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Half a Century of Constructive Engineering Service

An Appreciation of John D. Isaacs

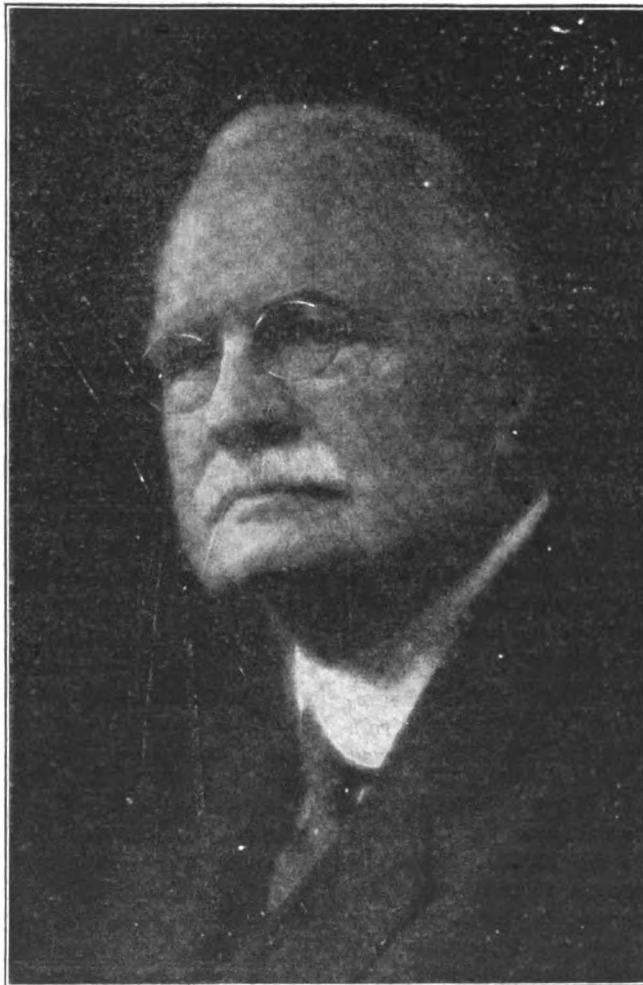
FOR half a century John D. Isaacs, consulting engineer of the Southern Pacific Company, has been engaged in a broad field of engineering work requiring unusual versatility. He is pre-eminently a constructive critic and as such has exerted his greatest influence on the development of railroad engineering in this country. Affiliated with the builders of the Southern Pacific since the days of its infancy he achieved success through unqualified loyalty to the company and untiring energy in carrying out the great programs of standardization instituted by its general officers. He has not confined his talents to any single field of activity, but has successfully applied himself to the solution of a vast number of the perplexing engineering problems which were encountered during the building of a great railroad system, from the days when scarcity of finished materials imposed extraordinary difficulties in design and construction. As an inventor, a resourceful experimenter, an accomplished structural designer and architect, and an expert on track and maintenance of way, he has made many notable contributions to the advancement of railroad engineering, reflected not only in their direct results, but also in their influence upon other men. Not a few of the present officers of the Southern Pacific received their early training under Mr. Isaacs, and many have remarked upon his eagerness to give due credit to his subordinates. Keeping personal considerations ever in the background, his primary purpose has always been to seek out the best talent for the company.

It seems appropriate at this time to record a few of his contributions to science and engineering. Among the inventions in which he shared may be mentioned the portable wood-preserving plant, the taper rail, the rifled oil pipe line, and the first apparatus which successfully produced what were, in effect, motion pictures. In re-

search and experimentation, his work is notable particularly in the study of steel rails and in wood preserving. His brilliant contributions to the studies of tonnage rating and traction have had a profound effect on the development of successful operation of freight trains

of large units. Mr. Isaacs was born Oct. 6, 1848, at Richmond, Va. He was educated at the University of Virginia, in the scientific course, which in those days was closely associated with the Department of Liberal Arts. His early practical training was as a machinist apprentice in Baltimore, Md., and Wilmington, Del. In 1875 he went to San Francisco and entered the service of the lines now comprising the Southern Pacific Railroad, as a draftsman in the maintenance of way department. His progress was rapid, and it was not long before he was made chief draftsman and later assistant superintendent of bridges and buildings. In 1890 he became acting superintendent of bridges and buildings and a year later, assistant engineer maintenance of way of the Pacific System of the Southern Pacific Co. and Lines in Oregon. Immediately following the launching of the project, by J. Kruttschnitt (then director of Maintenance and Operation, Southern Pacific Company and

