in order to take in the names of those to whom the leases may be assigned. It is all very well to make a lease for a piece of ground for a storehouse or some other purpose, and perhaps one month after that the lease may be transferred to some one else, or assigned, and that may go on two or three times in a year, so that there should be a proper place left for making a record of these transfers.

I do not know whether it is in the province of this committee to take up the matter of a proper indexing of the records of the plans—land plans, profiles, plans of buildings, bridges and such structures that are in charge of the chief engineer's office—but those of us who have had experience in getting the plans of subsidiary roads thrust upon us to catalogue and index, know the trouble we have had in putting them shipshape. And if there is any standard method of a card catalogue or other method of placing plans so that the plan will not go into the wrong bin, so that some systematic method of indexing and taking care of these things could be provided, if it is in the province of this committee, I would like them to take it up when the proper time comes.

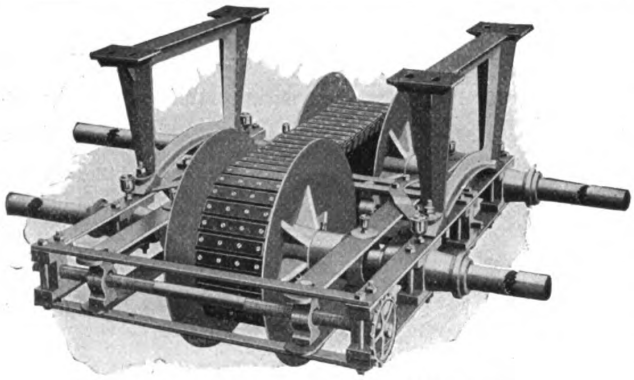
Mr. McDonald (N. C. & St. L.)—There is one more point in regard to this subject, and that is as to rights of way that are condemned. The committee here seems to be of the opinion that there are no titles to roadway through decrees of courts. That is a method we sometimes have to resort to to secure titles to land, and unless the real estate department or the chief engineer has a transcript of this decree it is an extremely difficult matter to keep track of them. Some provision should be made for the care of these decrees of the chancery courts, as well as other decrees.

The Reeves Variable Speed Transmission.

The accompanying engraving shows the Reeves Variable speed transmission, manufactured by Reeves Pulley Company, Columbus, Ind.

Step cones, taper cones and other well-known appliances, all bear testimony to the fact that a variable speed is an absolute necessity in many instances, while in others it would be very desirable, provided some better way of changing speeds was obtainable than those commonly used.

A step-cone accomplished only partially the results desired. By its use, a series of fixed steps are obtained, which are rarely exactly what is wanted, but only approximate the speeds required. Again, whatever results are obtained are accomplished, only after the annoying and time-losing process of shifting the belt.



THE REEVES VARIABLE SPEED TRANSMISSION.

It is claimed by the manufacturers of the variable speed transmission here mentioned, that it is built on scientifically correct principles; and, further, that their experience with the large number of their transmissions now in actual operation, has proven this point, from a practical standpoint.

These machines are built to meet the requirements of every condition, so far as possible, and are therefore built to hang from the ceiling, the same as an ordinary countershaft, or set upon the floor; they are built in sizes small enough to transmit 2 horsepower, also large enough to transmit 200 horsepower, together with intervening sizes; they are built to give a variation of 10 to 1, or any variation less than this.

The makers have furnished more of these transmissions for use in iron-working institutions, for operating planers, shapers, boring mills, milling machines, lathes, etc., than any other single line. They have also furnished them in large quantities to cement manufacturers, for regulating the speed of the rotary kilns; also to paper manufacturers, for regulating the speeds of their large cylinder rolls.

The large sizes are furnished either with heavy cast-iron base, or with the light steel frames, where it is desirable to place them on light foundations. Special machines will be furnished for any requirements outside of those listed.

SIGNALING AND INTERLOCKING.*

Your committee has not completed the work on any of the subjects assigned. Most of the data furnished by the railroads represented in the association and by the signal companies, which data is being used as a basis for the work of the committee, was not received until several months after the last annual meeting.

The many changes in the committee's membership, only one of the original members now being on the committee, and the consequent inability to hold meetings, prevented any effective work being done until this winter.

Meetings were held on January 22 and February 12, which were attended by four and five members, respectively. It is to be regretted that more has not been accomplished, but enough has been done to show that the committee has not been idle since the January meeting, and to indicate the character of the work to be performed.

