

BRIDGE OVER THE MISSISSIPPI RIVER AT THEBES, ILL.

Contracts have recently been let by the Southern Illinois & Missouri Bridge Company for a double-track railroad bridge to be erected over the Mississippi River between Thebes, Ill., and near Gray's Point, Mo., about 42 miles from Cairo, Ill. The bridge will be owned and operated by the Bridge Company and will be used by the Chicago & Eastern Illinois, the Illinois Central, Missouri Pacific and the St. Louis Southwestern, these companies paying a fixed charge for its use.

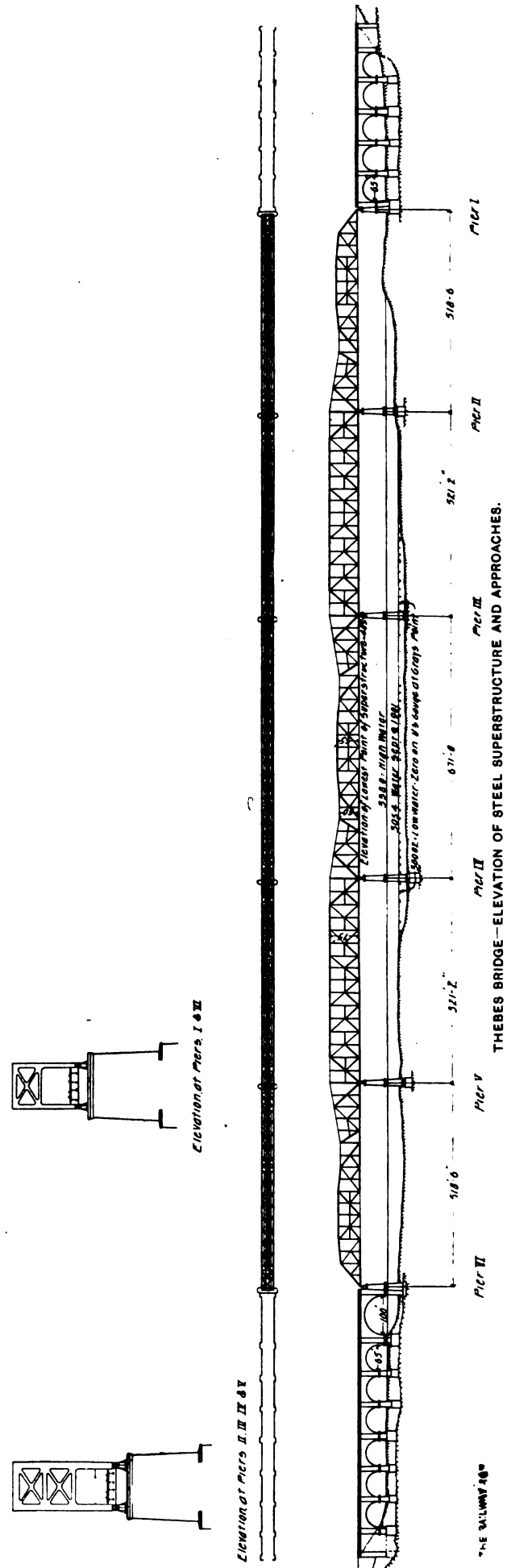
Of the roads mentioned, the Chicago & Eastern Illinois and the Illinois Central will approach the site of the bridge on the east, the Missouri Pacific and the St. Louis Southwestern on the west, and the structure will be employed for interchange of traffic across the river, doing away with the ferry service now used at that place. It will have a total length of 3,907 feet, consisting of five steel spans, with masonry and earth approaches at either end. In the steel superstructure the channel span will be 671 feet in length, consisting of a 366-foot suspended truss, with two cantilever arms, each 152 feet 6 inches center to center of end piers. On either side of the center span will be fixed trusses 521 feet 2 inches long, while the shore spans will be 518 feet 6 inches in length, each consisting of a suspended truss 366 feet in length, with a cantilever arm 152 feet 6 inches long.