Consulting Engineer of Southern Pacific
in Service of Company for
Forty-Five Years



JOHN D. ISAACS

Union Pacific System) to establish standards common to all the Associated Railroads—"Common Standards"—at the Chicago meeting of the Harriman engineers in 1905, Mr. Isaacs was appointed consulting engineer of Southern Pacific Co. and the Union Pacific System, becoming the consulting engineer for all of the Harriman Lines and their subsidiaries. After the dissolution of the Harriman property in 1913, he was retained as consulting engineer of the Southern Pacific Co., and still occupies that position.

In the early seventies the late Senator Stanford, who was one of Mr. Isaacs' closest friends and who often

sought his advice in mechanical problems, made a bet of \$25,000 with James W. Keene that a trotter at one period of the stride had all four feet off the earth at once. Historically, this bet marked the birth of the motion picture. It was decided to use a number of cameras, set side by side, to make an accurate photographic record of a trotting horse. After several devices for mechanically operating the shutters of the cameras had failed, Mr. Isaacs was called in and finally devised a simple electromagnetic release, which successfully recorded a series of photographs, settling the bet in favor of Senator Stanford. A considerable sum of money was spent on these experiments and it was not until 1878 that they were concluded.

INVENTIONS

The steady drain on the great timber resources of the Pacific Coast threatened eventually to denude the forests and attention was turned to the study of wood-preservation. Being one of the foremost designers of wooden structures, and having worked out plans making possible the construction of wooden trusses and drawbridges of long span, it was quite natural that Mr. Isaacs should become prominent in the study of wood preservation. His appointment to complete charge of the wood preservation work of the Southern Pacific was one of his first assignments as consulting engineer. He is generally recognized as one of the ablest authorities on wood preservation in the United States, having won this distinction by his active work in the practical development of the creosoting and Burnettizing processes, now so extensively used. His joint invention with W. G. Curtis of the portable wood preserving plant, immediately after he was appointed second assistant engineer maintenance of way in 1892, marks one of the greatest advances in the industry. One has only to examine the maintenance records of the railroads which treat ties to realize the importance of this work.

The Taper Rail devised by Mr. Isaacs to connect two abutting rails of different section has been very widely used. This simple device, now well known to all track men, consists merely of a piece of rail from 8 to 16 feet long so forged that the ends correspond respectively to the two sections to be joined, permitting the use of ordinary joint bars without the annoyance experienced in the connection of rail by so-called compromise joints.

The Rifled Pipe Line, invented jointly by Mr. Isaacs and J. B. Speed in 1905, afforded a temporary solution for what seemed at first to be impossible. Some of the heavy California oils could not be transported in pipes without expensive preheating, on account of the frictional losses in head. Mr. Isaacs and his assistant conceived the idea of rifling the pipe like a gun bore, to give the oil a whirling motion. Then, when pressure was applied water (introduced as a lubricant) mixed with the oil and being somewhat heavier would be thrown by centrifugal force against the pipe surface and maintained there as a thin film, thus permitting much easier passage for long-distance pumping. This use of water as a lubricant appeared to make it impossible for a crude oil to stick to the pipe and impede its progress. After exhaustive preliminary tests, an experimental rifled pipe line was constructed between Delano and Volcan, a distance of 31 miles. The results were good enough to warrant the laying of the 282-mi. line of 8-in. rifled pipe from Delano in the Kern River oil fields to tidewater at Port Costa.

