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Announcement

THIS is the initial number of the ENGINEERING WORLD. Its name suggests an editorial policy framed to cover the whole field of technical endeavor and to be of PRACTICAL value to the technical worker. This publication will contain timely, accurate information indispensable to the engineering industry, articles by experts and specialists on pertinent subjects, and a news department presenting fresh, reliable reports from near and far. A serial installment, complete in each issue, will discuss comprehensively economical, factory and shop systems. A special feature will be a section of classified want advertisements offering opportunities of obtaining desirable positions to capable men. Thus, our plan will anticipate the needs of men who desire to rise, whether they are executives or assistants, professors or students, employers or employees. Our field is world-wide, our resources unlimited, our future bright. We are cosmopolitan, up-to-date, instant in execution. The ENGINEERING WORLD is a journal of progress, of education, of success.

THE EDITORS.

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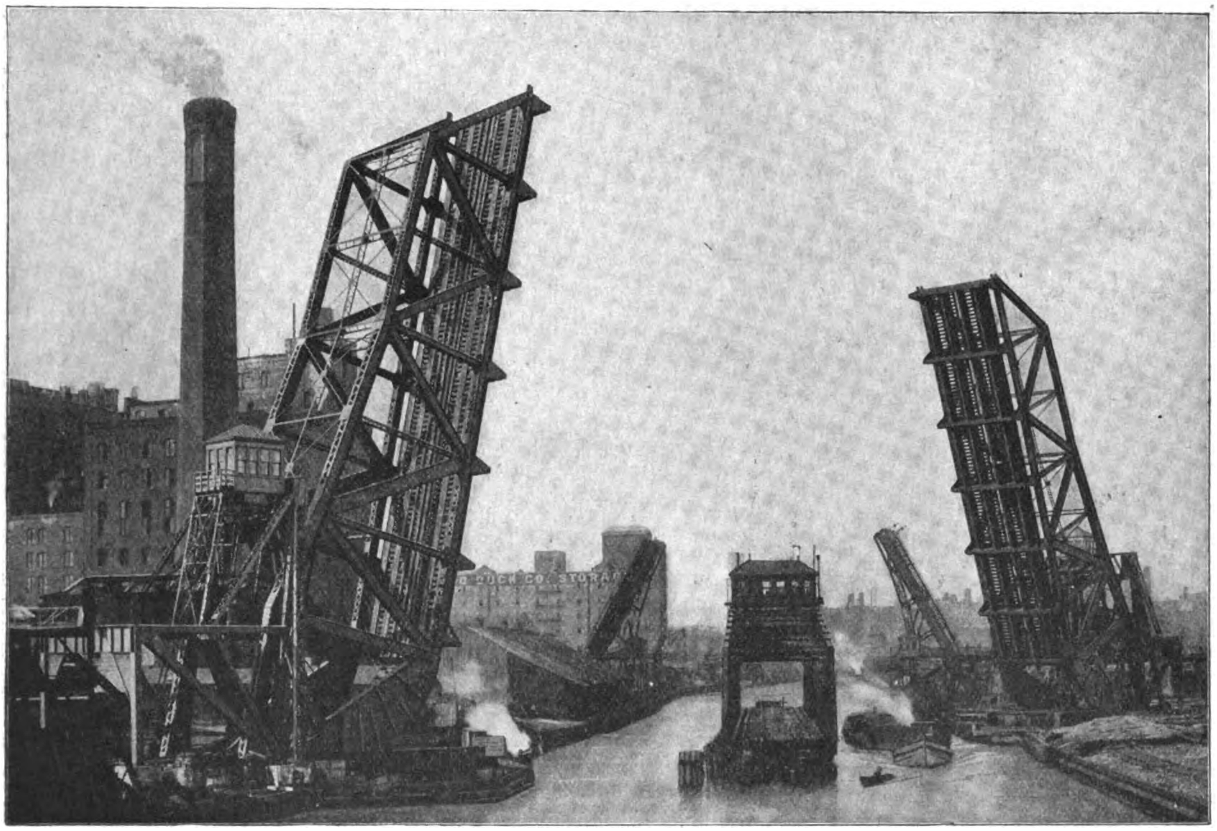
SCHERZER ROLLING LIFT BRIDGES.