As stated in the preliminary report made at the last annual meeting, the subjects which the committee would consider first would be those relating to interlocking plants. The joint use and ownership of so many plants by two or more railroads makes the general adoption of like rules, specifications and standards relating to such plants a matter of considerable importance.

It may be readily seen that these subjects, therefore, are of greater moment than those which pertain to the signaling of each road individually, and consequently should take precedence over those signal matters which affect each road separately.

Considerable work has been done on plans and specifications. Blue prints of the plans completed are submitted herewith. As numerous references to the plans will be made in the specifications, the latter will not be ready for submission until all of the plans are completed.

The usual practice of committees is to complete first the general definitions covering the subjects under consideration, but this committee thought it would accomplish most by the method it is pursuing. It is expected, however, that the definitions and the rules on maintenance will be ready for submission with the plans and specifications.

The committee will give careful consideration to the definitions and rules relating to signaling which have been promulgated by other railroad associations, and whenever possible such definitions and rules will be recommended for adoption.

The committee has endeavored to go rather minutely into the specifications governing the installation of interlocking plants and into the detail designs of interlocking appliances.

The many years of development in this branch of signaling has inevitably led to the establishment of certain fixed principles and certain fixed types of apparatus.

The lack of organized efforts on the part of the railroad companies has, however, prevented that uniformity in designs and methods which is necessary to secure the best results.

The materials at hand are sufficient and of such a character that this uniformity may be secured by following the best practices now in vogue.

The adoption of standard designs of signal, switch and lead-out material by most of the railroads will materially reduce the number of parts to be carried in stock at joint interlocking plants and will reduce the expense of construction and maintenance of such plants.

These appliances have been developed to such a point that the adherence to certain designs can be maintained with but few changes for a considerable period. Improvements in designs will necessitate a revision of some of the plans from time to time, but the adoption of standard designs should aid in discouraging the development of unnecessary appliances which mark no advancement, but do multiply the parts to be carried in stock and thus add to the expense of the maintenance of way departments.

Mounted and details plans have been made of high and dwarf signals and lead-out cranks, rocker shafts, chain wheels and foundations.

Drawings will be made of the other apparatus used in the lead-outs and at switches, and those parts of the tower necessary to show certain standard dimensions, applicable to the different sizes of machines to be provided for. No particular outside design for towers will be specified, as it is not considered expedient to have all towers of the same exterior appearance.

The dimensions of most of the plans of recommended designs are 15 inches wide by 20 inches long. Those plans which have different dimensions are made in the same proportion, namely, ¾ to 1.

The plans may be photographed down to any suitable size for publication in book form, while the tracings may be kept on file at the secretary's office, where members may secure prints for working drawings on application.

The committee has not yet come to a decision on the form of signal arm to recommend, although at least three designs are under consideration. It was the intention at first to recommend two different forms of signal arm castings for interlocking pur-

*Report of the Committee of the American Railway Engineering and Maintenance of Way Association, presented at the second annual convention, Chicago, March 12, 13 and 14, 1901.

poses, one of which designs is shown on the drawings of mounted signals.

The latter arm is designed for a 70-degree arc of travel and to give two indications by position; the other arm was to be designed for a 90-degree arc of travel and to give two indications by position.

The large majority of railroads employ signals, the arms of which, in the clear position, form an angle with the signal mast, this angle varying from 15 to 30 degrees on the several roads.

A few roads of prominence use the signal arm casting design for a 90-degree movement, the arms pointing down and standing parallel with the signal mast when clear.

The adoption of these two forms of arms would be in line with a conservative policy, for there is not a road of prominence in signal matters which could not adopt one or the other of these arms for interlocking signals and maintain the same relative positions of the arms for the indications to be given as in vogue at present.

Should the association adopt a two-position signal as standard for interlocking purposes, it would be adding the weight of its authority to the inconsistent practice of having the distant signal arm for the caution indication and the home signal arm for the stop indication, both standing at right angles to the signal mast.

The only distinction made at interlocking plants between the home and distant signals for day indications is the form and color of the blades.

Several roads which use two positions of the arms for giving three indications at interlocking plants, namely, stop, caution and clear, use three positions of the signal arm for giving these indications at train-order stations.

It is evident that the best practice would be to have a distinct position of the signal arm for each indication to be given, and to have the indications the same for interlocking signals, train-order signals, station block signals and automatic block signals.

There is no mechanical difficulty in doing this; the precedents established and the cost for making the changes are the two principal features which stand in the way of the accomplishment of this result.