In 1899 J. Kruttschnitt, then general manager of the Southern Pacific Company, appointed committees of engineering officers of the maintenance and mechanical departments to prepare a uniform and consistent system of locomotive tonnage rating on all divisions of the company's lines. The paper on tonnage rating, written by W. G. Curtis, engineer maintenance of way, with the able assistance of Mr. Isaacs, is an outgrowth of this work which has attracted wide attention. After the study of detailed line profiles and extensive mathematical analyses, here was developed a theoretical basis for rating the tonnage to be handled over a division by a given class of locomotives at the required speed according to the time tables for the trains—a matter of the greatest importance on a busy section of single track. In 1909 the first paper was supplemented by another—"Most Efficient Speed for Freight Trains," prepared jointly by Mr. Isaacs and his assistant, E. E. Adams, now consulting engineer of the Union Pacific System.

THE HARRIMAN "COMMON STANDARDS"

Immediately before his appointment as consulting engineer, Mr. Isaacs attended a Chicago meeting of Union and Southern Pacific engineers, which was called in 1905 by Mr. Kruttschnitt to establish standards for way and structures common to all of these lines. He had with him plans of the standards then in force on the Pacific System of the Southern Pacific Company, and was thoroughly familiar with all their advantages, having been in charge of the actual preparation of many of the drawings. He presented them in a forceful way and they were adopted as "Common Standards." Not only was this a great personal triumph; the adoption by the company of the policy to establish "Common Standards" was successfully worked out by Mr. Isaacs in collaboration with the other engineers of the Maintenance of Way Department of the Union and Southern Pacific Systems, and has contributed to the splendid appearance and systematic neatness of the properties for thousands of miles. These results were obtained through the scientific standardization of track and structures and the rigid policing of right of way and structures by operating and maintenance forces.

The classic series of Common Standard Bridges from 30 ft. to 200 ft. span, varying by 10 ft., both single and double track, were designed by Mr. Isaacs and have stood the test of 16 years of service and have been rewarded by generous praise of bridge manufacturers. There has been a considerable saving on the cost price of every standard bridge ordered, accounted for by the saving in drawings and templets. Fully as great, perhaps, as the monetary saving is the avoidance of untold discussion by this definite bridge policy. There are no arguments necessary regarding the type, depth and the many petty details which ordinarily harass the management on every new bridge project.

Among the first of a long series of important designs made by Mr. Isaacs, was the large car transfer steamer Solano, operated for many years across the Straits of Carquinez, between Benicia and Port Costa, Cal., where the great rise and fall in tide necessitated the use of unusually long ferry aprons. When he was chief draftsman in 1876, Mr. Isaacs designed and drafted, himself, the plans for all the timber trussing for the Solano, as well as the 100-ft. span aprons and machinery, including hinges and pontoons to carry the rolling trainloads from the shore to the steamer deck. This was considered a

remarkable accomplishment at the time, as there was no precedent for aprons of such span and loading.

IMPORTANT BRIDGES AND STATIONS

Important structures built under Mr. Isaacs' direction are too numerous to mention and only a few of the most notable can be recorded here. The double deck and track Sacramento River drawbridge is said to be one of the heaviest ever built. Other examples of his work are the Coos Bay drawbridge, 458 ft. long; the reinforcement of the Pecos River viaduct, 1,516 ft. long and 320 ft. above the river bed, with practically no interruption to traffic; the lift bridge over the Willamette River, Portland, Ore., and the Berwick drawbridge over the Atchafalaya River, La., involving the deepest caisson work ever attempted for bridge piers. His work has been notable in the design of general layouts for passenger terminals, freight car classification yards, and railroad shops. More recent work of this character includes the Galveston Freight Terminal and Grain Elevator; Marine Ways at Alameda, Cal.; Empalme Shops, Mexico; and the Pacific Electric Shops and Yards at Torrance, Cal. He has a fine sense of the esthetic features of design and is a proficient student in the architectural forms. Many have remarked upon the characteristic beauty of his passenger stations, and he should be accorded full credit for those at San Antonio, Tex., and Spokane, Wash.