How They Superceded the Old Swing Spans by Excelling in Practicability, Operation, Cost and Appearance.

Complicated conditions, existing along the Chicago river, in Chicago, gave rise to a revolution in the method of spanning navigable streams. When the Government strove hardest to cause the removal of obstructions from navigable rivers, the Chicago river was continually a scene of blockade. It was notable for center-pier bridges, each of which was pivoted on a foundation with a large bridge protection pier midway of the channel, dividing the stream into two passage-ways and constituting in itself a formidable obstruction. Since Chicago's is the leading harbor in point of tonnage, arrivals and clearances of vessels in America, the river is a very busy one and an important factor in the commercial supremacy of this city. It was impracticable to build a bridge high enough to permit vessels to pass under it. Cost of construction and the requirements of traffic altogether made such a structure an impossibility.

the streets at either end of the bridge and were packed in a jam until the structure could be again returned to position, allowing the horse-cars, wagons and people afoot to cross. When the long-waited-for opportunity came, there was a great pellmell rush for the bridge, and in cases of weak structures the possibility of serious accident from this weakness was always uppermost in the minds of those who watched the condition day by day. In cases where the machinery would give out, the bridge would lay helpless at the point where mechanical operation had failed, sometimes open lengthwise of the river, sometimes half closed and half open, and sometimes closed. It will be seen that in any position it was a nuisance of some kind; when it was closed, it hindered the traffic of the river; and when it was open it hindered the traffic of the streets, when it was half open and half closed it hindered both. Sometimes people were caught on the



SCHERZER ROLLING LIFT BRIDGE, 275 FT. SPAN, AT GRAND CENTRAL STATION, CHICAGO—View before removal of Swing Bridge.

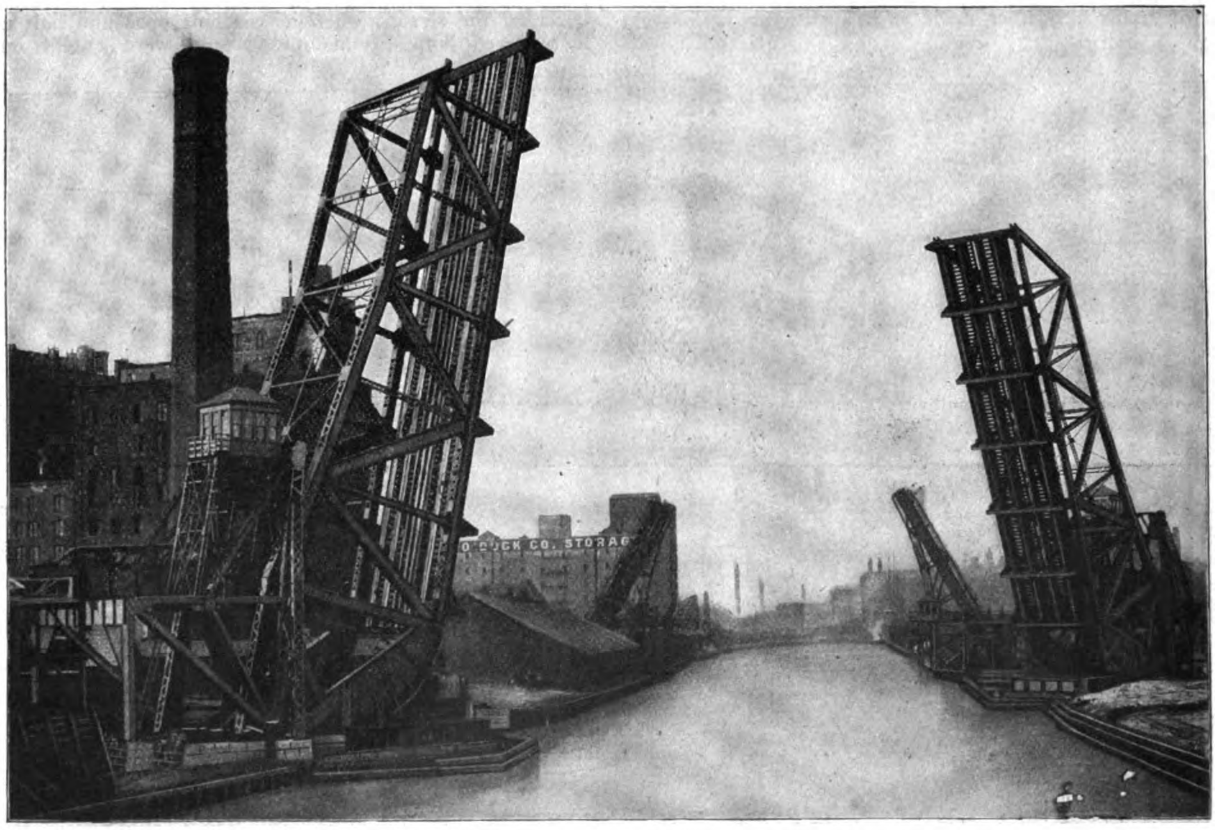
Year after year, the traffic and commerce increased and the center-pier bridges became more and more the object of the disgust of merchants and seamen who were constantly delayed by the palpable awkwardness and position of them. It was found necessary to build expensive tunnels under the river in order that street cars might not be subjected to the delays and dangers incident to the operation of crowded center-pier swing spans. Besides often causing the jamming of boats in the harbor, the bridges, when in operation, moved slowly, and, even to the eye of the layman, suggested the need of something more modern and more representative of twentieth century engineering skill. Serious accidents in which were injured some of Chicago's most representative citizens, added popular indignation to the already expressed condemnation of many well-known and skillful engineers. While the bridges were open, locomotives, cars, vehicles and people have been plunged into the muddy stream. Owing to the slowness of operation, traffic and pedestrians accumulated in