After considerable thought and investigation the committee decided to look further into the matter and to secure the opinions of members of the association before making any recommendation.

A plan is herewith submitted of a design of signal arm which will answer for interlocking signals, train-order signals, station block signals and automatic block signals.

The stop indication is given by the horizontal position of the arm, the caution indication by the diagonal position of the arm, the arm inclining below and forming an angle of 45 degrees with the horizontal plane; the clear indication by the vertical position of the arm, the arm pointing downward and standing parallel to the signal mast.

The arm castings is designed to carry glasses for giving the three indications at night, with the lamp located on top or at one side of the mast. The counterweight is applied around the lower spectacle and is effective in any position of the arm. A line drawn from the center of the lower spectacle to the center of the arm bearing will not make a greater angle than 45 degrees with the horizontal when the signal arm is in the danger or clear positions. The spectacles are so arranged that either white or green may be used for the night clear indication, consequently a railroad using this type of arm may change from white to green without other expense than the cost of furnishing and putting in the green glass.

When used for interlocking purposes, two red glasses may be placed side by side, by which means a red light will be displayed at night, unless the arm is more than half way to the clear position.

The two latter features are also provided for in the signal-arm castings, designed for a movement through a 70-degree arc. These two features are important and should be provided for in whatever type of arm the association adopts.

The committee would like to have the opinion of the members on the desirability and practicability of adopting a single type of fixed signal for interlocking and block purposes.

It is not desired to have the association take final action on the plans at this meeting. It is best to defer such action until all of the plans are completed.

The committee, however, would be very glad to have the plans criticised and suggestions made, for if any changes in the methods are to be made, those changes should be determined now, as they would entail a large amount of work if made after all of the plans have been completed.

H. D. Miles, signal engineer, Michigan Central Railroad, Detroit, Mich., chairman; T. S. Stevens, signal engineer, Santa Fe Railroad, Topeka, Kan.; C. Lewis, assistant engineer, Baltimore & Ohio Railroad, Baltimore, M.; D. C. Morgan, engineer maintenance of way, Chicago & Alton Railroad, Kansas City, Mo., committee.

Discussion.

Mr. Miles—The report of the committee is brief, but I believe that it fully covers the difficulties which have been experienced, the character of the work to be performed and what has been accomplished. The committee, as stated in the report, has first considered the subjects in connection with interlocking plants, as that is undoubtedly the most important part of the committee's work, as it affects jointly the majority of the roads; and the most important part of that subject, it seems to the committee, is the classification of standard specifications, the standard appliances and rules on maintenance. The rules on operation of interlocking plants have not been considered by the committee, because, as stated in the preliminary report made at the last meeting, it is a subject which should be considered by operating officials, and as there were no objections made to that conclusion, the committee has acted according to its original intention. The membership of the committee has continually changed, and the chairman is the only original member left. Some work has been done on specifications and work will be done on rules for maintenance of interlocking plants. After that subject has been considered matters in connection with the general signaling systems used on railroads will be taken up next. We have three sets of blueprints here, so that any members who desire may examine them, of the drawings which have been made in connection with lead-out material and standard signal apparatus in connection with interlocking plants.

The committee considered that the important thing on which it should have advice at this meeting is the subject of a standard signal. The standard apparatus and other apparatus in connection with interlocking plants is comparatively easy to determine, but the signal which is to be observed by trainmen and which should be standard all over the country, if possible, and which should be standard for interlocking purposes, block signal purposes and for station block signal purposes, is another matter. We believe they should be of the same design and have the same position for the indication to be given. The committee finally was able to secure a drawing from the Union Switch & Signal Company, recently made by some of their best engineers, having a signal which could be used universally for all purposes, and the position of the arm, for the indication given, is explained in the report. The horizontal position of the arm would indicate danger for all signals—but that might not be so if the horizontal position should be also used for the caution indication or distant signal at interlocking plants, and depend on the fishtail blade, and color of the blade, to distinguish the distant signal from the home. But if that practice is carried on, the inconsistency will be recognized, as most train order signals, where three indications are desired, when given to one train, must be given to all others. The position and form of the blade must be the same, and while the committee has not yet fully decided what it shall do in that regard, it would be glad to have an expression of opinion from the members of the association. The committee will say in connection with this matter that it has rather favored the adoption of an arm having three positions for the three indications to be given, namely, danger, caution and clear, and have that signal used for all purposes.