The fixed trusses will be 75 feet in height, the suspended trusses 55 feet at the center and 50 feet at the end posts, while the cantilever arms will taper from 75 feet over the piers to 50 feet at the ends. The width of the steel portion of the bridge will be 32 feet center to center of trusses. Figuring approximately the weights of the two fixed spans will be 10,960,000 pounds; of the four cantilever arms, 4,830,000 pounds; of the three suspended spans, 6,340,000 pounds, and of the bearings, 900,000 pounds, making a total of 23,030,000 pounds for the entire superstructure. The loads for which the bridge will be figured are: For truss members, 4,000 pounds per foot of track, with a concentrated load of 40,000 pounds, and for the floor system a load of 5,000 pounds per foot, with a concentrated load of 50,000 pounds.

Open-hearth steel will be employed principally in the construction, and of the three grades most largely used, the medium steel will have an ultimate strength of 62,000 to 70,000 pounds per square inch, an elastic limit of not less than 35,000 pounds, and an elongation of 22 per cent in 8 inches, with a reduction of 44 per cent in area. The pin steel will have the same ultimate strength and elastic limit as the medium steel, with an elongation of 18 per cent in 8 inches, accompanied by a reduction in area of 36 per cent, while for the soft steel an ultimate strength will be required of 52,000 to 60,000 pounds per square inch, an elastic limit of not less than 30,000 pounds, and an elongation of 26 per cent in 8 inches, with a reduction in area of 52 per cent. Changes in the length of the spans due to variation of temperature will be provided for by expansion rollers of either wrought or cast steel.

In erection, false work will be used for all the spans excepting the center one, 671 feet in length, on which the usual method for placing cantilever spans without the use of false work will be employed, so that this portion of the river may be left open to traffic. Contracts for the steel work have been given to the American Bridge Company.

The substructure proper will consist of six piers of about the same general design, with the exception that the two outer ones are to be built in union with the supports for the adjoining arches of the approaches. In the accompanying illustration of one of these piers their general construction and proportions are shown. All of the piers will be sunk by means of pneumatic caissons, with the exception of No. 6, which is to be built in open excavation. The caissons will be sunk to solid rock and will be left in position as permanent parts of the piers, the working chambers to be filled with concrete and cement mortar. An annular space in the caissons 6 feet in width from the sides and 2 feet in depth will be filled with concrete of the proportions of one volume of cement to two of sand and three of broken stone. In the



