

azimuth work, devised by G. C. Comstock, Professor of Astronomy in the University of Wisconsin.

A description of the slide-rule, with illustrative examples of its use.

Various improvements in the field methods of surveying with the transit and stadia, prepared by L. S. Smith, Assistant Professor of Topographical and Geodetic Engineering in the University of Wisconsin.

The chapter on Mining Surveying has been entirely rewritten by Prof. Robert S. Stockton, E. M., of the Colorado State School of Mines, Golden, Colo., and by Mr. Edward P. Arthur, Jr., E. M., U. S. Deputy Mineral Surveyor, Cripple Creek, Colo.

A new Appendix B, being the latest Manual of Instructions for the Survey of Mineral Lands, brought up to 1899.

A new Appendix I, a reprint of the latest Rules for Restoring Lost Corners as issued by the General Land Office at Washington.

We need add nothing to this statement other than to say that the new articles on the stadia cover the use of an interval factor, a simple way to determine the wire interval of a transit, and the prevention of systematic errors. The purpose of the interval factor is to make it practicable to read one and the same rod with telescopes having different wire intervals. Having a rod graduated to the standard units the reading taken from it is multiplied by a factor peculiar to the telescope used. This method has not been adopted because of the extra computation, but by the use of a reduction table the labor is made very small. It is found that with a little practice and the help of a reduction table the field notes of an entire day may be reduced in 15 minutes or less.

The Consolidated Iron & Steel Companies.—The American Iron & Steel Association has compiled a list of the consolidations of iron and steel companies which have taken place in the United States since Jan. 1, 1898. The list is issued as a supplement to the Directory published annually by the Association and is corrected to February, 1900. It is an octavo volume of 66 pages and is to be obtained from Mr. James M. Swank, General Manager of the American Iron & Steel Association, at No. 261 South 4th St., Philadelphia, Pa. The price of the supplement is \$2. The last addition to the Directory of Iron and Steel Works appeared in 1898, and this supplement brings matters up to date. It contains an authorized description of the organization of each of the consolidations mentioned, giving capitalizations, officers and character of plant. Mines, coke ovens, railroads and ships owned by the consolidated companies are also given.

#### TRADE CATALOGUES.

Car Couplers, Buffers, Vestibules, etc.—The Gould Coupler Co., 25 West 33d St., New York City, with offices in Chicago & St. Louis, and works at Depew, N. Y., issues its catalogue for 1900. This contains good illustrations, with descriptions, of the various devices made by the Gould Company, and these are so well known that we do not need to enumerate them. It may be well to remind the reader, however, that besides couplers, buffers and vestibules the company makes steel platforms and draft rigging, malleable iron draft beams, steel axles, brake-slack adjusters and special malleable castings. The steam forge which was burned in 1895 was rebuilt with improved facilities and the company is prepared to furnish forgings in considerable variety. It is also prepared at its various works to supply malleable and steel castings. A novelty which we discover in this catalogue is an improved attachment to the lock of the freight coupler, designed to quicken the action of the lock and to prevent "any possibility of its being displaced by shocks." With this attachment the lock, it is said, cannot vibrate out of place. This consists of an eye bolt connection to the back of the lock which has a spring, abutting against a lug in the shank of the coupler. The action of this spring is forward and downward and the spring is long and works under limited compression. If it should break, the lock is still operative. An excellent feature of the catalogue is that the drawings are given with such clearness and completeness that one can get considerable satisfaction in studying the details.

Inspection Cars.—The Light Inspection Car Co., formerly the Railway Cycle Mfg. Co., of Hagerstown, Ind., issues a small pamphlet showing various designs of inspection cars of the Hartley & Teeter patents. These cars are essentially of bicycle construction; that is, with tube frames, bicycle saddles, pedals and handle bars, wire suspended wheels and ball bearings. They are provided also with rubber tires and an efficient brake. One can imagine that great speed can be made with these cars and that one can get over the track with them with the minimum of effort. These cars are made to carry one or two persons.