Mr. Sullivan—I ask whether or not the committee recognizes the work which has been done by the American Railway Association in their joint committee on interlocking and block signals, in establishing requisites of installation, also principles and rules for the operation of signals? These rules have been adopted by that association and are now the standard practice on all of the lines of the members of that association. I would ask what effect that work has had on the work of our committee, and what recognition our committee has given to that practice.

Mr. Miles—The report states that the committee will give full consideration to all rules and recommendations concerning signals adopted by railroad associations. The American Railway Association has adopted certain rules on operation which, as I said before, it is not the intention of the committee to consider or make any report on in any way; but as to the rules on maintenance, the committee would consider those recommended by the American Railway Association, and it is the opinion of your committee that these rules on maintenance, and also on specifications, while covering in a general way the subject, do not cover it in detail enough for the signal engineer; and it was therefore the opinion of the committee that they would go more into detail and have gone into detail, so far as they have gone into the question of specifications, to a greater extent than they were gone into by the American Railway Association. We believe, however, there is no railway association that has done anything for standardizing apparatus, and when you go into the details of standard apparatus, you must go pretty thoroughly into the details of standard specifications.

President Wallace—It seems to me that the function of the American Railway Association should be to determine everything that relates to the indication. They should determine the form and establish the position of the signals. I believe it should be the function of this association to then determine the standard drawings or specifications and the mechanical construction and maintenance necessary to give expression to the indications required by the American Railway Association, which is supposed to control the matter from a transportation standpoint. What do you think of that, Mr. Sullivan? You are a

member of that association, and have had experience with this same matter in that association.

Mr. Sullivan—Probably, as you know—perhaps some of the members here do not—the committee on interlocking and block signals of the American Railway Association is a joint committee formed by combining the committee on safety appliances with the committee on train rules, and the two sit together and work together. As I understand they have not so far accomplished any work relating to block signals and interlocking. The function of that committee has not been merely to provide rules for operation, but, what required much greater time and thought, it had to determine the essential requisites of signals. That has been gone into with great care and has been put in careful shape; the language has been weighed with great exactness and nicety, to have it express the precise meaning that the committee wishes to have incorporated in what it considers the essential principles. The rules that follow that indicate the manner in which the operation of the signals shall be conducted and what the indications of the signals shall represent—how they shall be construed. I asked the question of the chairman of the committee, as a matter of information, in order that I might understand the status of the committee on this work. I fully appreciate there is ample room for work of this kind, and what I desired to ascertain was if the committee were working from these established principles—whether they recognize them as a basis for their own work, or whether they sought to go beyond them. It is quite necessary, in my opinion, in order to get the best results from association work, that the principles laid down by the experts in one association shall be recognized in another; certainly after they have received the approval of the association which they represent. In that way much time and labor is saved in not having to go over the same ground twice, and it puts before the railroad men of the country the fruit of the ripest experience in the particular line of development that is necessary to construct and put into successful operation a scheme of signaling or interlocking plants.

Mr. Miles—I think it would be a great mistake for the signaling committee of this association to do anything contrary to the work that has already been accomplished by the American Railway Association; and, as I stated, it is not our purpose to do so. There may be one or two things which our committee may feel should be altered on account of the developments which have taken place since the work of the American Railway Association was done; and I would like to ask Mr. Sullivan if he does not think that the committee of this association should, in the matter of requisites of installation and rules on maintenance, go a little more into detail than the American Railway Association has done. As I understand it, they establish more general rules or specifications, and that the aim of this association is to accomplish a little more, so that standard apparatus and standard appliances could be used at joint interlocking plants and economies introduced on account of the adoption by many roads of like specifications and like appliances.

Mr. Sullivan—I did not wish to intimate that there is necessarily any conflict between the work of this committee and the work of the other association. There need not be, and I hope there will not be. The work which the American Association has sought to do is to establish the fundamental principles of signaling. The manner in which those principles shall be given physical expression it has not gone into, and that is a phase of the work to which we shall give careful attention. This matter should be carefully considered by some body of men, and I do not know of any better qualified to handle it than the committee of this association. Of course, the preparation of these specifications and everything relating to maintenance is pre-eminently a matter which this association should deal with. I do not wish to appear in the attitude of criticizing our committee, but I have made these remarks with a view of securing more general information on the subject by all concerned. This is practically the first report of our committee, and a proper understanding of the scope of that work would help the members of the association generally to understand what to look for in the other reports.