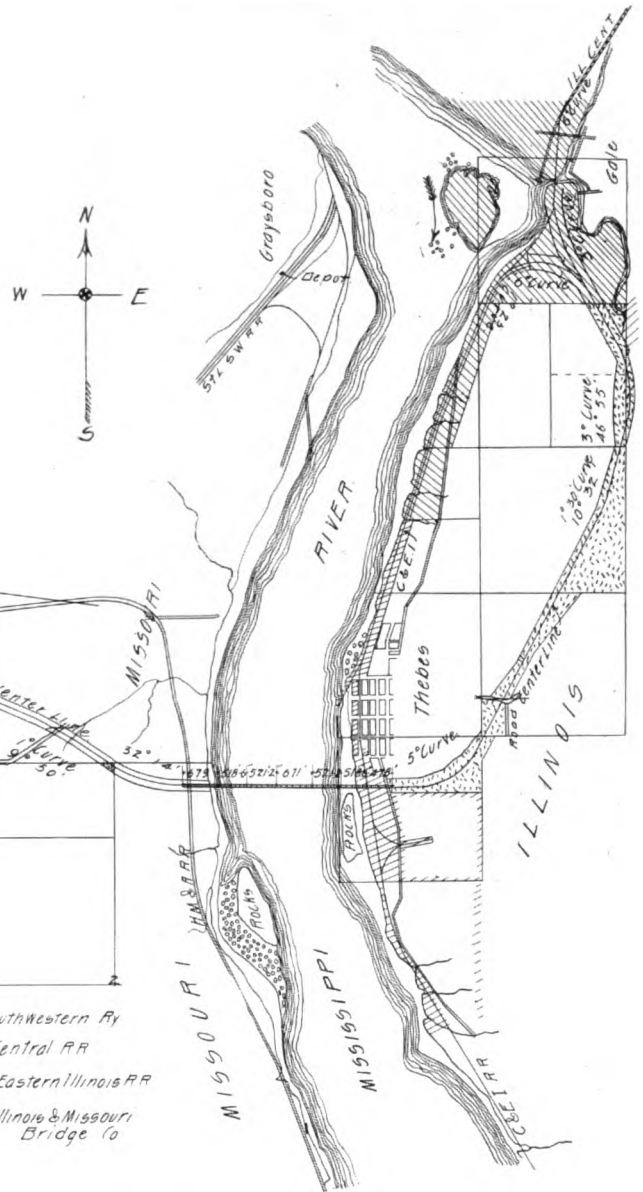
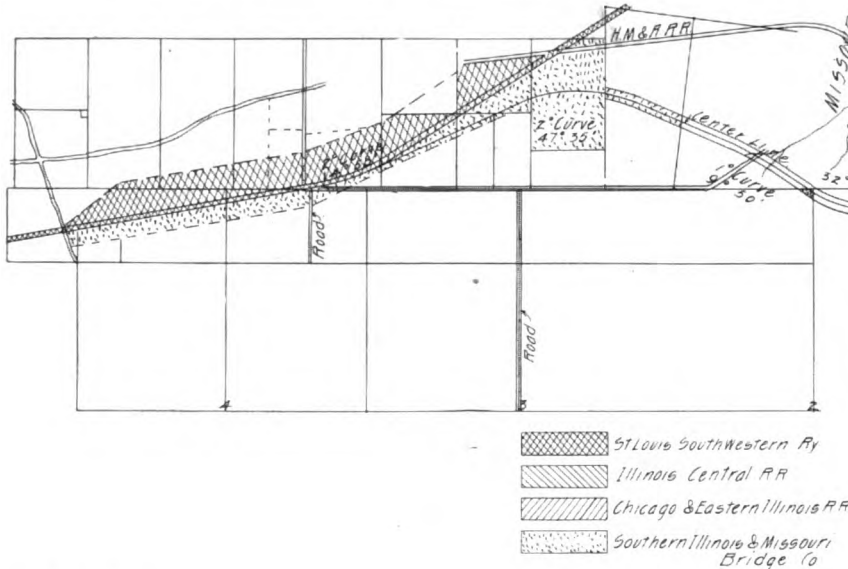
remainder of the working chamber to within 4 inches of the roof, the filling will be of concrete, consisting of one volume of cement to 2½ of sand and five of broken stone. The top space will be filled with mortar of one part of cement and three of sand.

In the open foundation work for the first depth of one foot above the bed rock and for the same width immediately under the bottom face stone course, the proportions of the concrete will be 1, 2 and 4, while for the intermediate portion, volumes of 1, 2½ and 5 will be used. All of the piers will be faced with limestone, with backing of concrete and in the facing work the stones of the curved upstream starlings of piers 2, 3, 4, 5 and 6, will be doweled with 1½-inch steel dowels. The bridge seat stones in the copings and the upstream cut-water stones below the high water mark will be of granite. The contract for the substructure has been let to W. S. Macdonald of New York.

In the approaches to the bridge proper will be included concrete construction of unusual interest. The east approach will consist of five arches of 65 feet clear spans, with one abutment at the east end of the approach and five piers, while the west approach will include six arches of 65-foot spans, one of 100 feet, an abutment at the west end and seven supporting piers. The height of the work from the foundations to the top of the copings, excepting at the ex-

the remaining piers being somewhat lighter, as the strength of the approaches does not require as heavy construction throughout.

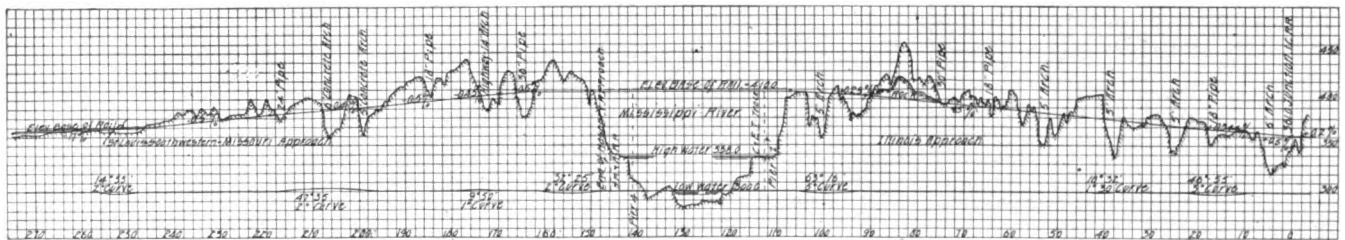
The arches will be semi-circular in form and at the crown