The Link-Belt Machinery Co., Chicago, has issued a 6 x 9 in. pamphlet illustrating different kinds of elevators and conveyors for handling general merchandise. These include inclined carriers for han-

dling freight from floor to floor in the same building, horizontal endless carriers and various styles of continuous freight elevators for small packages and barrels; somewhat similar elevators are used for handling ashes in power stations. Much of this apparatus is especially adapted for use in large freight houses and at docks.

The Boston Belting Co., Boston, Mass., has issued a little 16-page pamphlet entitled "Do You Know?" and in answer to the question the company explains it was established in 1828; that it makes all kinds of mechanical rubber goods, including belting, diaphragms, gaskets, hose, mats, matting, packings and numerous other articles; and that it makes these articles in many different forms.

Ventilating Fans.—The American Blower Co., of Detroit, Mich., sends catalogue No. 111, showing and describing a variety of disk ventilating fans. Vertical and horizontal fans are shown, to be run by steam and by electricity, either belted or direct-connected. Prices, dimensions, weights and capacity are also given.

#### Signaling as It Is and As It Might Be.

AN IDEAL ORGANIZATION.  
BY A. H. RUDD.

(Continued from page 197.)

The writer is specially aware that his ideas may by some be deemed extravagant from a financial standpoint, but are they not on the lines of true economy?

Although gross earnings are now largely increased, rates have not advanced and supplies have. High prices affect employees as well, and in order to enable them to live as comfortably as heretofore, their wages must be adjusted to this rise; otherwise they become discontented and seek other fields of labor where they can get more. How, then, can economy be effected? In manufacturing it is accomplished by labor-saving machines. In railroading it can be done—to mention one way—by increasing the capacity of present main lines, through shortening the intervals between trains. In large yards, the number of switchmen may be reduced by concentrating the control of switches under one or two men. A good many dollars are paid each day for foot races back and forth. Proper signaling will accomplish this end, though it is difficult to demonstrate in cold figures what this saving would be.

Block signaling is a species of insurance, and the only true way to estimate its value is to summarize the accidents occurring for a number of years, note carefully the cost of those which proper signals surely would or possibly might have prevented, and, then consider how many installations might have been paid for by the sums lost. Consider the cost of delays involved. Also the cost of detentions, which, even without accidents, might have been avoided in the ordinary course of traffic through more rapid handling of trains. Then remember that "an ounce of prevention is worth a pound of cure," multiply the amount of wreck damages by sixteen, and contemplate the result!

The following organization is suggested for a large road. For smaller roads some of the assistants may be dispensed with. It will be noticed that the Lehigh Valley organization has been quite closely followed, that being one which measures up to the requirements, better than most, and which with slight modifications will give the best results.

#### ORGANIZATION.

The Signal Engineer will report to, and receive his instructions from, the head of the engineering [or transportation] department, and will have charge of the installation and maintenance of all mechanical, automatic, electric and interlocking signals.

He will prepare plans, specifications and estimates for all new plants, and superintend their erection and installation.

He will prepare plans and instructions relative to the proper mechanical construction, manipulation and maintenance of all classes of signals, which, after approval by his superior, shall become standard. (Instructions regarding manipulation must also be approved by the General Superintendent, if the Signal Engineer reports to the Chief Engineer.) It shall be his duty to enforce adherence to such standards and instructions.

He will superintend the maintenance and any alterations of existing plants and fixtures.

He will make frequent inspections of all signaling plants and apparatus, and see that they are properly operated, and maintained in a satisfactory condition.

He will make periodical reports relative to the operation of the signaling systems under his charge.

He will investigate all reports of detentions to trains caused by failures of signals, and of damage done to signal plants or apparatus, reporting his findings and recommendations in the matter to his chief, to the Division Superintendent, and to any other official who should take cognizance of same.

He will prepare statements showing the cost of maintenance or installation of the various plants or branches of the service.

Division Superintendents will furnish the Signal Engineer any information and assistance he may require to enable him to discharge all the duties assigned to him.

All employees must obey the instructions of the Signal

Engineer in all matters relating to the proper construction, maintenance, and mechanical manipulation of the signal plants or fixtures in their charge.

The Signal Engineer will advise the division operators as to the disposition to be made of all messages relating to signal interruptions.