Colonel Prout—I would like to suggest an idea, which is not exactly pertinent to the discussion of this report, but which is very interesting. That is, the time may come when the American Railway Association will be the head of these various associations; for instance, our association, the Master Car Builders, the Master Mechanics, and perhaps some others, and that the American Railway Association would naturally and logically be the head of that sort of work, and that an effort might be made to co-ordinate the work that has been done by these separate associations. I know that when Mr. Loree was elected as president of the American Railway Association he was very much taken with that notion, but I doubt if anything has been done in that direction, and it is very possible that nothing can be done in that direction. I thought it was an interesting idea to suggest, as no doubt a good many of the gentlemen here will sooner or later be members of that American Railway Association, and this is something for them to think about.

More particularly with regard to this report, it has struck me that possibly the time has hardly come for standardizing many of the details of interlocking and signaling, for the change which is going on in that sort of apparatus is pretty radical and pretty rapid. For instance, I imagine we may reasonably look forward to getting rid of disc and banjo signals before many years pass, and the substitution for them of automatic semaphores electrically operated. I suppose that is sure to come in. I have not a word to say against the disc and banjo signals, because I recognize their great utility to the service, but it seems to me we are in a transitional period, a period when it would be dangerous to try to do much in the way of standardizing this apparatus. I suggest this from the depths of my ignorance on the subject.

Mr. Addison (Long Island)—As I understand this subject, this committee desires the association to attack a signal which is as well known as the home signal. The functions of this signal have been recognized and set forth clearly by the joint committee on block signals and interlocking of the American Railway Association; and it seems to me it is a radical departure to attempt at this time to actually eliminate the distant signal. As I understand the committee, that signal would be eliminated if their recommendation was adopted. I ask for information on that point.

Mr. Miles—I will say that the distant signal would not be eliminated at all at interlocking plants, and it is a question which the committee would like expressions upon, as to whether the arm would have the same relation to the post as the home signal, and distinguish the arm by changing the form or color; or whether that arm should be, not necessarily the same, but have a position distinctive in the interlocking plant. The caution signal would have two positions, one 45 degrees below the horizontal, and the other vertical. The caution position would be 45 degrees below the clear position, and the distant 90 degrees, which is the vertical, and that practice is carried on at station signals and is becoming more the practice.

Mr. Addison—Do I understand normal position of the distant signal is to be 45 degrees?

Mr. Miles—That was the question which the committee would like to have the association discuss. It is not our settled idea, we would like your opinion upon it.

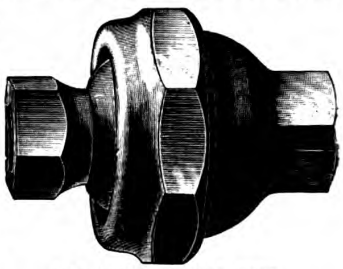
Mr. Markley—We have some trouble in keeping them adjusted in two positions, and with a third position it would seem almost impossible to do it.

Mr. Miles—The distant signal has only two positions, 45 degrees and 90 degrees.

President Wallace—The committee should continue its investigations of this subject, and give very close consideration to the recommendations of the American Railway Association, and confine its work, as Mr. Sullivan says, to the mechanical expression of the ideas outlined by that association, and that we should not as an association make any change from what the American Association has recommended as fundamental principles.

The Moran Flexible Joint.

The general utility of this device on railroads is becoming more marked every year. Having long since demonstrated its merits as a steam heat connection, it is now being taken up for air brake work with results equally satisfactory.



THE MORAN FLEXIBLE JOINT.

The Moran joint is also being extensively used as a flexible connection to rapid unloaders, steam shovels, pile drivers, rock drills and similar machinery, and is being adopted as a standard for these purposes by the manufacturers and users alike. This joint is also desirable for various connections about railroad shops, including pneumatic hoists, traveling cranes, expansion and contraction in pipe lines, in fact, for any service about a shop in which flexibility is a factor. The manufacturers of this device are the Moran Flexible Steam Joint Company, Louisville, Ky.

A new company in the railway supply field is the Jones Protective Coating Company of Chicago, manufacturers and sales agents of protective paint. This paint is marketed under the name of "Jones Protective Coating," and is covered by a trademark representing a man dressed in a complete suit of black armor. This paint has been manufactured by another company since 1883, and engineers who have seen the results of its use as a metal protector during the past 18 years, pronounce them remarkable. This material should be of interest to engineers and others in search of a paint having high protective qualities, especially for use in places where it has been found difficult to secure a paint that will adhere to the iron and furnish the protection required, on account of adverse conditions.