at high speed naturally picks up the red light first. Then, thinking that in a second or two he *may* pick up a yellow or green light to qualify the red light, he may take no immediate action, but wait for the qualifying colored light. With signals a mile apart on dense traffic lines, where trains travel at speeds of 70 m.p.h. or more, the few seconds' hesitation may be disastrous in case the circumstances are such that the qualifying lights are not being shown, but rather that a stop indication is being exhibited.

"Certain American roads have developed signals to simplify and reduce the number of aspects. The position-light signal as developed on the Pennsylvania, and especially the five-aspect signal as used on the Chicago Union Station, the color-light signal installation on the suburban district of the Lackawanna and the system of semaphore and light signals as used on the Santa Fe all possess characteristics of merit in respect to simplification, in fact, the Santa Fe was one of the pioneers in this field. The signal engineers of Great Britain have also given this problem of simplification of signal aspects considerable thought, and in a paper presented before the Institution of Railway Signal Engineers in London recently, W. J. Thorrowgood, signal and electrical superintendent of the Southern Railway (England), explained in detail the advantages of a new system of four-aspect, color-light signals being installed. Coming from England with the historic background of the route-signaling system, this change is indeed an innovation." * * *

This editorial carries the discussion a step further, as it points out what has been accomplished by the Atchison, Topeka & Santa Fe, the Pennsylvania, the Delaware, Lackawanna & Western and the Southern Railway of England in the use of simplified signal aspects in which the "red" aspect is eliminated in proceed at speed indications (not fully so on the Pennsylvania). The Baltimore & Ohio should be added to this list. Now let us sum up what the railroads have done toward the simplification of aspects:

The Pennsylvania first used position-light signals in 1915. The simplicity of the aspects is the distinctive feature of these signals. For example, the proceed aspect of both block and interlocking is three white lights in a vertical row, the equivalent of a one-arm semaphore or of a green light. The position-light signals are in extensive use on the Pennsylvania, replacing the semaphore type.

Position-light signals have recently been installed on the Lehigh Valley for directing train movements through the two Musconetcong tunnels. The marked simplicity of the aspects giving 11 indications are shown in the diagram with the article describing the signaling of the tunnels in *Railway Signaling* for December, 1929, (p. 444).

The Delaware, Lackawanna & Western first installed color-light signals with simplified aspects in 1920. The feature of this system of aspects is that the proceed aspect for both block and interlocking is one green light. The red light in all cases means stop, except when modified by a yellow or green light indicating respectively slow or restricted speed. Only eight aspects are required. This system of aspects is in use on the heavy suburban district. I quote the following from *Railway Signaling*, November, 1927, (p. 434):

"High-speed trains are operating on very close headway in heavy traffic territory on the Lackawanna, using the indications of wayside signals shown in the accompanying chart. It will be noted that these do not differ materially from those presented by Committee X at the stated meeting of the Signal Section, A.R.A., in September. These aspects and indications are used on multiple-track with reverse-traffic operation, through a considerable num-

ber of interlockings where there are not only through traffic, but also switching operations. By the simple expedient of a "light-out" relay, protection is secured against a less restrictive indication being given owing to a burned out lamp."

This system of simplified aspects has fully met the exacting requirements of a heavy train movement under close headway and, what is even more important, the trains are directed entirely by signal indications.

The Baltimore & Ohio first used color-position-light signals in 1921. The aspects are a combination of color and position. The proceed aspect is two green lights in a vertical row. The distinctive feature of the aspects is that for the three indications; proceed, proceed-at-restricted-speed, and proceed-at-slow-speed, no red lights are displayed. The necessity of disregarding the stop aspect displayed in conjunction with the proceed aspect is thus obviated. Under this system of aspects, the proceed aspect gives the command "Go," and not a confusing command, "Go-Stop."

On the recent installation on the B. & O. between Grafton, W. Va., and Parkersburg, 102 miles, for the operation of trains entirely by signal indication, color-position-light signals have been used throughout. Whenever the stop color (red) or the stop position (horizontal) is displayed, trains are required to stop; aspects permitting a train to proceed without stopping are not given in conjunction with the stop color or stop position. This means that the display of the red aspect means stop, no trains being "required" to pass a stop indication at speed.