Mr. Isaacs has always favored experiments to try out the value of new devices, with the result that the Southern Pacific has been a leader in the use of many important improvements. He is keen to observe flaws in bad schemes, but is always willing to accept for trial any device which appears to have merit. He played an important role in the experiments which led to the installation, by the management, of the large mileage of automatic block signals on the Southern Pacific Lines. The lessons to be drawn from train accidents have been thoroughly appreciated by Mr. Isaacs and he has displayed great acuteness in the analysis of causes, recommending revision or improvement of that part of track or rolling stock which appeared to contribute directly or indirectly to the accident.

Probably his most important work in the promotion of greater safety in railroad practice has been in the study of steel rail, and the resulting revision of specifications and inspection methods. Recognizing his intimate knowledge of the practical side of the perplexing rail situation, the American Railway Engineering Association conferred upon Mr. Isaacs the honor of the chairmanship of its Rail Committee for many years. Taking up this important subject in 1906 he started a vigorous campaign to reduce the number of rail failures on the Associated Lines.

This work, so vital to safety, with the high speeds and tremendous moving masses attending modern railroad operation, has been rewarded with most gratifying results. In a recent annual report of the Southern Pacific Company there appears the following statement by J. Kruttschnitt, chairman of the Executive Committee "By the exercising of greater care in inspecting and purchasing, the failures of rails per 100 miles of track, equated as to traffic borne, have fallen 85 per cent in eight years and in number are but one-fourth as many as those on all railroads in the United States and Canada, based on the latest available data." This may generally

be attributed to the policy of the management and to Mr. Isaacs' work in bringing about changes in section and specifications, and to the establishment of a special system of inspection, and his ingenious and original work in the compilation of statistics, including each rail failure on the entire system. The standard A. R. A., Series A, and R. E. Sections of the American Railway Engineering Association, which have come into such general use, were suggested by Mr. Isaacs and he supported them with conclusions drawn from the Southern Pacific failed rail statistics, which are considered by many the most comprehensive data on this subject in existence.

The diversity of work herein recorded emphasizes the fact that Mr. Isaacs has not confined himself entirely to the field of civil engineering. On many occasions his advice has been sought in the design of rolling stock and in mechanical problems. In the preparation and revision of the designs of the Southern Pacific standard equipment, Mr. Isaacs has worked jointly with F. W. Mahl, director of purchases and mechanical engineer, and with him worked up the design which was the basis for the Southern Pacific's suggestions for a standard single-sheathed box car, recently submitted to the American Railroad Association, though at the present writing it has not been adopted. The retention of a 200-lb. boiler pressure for superheated steam locomotives, a much disputed point, was recommended by Mr. Isaacs and finally ordered.

For the past seven years he has had charge of the centralized plan of inspection, established by the Harri-man Lines in 1912. This system, under which \$10,000,000 worth of materials annually were subjected to inspection, was instituted by Mr. Isaacs and has resulted in considerable economies as well as a marked improvement in uniformity of materials.

AN ARBITER OF CONTRACT DISPUTES

As a committee of one on arbitration of disputes between contractors and the Company, Mr. Isaacs enjoys an enviable reputation. The story is told of a contractor who once refused to pay a claim for repairs to a recently finished job. Litigation was threatened, but the contractor finally said: "Let us lay the whole matter before Mr. Isaacs; whatever he decides I am sure will be fair and right, and as far as we are concerned will be final." This is but an incident illustrative of the esteem in which he is held by large contractors who have been engaged in work for the railroad company.

Up to the time of Federal control, the Southern Pacific made contracts covering its larger requirements of certain standard materials, which were in the form of agreements between the Director of Purchases and the manufacturer. There were some contracts in which Mr. Isaacs was named as sole authority in cases of dispute as to the classification of materials, and there are no complaints on record of his ever using this absolute authority to impose unfair burdens.

Though a man of high professional attainment, Mr. Isaacs' life has been one of simplicity. Naturally of a retiring disposition, he has never sought the public eye. Always preferring the quiet satisfaction of a small circle of friends to the excitement of public gatherings, it has never been his custom regularly to attend the meetings of technical societies, except when his influence might be needed for the success of some important measure.