No removals or alterations, other than routine repairs incidental to the proper maintenance of signals, will be undertaken without orders from the Signal Engineer; excepting in emergency cases, in which event the Signal Engineer shall be notified as soon thereafter as possible, and satisfactory reasons given.

All requisitions for signal supplies will be prepared by the Signal Engineer, so as to insure perfect uniformity and accuracy of definitions.

The Signal Engineer will give special attention to training the various repairmen, to secure a reduction of expenses and higher efficiency of the force, by combining the work connected with the various classes of signals, as far as feasible.

The Signal Engineer will be assisted by an Electrician, a Supervisor of Interlocking, a Foreman of Signal Construction and a clerk (and draughtsman, if necessary). These will report to the Signal Engineer and be assigned their respective duties by him.

The Signal Engineer will report on a special payroll, to his superior, the time of all his men engaged on work on the different divisions, such time to be charged to these various divisions and the bills forwarded to the respective Division Superintendents.

For the head of such an organization a man should be chosen who can be implicitly trusted. He must be skilled in mechanical work, so that in designing standards, he may embody the best known practice, or improve upon it. He must be able to work out his own locking sheets, and make plans so perfect in detail that the Foreman of Construction will not have to spend half his time overcoming unexpected obstacles, which make the original plans impracticable, and the balance of it figuring out how the work is intended to be installed. He must understand all the problems to be solved, and be an electrician of ability, with thorough knowledge of the principles and methods of working the different systems, so that in designing his circuits no chances may be left for the display of clear signals erroneously. He must have knowledge of all the economic features of the profession, and possess a large share of executive ability.

Such men are to be found to-day, and are only waiting for the opportunity to demonstrate their ability when their handicap is removed. They should be given the opportunity to prove their competence, and when they have done it, be paid salaries commensurate with their positions and with those of other officials with like responsibilities.

They should have sufficient office help to enable them to get about and see what other signalmen are doing, and be allowed the necessary money for this purpose, that they may continually broaden and keep out of a rut. Then the Signal Engineer should be given, not absolute freedom from restraint by any means, but sufficient help, at large enough wages, to ensure the best results, and authority much beyond that with which any such officer is at this time entrusted.

Each autumn Division Superintendents should render reports of the points they deem it necessary to have signaled the ensuing year, the General Manager selecting from them the work most desired. Detailed plans and estimates on a liberal scale should then be prepared by the Signal Department after consultation with the engineering force as to possible track changes to simplify the signaling. A decision should then be reached as to the funds available for the purpose, and the points to be protected finally chosen. A secondary list could be made, of less important places to be attended to, if saving enough is effected over the estimates of the first list to allow it without exceeding the appropriation. In this matter of plans absolute authority should be given the Signal Engineer.

A little signaling, like a little knowledge, is a dangerous thing. If the work is worth doing at all it is worth doing well.

An installation should be complete throughout. All possible routes should be signaled and separate levers provided for at least the high speed route signals and preferably for all. All switch and lock levers should be underloaded rather than overloaded. Two or three light levers can be handled more quickly than one heavy one, and the maintenance cost is decreased 40 or 50 per cent. by such arrangement. It also lessens in great degree one of the danger points in mechanical interlocking; that of the switch remaining in one position with its lever in the other, through a broken connection, thus releasing the locking for a wrong route.

Careful inspection has sometimes prevented such trouble, but the possibility of it, though remote, exists. An additional and perfect preventive is the installation of circuit breakers in connection with and operated by the facing-point switch itself in each high-speed route and placed in circuit with electric locks on the levers of signals governing over all same. Electric locks should also be provided in places where detector bars will not absolutely protect, and especially to hold routes after distant signals have been cleared. These points, often neg-

lected, provide loopholes in the system and an axiom of signaling science is that "if there is a possible chance for any mistake, it will certainly be accepted sooner or later."

Expenditures on these lines will not be as impressive to the traveling public as fine stations and grounds, beautiful flower beds and other ornamentation and luxurious cars, but the lack of them will more forcibly impress this same public when avoidable accidents occur through their omission.

In the automatic block signal field, trolley and other foreign currents frequently pass over the rails, and knowledge of means to counteract them is often essential to prevent the most serious results.