The Institution of Railway Signal Engineers (of England) appointed a committee in 1922 to deal with the subject of signal aspects. The committee's well-considered report included a scheme of aspects for color-light signals. This scheme was put into use on the Southern Railway of England in 1926. The following is quoted from a description of the installation in *Railway Signaling* for June, 1926, (p. 234):

"With the view of simplifying the signals, as far as the enginemen are concerned, and to add to the efficiency of the signals as regards the greater capacity of the lines, the Institution of Railway Signal Engineers has taken a great interest in the four-aspect color-light system of signaling. * * *

"The four aspects in the color-light system the Southern is adopting are: Green to indicate 'clear'; double yellow for 'warning' (approach medium); single yellow for 'caution'; and red to signify 'stop.'

"A green aspect will tell an engineman going at any speed that he has a clear road and that the next signal ahead at that moment is either a double yellow or a green, and he will be sure to find one of the two when he reaches it, except under emergency conditions, when, of course, any signal may be exhibited. Passing a double-yellow aspect he receives a warning that he has full braking distance, and that the next signal ahead is at that moment in the 'caution' condition, i.e., exhibiting a single-yellow aspect. Under such conditions the engineman will take steps to get his train under control. The single-yellow aspect cautions him that at that moment the next signal ahead is in the 'stop' condition and that he must be prepared to stop at that signal. He always comes to a double-yellow and a single-yellow before he reaches a red or 'stop' aspect."

Under the system adopted by the Southern Railway, and I believe by other English railways, green means "Go" and red means "Stop." Green over red is not used for "proceed." To sum up, the simplified system of signal aspects in use on the A. T. & S. F., the B. & O., the D. L. & W., the L. V., the N. & W., the P. R. R., and on certain English railways, fully answers the question as to how to eliminate "red for the higher-speed indications."

This question is an old one as it was ably discussed in the Railroad Gazette, May 20, 1892, (p 362), under the title "To Avoid Running Past Red Light." In this article the suggestion was made that for the proceed aspect, the red light should be screened. Nothing was done, however, until the light signals came into use, and then it was discovered that by the simple expedient of extinguishing lights, it was possible to simplify the aspects, so that the aspect for proceed would give the order "Go," either by the position of the lights, or by the color (green), and with the lights for the "Stop" position, or red, extinguished. The A. T. & S. F. in 1912 urged the adoption of a simplified system of signal aspects.

The other question is how to "secure better light-out protection." This question has been answered by the position light and the color-position-light signals. Light-out protection for the color-light signal can be had by using a double-filament lamp, or two separate lamps, or by placing two red lights side by side, and close together.

To continue the use of color-light aspects identical with the night aspects of semaphore signals fails to take advantage of the ease with which an electric light can be extinguished for the purpose of simplifying the aspect. The subject is now receiving more attention than heretofore, no doubt owing to the fact that the night aspects of the semaphore signal were only distinctly visible at night, whereas the color-light signals are working 24 hr. a day, and, due to their higher visibility, are emphasizing the confusing character of the proceed aspect, which shows both green and red. The more general use of cab signals will also force us to simplify color-light signal aspects.

Why say "Go-Stop" or "Go-Stop-Stop" when we mean "Go"?

Advocates a More Progressive Sequence of Signal Aspects for a Four-Block System

By C. F. Stoltz

Signal Engineer, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio

THE color-light signal indications now in the Code are not altogether consistent. There is permitted the use of red indications under the most favorable conditions, which is not only unnecessary, but highly undesirable. Red being the most restrictive, yellow less restrictive and green unrestrictive, a system of signaling can be devised, which will display a consistent set of indications and afford the engineman a practical means of interpreting them. In my opinion the correct indications for a four-block system are:

Red-over-red = Stop
Yellow-over-red = 1 block clear
Yellow-over-yellow = 2 blocks clear
Green-over-yellow = 3 blocks clear
Green-over-green = 4 or more blocks clear

It will be noted that the colors displayed can be given a numerical value. Red being 0, yellow 1, and green 2. The sum of the colors displayed on any signal will indicate the number of blocks clear up to

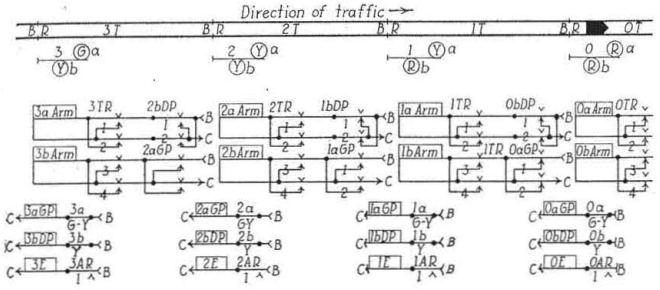
4, and even a novice can determine his position with relation to the stopping point. Another advantage in the above system, is that it has the effect of providing a preview to each block in advance, after the first restrictive signal is encountered. It will be noted that the lower light of each indication repeats the top light of that following, and the red indication appears only at the stop indication and at the lower light of the signal next approaching the stop signal.