THEBES BRIDGE—APPROACHES OF ROADS TO SITE OF BRIDGE.

treme ends, will average more than 100 feet, with an average height above the surface of the ground of about 80 feet. Some 36,000 cubic yards of concrete will be required in the two approaches and while other arches of the same material have

the smaller ones will have a thickness of 3 feet 3 inches and the 100-foot arch 4 feet 6 inches. The copings and parapet walls are to be built separately and in sections, and will be joined to the remainder of the structure by means of 1¼-



THE RAILWAY AGE

THEBES BRIDGE—PROFILE OF APPROACHES AND BRIDGE.

been built of slightly greater span, the present work will be the largest and most imposing of its kind ever constructed. The accompanying illustrations of the approaches and the general details of their construction show a uniform design for all the work, embodying very few ornamental features. Every third pier will be a buttress pier capable of withstanding the horizontal thrust of one of the adjoining arches,

inch dowels and 1 inch square steel ties. Between the spandrel walls an opening will be left for the filling in of material on which the roadbed will be constructed over the approaches. This space at the top of the walls is 20 feet in width and is decreased by steps to 18 feet at the crown of the arches and to a width of 10 feet above the smaller piers and to 8 feet over the larger piers. The depth of this

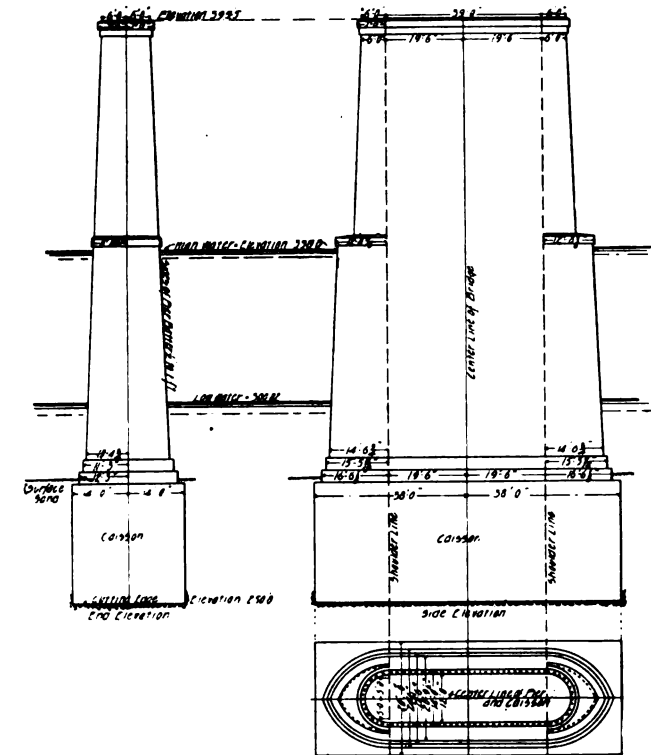
opening will increase gradually, from 9 feet below the top of the coping at the crown of the arches to about 25 feet over the center of the smaller and 28 feet over the larger

The upper surfaces of the arches and the inside surfaces of the spandrel walls will be plastered with a fine coat of mortar and coated with asphalt to furnish a surface from which the water will easily drain. Into this space between the side walls will be filled stones and earth, forming the roadbed. At the bottom of the pits over the piers stones not to exceed 6 inches in their greatest dimension will be placed by hand around the openings in the 8-inch drain pipes. Above these in successive layers the stones will be diminished in size until in the top layer those with dimensions not to exceed one inch will be used. The remaining open space up to a height of 5 feet above the top of the arches will be filled with loam, coarse sand or gravel, or other permeable material. The entire fill will be thoroughly tamped or flooded with water, and the top surface graded with a slope from the sides and toward the piers. The ballast will be placed on top of this, bringing the roadbed to within about 21 inches of the top of the coping.