Materials and workmanship in installation should be of the best. The almost universal employment of wood for foundations necessitates expensive renewals on an average every five or six years. During renewals switches and other functions must often be disconnected and worked by hand. The use of concrete or cement piers obviates this necessity, and the additional first cost is more than saved in a short time.

The Signal Engineer, who understands these matters, should have final decision as to plans, materials and methods of construction.

[TO BE CONTINUED.]

#### Present Status of "Light Railroads" in England.

What are the best means of encouraging the building of light railroads? constitutes Subject 33 for discussion at the International Railway Congress, to be held next September; and reports on the subject have been made by Mr. Joseph Tatlow, Manager of the Midland Great Western Railway of Ireland, and by Mr. W. M. Acworth. Mr. Tatlow reports for Great Britain and Ireland; and the report, with appendix, fills over 80 pages of the Bulletin for January. Mr. Tatlow discusses the law in detail, gives a history of State-aided railroads built in Ireland since 1839 and then goes on to tell what has been done under the Light Railway law of 1896. Only one railroad has been finished and put in operation under this law, but the applications which have been made and the action of the Board of Trade and the Light Railway Commissioners on these are reported at great length. Inquiries were made of 44 railroad managers in England and replies are given showing their views on the subject of building inexpensive railroads to accommodate rural districts. Mr. Tatlow refrains from stating his conclusions as to the probable benefits of the Light Railway act, as it will be necessary to wait for further experience before it will be possible to form an opinion. The Act appears thus far to have worked with smoothness and efficiency.

Mr. Acworth was asked to treat the subject with reference to countries other than England, but he says that he has no special knowledge which would enable him to do this successfully, and he makes a short report criticizing the working of the English Act. He has no great hopes of beneficial results from this law, for the reason that the relaxation of the restrictions which are imposed by the Government on the construction of standard railroads has not been carried far enough. The standard of construction and of safety is still too high. Many of the companies already started are likely to find it impossible to earn a profit on their capital. The Government grants not more than 20 per cent. of the capital necessary, even in poor districts, while railroads already running in Ireland have been built at the sole expense of the Government. State aid is difficult to manage at best, as it will be impossible to adjust the rival claims of old unsubsidized railroads and new State-aided lines.

#### TECHNICAL.

##### Manufacturing and Business.

George A. Barden, formerly Superintendent of the works of the Standard Pneumatic Tool Co., Chicago, has been appointed Eastern Agent of the same company, with headquarters at 619 Washington Life Building, 141 Broadway, New York.

McCord & Co., Chicago, makers of railroad supplies, have moved their Chicago offices to Suite 1475, Old Colony Bldg.

The American Locomotive Sander Co., of Philadelphia, informs us that on the first of the month it had on its books orders for 901 track sanders for future delivery. This indicates a rapid growth in the application of sanders to locomotives.

F. M. Pease, of Chicago, has bought all the narrow-gauge rolling stock of the Baltimore & Lehigh RR, which road is now being made standard gauge. Mr. Pease has also delivered 50 box cars to Swift & Co. and 100 cars of the same type to the Pittsburgh, Shawmut & Northern RR.

The Illinois Central is building a second Jordan earth and ballast spreader. The Grand Trunk has bought from H. H. McDuffy, sole agent, 521 Monadnock Block, Chicago, a license to build two of these machines for use in the grade reduction and double track work to be done this season on the Chicago & Grand Trunk division.

The New York offices of the Chicago Pneumatic Tool Co. have been moved from 122 to 95 Liberty St.

#### Iron and Steel.

Jones & Laughlins, Ltd., operating the American Iron & Steel Works at Pittsburgh, Pa., and Laughlin & Co., owning and operating the Eliza furnaces in the same city, which are practically the same interest but which have been operated separately, have been merged into one company hereafter to be known as the Jones & Laughlins, Ltd., capitalized at \$20,000,000. The officers of the new company are: B. F. Jones, President; C. M. Laughlin, Vice-President; Willis L. King, Secretary, and B. F. Jones, Jr., Treasurer. The holdings of Laughlin & Co. in the Lake Angeline Iron Co., the Monongahela Connecting RR. and in ore, coal and coke properties have also been acquired.