If but a three-block indication system is desired, the yellow-over-yellow, may be omitted and the preview principle will still obtain. I believe the foregoing to be much more consistent and logical than the present A. R. A. Code indications.

Recommends Changing Two of the Signal Aspects

By CLAUDE H. CAMERON
Signal Foreman, Canadian Pacific, Toronto, Ont.

IN THE accompanying sketch I have shown a three-block system of signal aspects and written circuits for the control of the signals. It will be noted that signal *0* and signal *1* have been left as required by the A.R.A. code. In signal aspect *2* I have substi-



Arrangement of color-light signal aspects and circuit sketch for a three-block system of signaling

tuted yellow in the lower unit, but have left the yellow light in the top unit. In signal *3* I have substituted yellow in the lower unit. The circuit is so designed that in case of a lamp failure in any unit, the remaining unit will repeat the indication of the other unit, or it will give a more restrictive color-light aspect. In this scheme the use of red is eliminated for all high and intermediate speeds. The circuit shown is comparatively economical to install as the wiring is practically uniform at each signal location. This circuit can be applied to A.P.B. control on single track, by the addition of a stick relay and other slight changes.

How To Reduce Frost Trouble

"How do you prevent failures on account of frost on contacts, commutators, etc.?"

Proper Ventilation of Cases Will Help

By R. B. WORKMAN
Signal Maintainer, Chicago, Burlington & Quincy, Omaha, Neb.

ALL moving parts of a signal mechanism should be thoroughly cleaned in the late fall, and signal mechanism cases should be properly ventilated. A good way to do this is to install two 1-in. pipe elbows with screened inlets, one on the lower side of the case and the other on the upper side. These openings will provide an air draft and will tend to prevent frost from collecting on the contacts and commutators of the signal motor. This scheme has been tried out in the territory along the Missouri river near Omaha, and it has resulted in reducing signal failures 85 per cent.

The other more obstinate cases of trouble have to be handled differently. All of the vent holes in the case must be plugged up and an 18-watt, 10-volt lamp installed in the mechanism case, as near to the commutator as possible. This lamp should be hooked up in parallel with the signal light, which burns continuously on 10-volt a-c. power. Enough heat is dissipated by the 18-watt lamp to keep any frost from forming on the commutator and circuit breaker. Of course, where a-c. power is not available the foregoing suggestion cannot be followed. If the provision of suitable ventilation will not solve the difficulty, the only thing left to do is to apply chemically-pure glycerin on the commutator surface and circuit breaker contacts.

Carl T. Smith, assistant signal supervisor, Boston & Maine, Concord, N. H., replies as follows: "Years ago we experienced considerable trouble due to frost collecting in signal cases, switch circuit controllers, battery shelters, etc., but at the present time we are little bothered with frost trouble. This improvement is the more striking when it is recognized that a 30-deg. drop in temperature within 24 hours is not unusual. Plenty of ventilation is the best preventive. When this does not suffice, we use kerosene in a shallow dish placed inside the case. The maintainer can also wipe signal mechanisms with a cloth damped with kerosene. On Union Style-B semaphores, better ventilation can be secured by raising the pinnacle on top of the signal, by inserting small wood blocks."

Starting Motor Car in Cold Weather

"What special methods do you use to start your motor car in cold weather?"

Pre-Heating of Spark Plug Points Will Help

By R. B. WORKMAN
Signal Maintainer, Chicago, Burlington & Quincy, Omaha, Neb.

ALL motor cars should be equipped with an Imperial primer, so as to force gas into the cylinder in a vaporized form. When an engine is primed with an oil can, the raw gas tends to foul the spark plugs. The next step is to move the car until the ignition timer contact pin closes the circuit. Then close the coaster valve and the ignition switch and let the ignition circuit operate for about 15 sec. This action will cause the ignition points on the spark plug to become heated. The next step is to flood the carburetor, or if a primer is provided, give the engine three or four "shots" of gas from the primer.

When all of this has been done, open the coaster valve and give the motor car a quick and vigorous shove about a half-rail length. The car must have enough momentum so that it will turn the engine over at least three or four times after the operator jumps on board. The operator should jump on the car before closing the coaster valve in order to get more traction between the rails and the wheels. This is particularly desirable on slippery rails.

When the cold gas reaches the combustion chamber and comes in contact with the spark plugs, it vaporizes freely and inside of a few engine revolutions the engine will fire and continue irregularly until it is running