No metal work of any kind will be used for carrying strains to which the arches will be subjected, concrete alone being relied upon. The small 1¼-inch rods noticed extending across the arches and parallel with the intrados are used only near the outer surface of the work to prevent the formation of any small cracks in the faces.

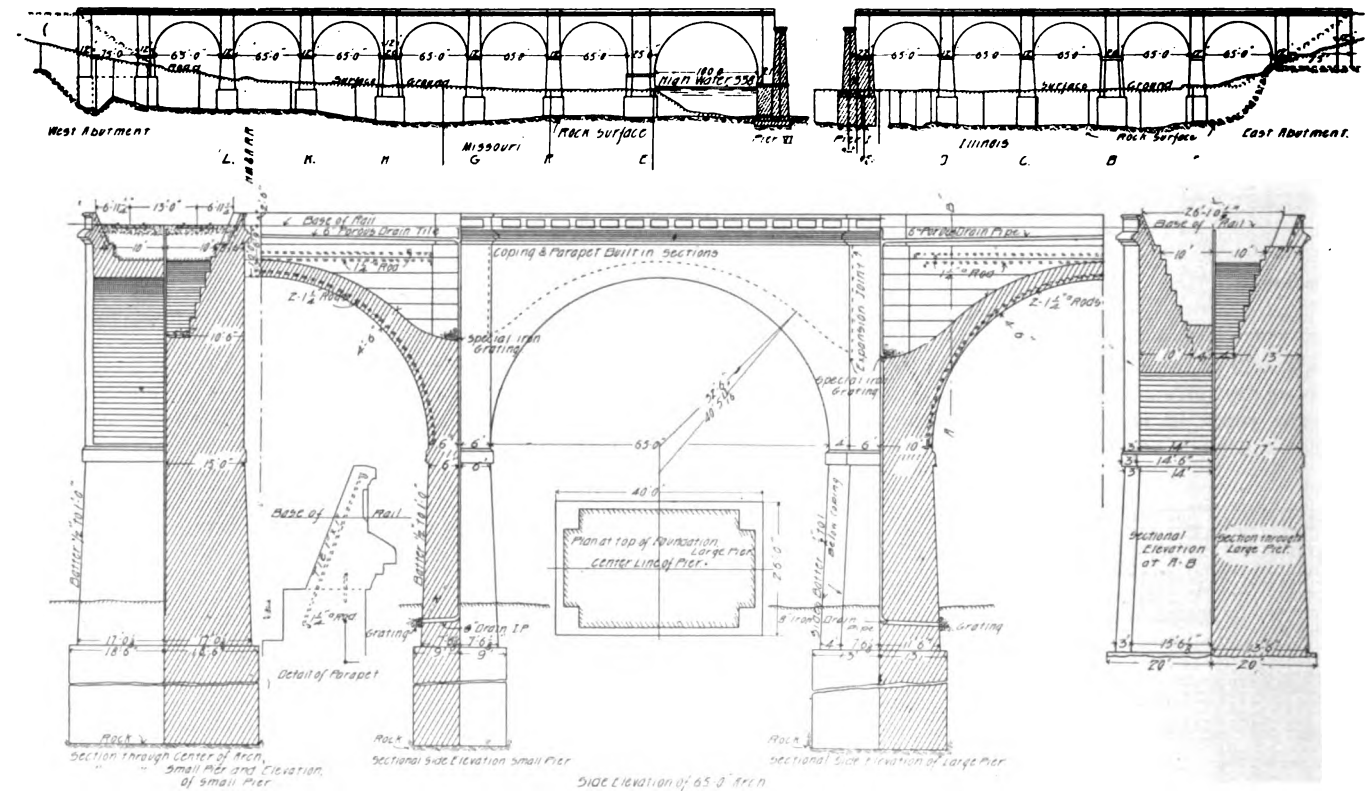
A noticeable feature of the construction is the provision of open joints over each pier to allow for the expansion or contraction of the material due to changes of temperature. These are one inch in width and extend from the top of the coping to the haunches of the arch. Below this point the joints could not well extend because of the thrust of the arches, but lower than the haunches provision for expansion is necessary. The joints will be packed with asbestos coated with soft asphalt, for the purpose of keeping them free of earth and stones.