Bids will be wanted about May 1 by James H. Purdy, Thornton, N. M., President of the Cochiti & Northwestern Ry. Co., on 52-lb. rails.

Horace Crosby, Second Vice-President of the National Tube Co., died of pneumonia at his home in Allegheny, Pa., April 6. He was born in Belfast, Me., December, 1847.

The Detroit Bridge & Iron Works has a contract with the Grand Trunk Ry. for bridges requiring 4,000 tons of material, and also a contract for 2,000 tons of bridge steel for the Missouri Pacific.

Owen Sound, Ont., offers subsidies, etc., for an iron and steel plant to cost \$600,000. A company is being organized with a capital of a million dollars.

The Blue Bell Iron & Steel Co. of Philadelphia, Pa., has been incorporated in Delaware, with a capital of \$300,000, by Herman Becker, Edwin A. Yarnell and Joseph W. Thompson, all of Philadelphia.

The Risdon Iron & Locomotive Works, San Francisco, Cal., are reported to have secured control of the Pacific Rolling Mill of that city. It is stated that the Risdon Co. will spend about \$3,000,000 for a ship-building plant and a large dry dock.

The Pittsburgh Steel Construction Co. has been organized by Geo. M. Bole, John L. Mullen and others, and headquarters have been opened in the Westinghouse Bldg., Pittsburgh. The company proposes to build steel bridges, buildings, etc.

Col. David Campbell, Superintendent of the Empire Iron & Steel Company's furnaces at Philadelphia, Pa., died in that city April 3. He was born in Middletown, Pa., Dec. 30, 1832.

Andrew D. Cramp, at one time Superintendent of the Cramp ship yards at Philadelphia, died in Boston, Mass., March 29, at the age of 43. He was a son of William H. Cramp and was born at Philadelphia.

Three bills before the Ontario Legislature authorize municipalities to grant bonuses to companies establishing iron and steel works. One bill is to enable the city of Collingwood, Ont., to pay \$15,000 to the company which proposes to establish a steel plant at that place. Another is to enable the town of Fort William to grant \$50,000 to the Mattawin Iron Co. which will build an iron furnace in that town. The third is for a \$25,000 grant for a copper smelter in the same town.

The Lukens Iron & Steel Co. is having a universal plate mill built at Coatesville, Pa., to roll plates from 9 in. up to 48 in. wide and 100 ft. long.

The Maryland Steel Company, Sparrow's Point, Md., has an order for 1,510 tons of rails for the Metropolitan Railway of London, England.

The Nashua (N. H.) Iron & Steel Co. has been sold to the Eastern Forge Co. of Boston, Mass. E. F. Chandler, the present manager, will continue to act as agent.

The Gillette-Herzog Mfg. Co. of Minneapolis, Minn., has the contract to rebuild the Convention Hall at Kansas City, Mo., which was destroyed by fire last week. The Carnegie Co. will supply the greater part of the material.

#### New York State Canals.

The bill appropriating \$200,000 for surveys of the canals of the State of New York was unexpectedly passed last week at Albany.

#### The Nicaragua Canal.

So far as we can now judge the Nicaragua Canal bill will not be passed at this session, although of course we cannot be certain until Congress has adjourned. No doubt its passage this session would be premature and unfortunate, considering the very important report that the Commission is certain to make within the next 10 months.

#### Steel Underframe Cars.

The Pressed Steel Car Company has taken an order from the Philadelphia & Reading Railroad for 540 box cars with steel underframes. These cars are of 80,000 lbs. capacity. The company has also an order for 1,000 gondola cars with steel underframes from the same road. The company will add somewhat to its new establishment at McKees Rocks for the purpose of building cars of this type.

#### Cost of Treating Ties at Edgemont.

In describing the tie treating plant of the Burlington & Missouri River RR. in our last issue, page 213, it was said that the cost of treating by the chloride of zinc or "Burnett" process (which is used at Edgemont, S. D.) is from 12 to 15 cents for each

tie. We learn from the Chief Engineer of the road that these figures are a little too high, the cost being from nine to ten cents, and never exceeds the latter figure.