Concrete of various mixtures will be used for the different portions of the approaches. In the foundations for the first foot above the rock the proportions will be one vol-



THEBES BRIDGE—ELEVATIONS OF PIER 4.

piers. By this arrangement into the pits formed over each of the piers will collect the drainage from half of the roadway over the adjoining arches, and to provide an escape



THEBES BRIDGE—DETAILS OF CONCRETE ARCHES AND PIERS.

for this drainage, 8-inch pipes will be built down through the center of the piers, with openings at one side near the bottom. The upper end of this pipe will extend to a point just below the ballast in the track, where it will connect at either side with 6-inch porous drain pipes laid under the ballast and between the two tracks.

ume of cement to two of sand and five of broken stone, and for the remainder, proportions of one, three and seven parts; in the piers and pilasters the mixture will be of 1, 2½ and 6 parts; for the arches and spandrel walls, 1, 2 and 5, and for the copings and parapets, proportions of 1, 2 and 4. Clean, sharp river sand and hard limestone will be used for all of

the concrete. In the broken stone all dust and fragments passing through $\frac{3}{8}$ -inch openings will be removed and no pieces larger than one inch in diameter will be used in the parapets or copings, or larger than $1\frac{1}{2}$ inches for the remainder of the work. Concrete will be placed in layers from 6 to 12 inches in thickness and the arch rings and spandrel walls will be made monolithic. The work will be faced in the usual manner by the working back and forth of a spade between the concrete and the forms until a neat surface is obtained.

Very often, in defining proportions of ingredients to be used in the concrete, no definite means of measurement is specified, but in the present work one volume of cement will be taken to mean 380 pounds net and one volume of sand or broken stone as $3\frac{1}{2}$ cubic feet packed or shaken down.

Because of the relative height of the approaches to the bridge and the unevenness of the ground in that vicinity, a large amount of earthwork in excavation and filling will be necessary on both sides of the river. Contracts for this work, including 230,000 yards of earth and 30,000 yards of rock excavation on the Illinois side, and 306,000 yards of earth excavation on the Missouri side have been let to McArthur Brothers of Chicago.

The approaches of the various roads to the bridge are shown in the accompanying reproduction of a map. In the case of the Chicago & Eastern Illinois, in particular, on the east side of the river, considerable work will be necessary in bringing the tracks to the proper elevation for crossing the bridge. The lines of the latter company from the north cross at right angles under the structure some 75 feet below the elevation of the tracks, as proposed on the bridge. A complete loop about 4 miles in length will be built, reaching the elevation of the bridge with a maximum grade of 5 per cent. At the south end of the loop the lines join those of the Illinois Central and from this point the same roadway is used by the two companies to the approaches.

The engineers for the work are Noble & Modjeski, Monadnock building, Chicago, through the courtesy of whom and to Mr. W. E. Angler, resident engineer, we are indebted for data. It is expected that the bridge will be completed by January 27, 1904, which is the time set in the authority granted by Congress for the completion of the work.

THE IMPRACTICABILITY OF COMMODITY CLASSIFICATION.

At a hearing before the Interstate Commerce Commission recently on the subject of commodity classification, Mr. A. I. Culver, comptroller of the Delaware & Hudson Company, made the following forcible presentation:

Since our meeting here on May 9 careful thought has been given the subject in order to ascertain the labor and cost necessary to comply with the desire of the commission and how best we could proceed to get at the information. Our conclusion is that all estimates as to the utility of the information when compiled are the same. The cost to the company I represent would be approximately \$33,960 per year, to furnish the Interstate Commerce Commission with the statistics as best we can, if the classification which appears on page 63 of the present form of report were made the basis of such returns, and it would cost approximately \$5,000 more per year if similar information were required by the several States through which we operate. As stated by the special committee of the Association of American Railway Accounting Officers, the cost to the railroads of the United States of furnishing such additional statistics would be from \$3,000,000 to \$4,000,000 per annum. This estimated expense represents an annual fixed charge on a capitalization of from \$75,000,000 to \$100,000,000. This estimated expense, large as it may seem, I am sure is very much underestimated. There must be good reasons to justify the imposition of such an enormous fixed charge. If taxed in this way, some means must be found to increase the companies' net results by an equivalent amount. An increase in transportation charges will be justified if this tax is levied. Unless some practical value to the railroads or public, or both, can be demonstrated, the burden should not be borne by the railroads.