#### Grand Trunk Railway Bridges.

In the annual report of the Grand Trunk the Chief Engineer says the replacement of the old bridges, which are too light for the present loads and rolling stock, by others sufficiently strong to meet all probable future requirements, has been carried on more slowly than was expected by reason of the impossibility of obtaining the necessary steel for superstructure. All the bridges between Montreal and Island Pond, a distance of 147.83 miles, have been finished, and trains of maximum weight are now running over them. Between Island Pond and Portland, 149.42 miles, the renewal of the bridges is being pushed forward as rapidly as the short supply of material will permit. The Victoria Jubilee bridge has been finished, including roadways, footpaths and approaches, and was opened to the public Dec. 1 last.

#### Carnegie Pattern Shop Burned.

The pattern shop of the Carnegie Steel Co. at Homestead, Pa., was burned during the night of April 7. Numerous patterns and armor-plate drawings that were to be submitted to the Navy Department were destroyed. The loss was \$75,000.

#### Chicago Drainage Canal.

Water was turned into the Van Buren St. by-pass, Chicago, on the morning of April 6. Its completion is the last important work remaining on the drainage canal, and the filling of the tunnel will diminish the velocity of the current in the Chicago River. The by-pass at Adams St. was opened Nov. 2 and noted in our issue of Nov. 18, 1899. The combined length of the two by-passes from Adams to Van Buren Sts. is about 1,150 ft. They are crescent-shaped tunnels under the west bank of the South Branch of the Chicago River, and were made necessary by the narrowness of the river and its inability to carry the required amount of water. They will carry 100,000 cu. ft. of water a minute at their fullest capacity. The tunnels run under three buildings, three railroad tracks and the teaming yards of the Fort Wayne railroad and the work has been done without causing any interruption to traffic. They are 50 ft. wide and 16 ft. deep, with concrete walls on both sides, on which rest steel girders weighing 15 tons each, placed 10 ft. apart. Between the walls concrete arches 4 ft. thick at the girders and 15 in. thick at the crown are built to add to the strength of the surface. Lydon & Drews had the contract for the substructure, in which 2,500,000 ft. of timber (board measure) and 76,000 lineal ft. of piles, and 8,000 cu. yds. of concrete for the walls was used. The superstructure was built by Griffith & McDermott, and 4,000 cu. yds. of concrete and 1,500 tons of steel have been used by them. The work has been carried on day and night and Sundays under the direction of Mr. G. M. Wiener, who has been the engineer in charge, and it has cost about \$550,000.

#### Subway to East Boston.

The Boston Transit Commission has asked for sealed bids for building Section A of the East Boston tunnel in Maverick Sq. and Lewis St. The section consists of about 139 ft. of open incline, and 690 ft. of two-track subway. Bids will be received at the office of the Commission, 20 Beacon St., Boston, Mass., until 12 o'clock noon, Friday, April 20. A bond to the amount of 20 per cent. of the contract will be required. H. A. Carson is Chief Engineer.

#### Block Signals Needed in France.

The Minister of Public Works in France has designated the following lines which it is declared should be equipped with the block system as soon as practicable. He specifies the portions which should be first equipped as follows, Table No. 1 giving the most important, and Table No. 2 those next to be looked after:

TABLE NO. 1.

Line.	Km.
State Railroad, Chartres to Bordeaux (sections not yet equipped).....	434
Paris to Royan.....	47
Total.....	481
Eastern.....	6
Southern.....	205
Orleans, main lines 302 km., branch lines 227 km.....	529
Western, main lines 127 km., branch lines 170 km.....	297
Total.....	1,628

TABLE NO. 2.

Line.	Km.
State lines, Nantes to Bordeaux.....	373
Paris-Lyons Mediterranean, main lines and branches.....	895
Orleans, Brive to Montauban.....	163
Western, main lines and branches.....	174
Total.....	1,605
Aggregate, 3,233 kilometers or 2,009 miles.	

#### THE SCRAP HEAP.

##### Traffic Notes.

It is reported that the Wabash road, after paying employees by check for a long time, will resume the use of the pay car.

The Buffalo, Rochester & Pittsburgh has voluntarily advanced the pay of locomotive firemen. It is said that the advance amounts to 10 per cent.