At the present time we are furnishing to the commission information which is meaningless, and you are now considering the extension of this meaninglessness and at an

enormous increase in the cost over that which the railroads are already bearing. I will explain what I mean. In an effort to determine the conclusiveness or inconclusiveness of the information now furnished and that sought for, the following test was made: Three men of much more than average ability were given 500 waybills containing 2,150 items, with instructions to classify by commodities as per page 63 of the Interstate Commerce Commission report. All three men were given the same instructions and the test was three times repeated. The result was that in only two cases did any two men agree on commodities; two men having reached the same conclusion as to their mill products and live stock; in all other cases there was a variation, some small and others very large, and the reason they agreed on mill products and live stock was because there was only one waybill under each head. The waybills I have in my hand, I submit, will demonstrate that it is impossible to get any two men to agree as to classification. Surely we should not continue this farce, and certainly we do not care to have a supplement at such an enormous cost. On page 11 of the proceedings of the seventh annual convention of railroad commissioners appears the following:

"Your committee understood at the time of its appointment that it was to consider what line of statistics would be of greatest use to those commissions imposed by law with the duty of judging as to the fairness and reasonableness of rates. Their study of this question has impressed upon them this fact, that the only unit of traffic movement now arrived at is the revenue per ton per mile, a unit which results from a compilation including returns for all classes of freight, and for all rates of all classes. Such a unit does not appear to your committee satisfactory. The method by which it is arrived at contradicts the first principle of statistical science, namely, that a rational classification of facts must precede their compilation."

No truer words than the last sentence contains were ever spoken—"A rational classification of facts must precede their compilation." Page 63 of the present form of report is not a rational compilation of facts; consequently, no deductions therefrom are rational. It necessarily follows therefore that in order to comply strictly with the principle enunciated by the commission—and it is certainly a correct one—nothing but a classification which will admit of a distribution by commodities so as to exclude from each subdivision even any article bearing the same name, but varying in applying facts, will be correct. This practically means tariff. A proper reply to page 63 is the word "impossible." No information beyond that furnished by the tariff except the quantity of each article carried would be obtained by even a proper distribution of the commodities. Quantity would not enable you to determine anything beyond the quantity. Quantity would not enable you to determine the reasonableness or unreasonableness of rates. If a rate is unreasonable, it is unreasonable whether the quantity is large or small, and as to determining the effect upon the carrier's revenue by a change in a particular rate, it is concededly impossible. It will not enable the commission or anyone else to determine anything which the tariff does not give a key to, and I am prepared to defend that position.

I will state further that if the distribution of commodities were carried out as they should be the cost would be many times the estimates furnished, and all you would have would be tariff. Thus you are shown the reductio ad absurdum of this whole thing. I have spoken plainly because, Mr. Chairman, you stated in your opening remarks on May 9 that the hearing was in the nature of an order to show cause why such an order should not be made. On behalf of the Delaware & Hudson Company, therefore, I respectfully petition your honorable body to relieve us from furnishing the information called for on page 63 of the present form of annual report, and also ask that the additional statistical information under consideration as to ton mileage and freight earnings according to a classification of commodities be not required.

A meeting was recently held in Saint Louis of the general managers of the lines using the Union station in that city, for the purpose of discussing plans presented by the Terminal Association for the improvement and expansion of the terminal system and depot at that place. The plans considered relate to the enlargement of the approach to the station, additional main tracks, enlargement of the power house and interlocking plant, removal of the express buildings to the west side of the station, a subway system for baggage handling, extension of the yards to the westward for car storage purposes, laying of tracks on Compton avenue property recently acquired, a new interlocking plant and rearrangement of the yards on the east side and the laying of additional tracks and completion of the Terminal Belt Line on the west side. No final action was taken and another meeting will be held on June 10. The improvements, it is stated, will cost about \$4,000,000.