bridge when it would become inoperative while open, and there was for them the alternatives of swimming to shore in order to keep their appointments or possibly passing several hours over a stream famous for its disagreeableness until the machinery could be repaired. It was indeed a condition that might lay open plenty of sensational material for some enterprising novelist.

Such considerations, boiled down, always become more notable when they are expressed in terms of dollars and cents. A man never takes action so quickly as when his pocketbook is affected. This applies to business. The menacing conditions here described resulted in a daily loss of thousands of dollars to Chicago's commerce. The spirit of immediate action toward remediation, claimed as typical of our city, at once set in motion a train of effort calculated to solve the difficult, even exasperating problem. Some of the best known engineers of the old and new worlds were called on to give advice and suggest new measures. Various styles of bridges, possible and impossible, were proposed, and of these some were built and put in operation, such as that operation turned out to be. For example, the Halsted street lift bridge cost $237,000, and, while excellent in structural detail, was wrong in principle. As a practical bridge over a busy stream, it was an impossibility. To describe it graphically, it was no more nor less than a large elevator built to rise perpendicularly between four great corner structures. It could go high enough to allow the passage along the river of the tallest mast. This bridge had a failing of being balky at times, and its inoperation at critical moments required that certain very worthy citizens of this city spend their nights half-way between heaven and earth. We remember a case of one man jumping into the river from an altitude of 161 feet. We understand that he was an advocate of something new in the line of bridges. Anyway, he holds the record for the high dive and still lives. In cases where the bridge became fastened at the top of the pillars and it was impossible for people thereon to return to terra firma again until the bridge became operative, it was not unusual for food to be furnished them by means of pails and baskets lowered by long ropes. A basket picnic was not always enjoyable on a cold winter's night and the bridge was pronounced thoroughly, irrevocably, and for all time a failure.

A happy suggestion provided an idea that, because of its uniqueness and wonderful distribution to all needs, successfully provided for the easy navigation of the river, at the same time preventing congestion and danger of panic in the streets and allowing of an easier method of operation and more artistic design than had ever been possible in the center-pier swing spans. This bridge was composed of two movable leaves which came together in the center of the stream and rolled up and down, operating from piers located on the shores. It was known as the Scherzer rolling lift or bascule bridge. In bridge building, it has come to be the modern and eventual development of the science of spanning rivers charged with commerce and over which other commerce must pass. It is as far in advance of the center-pier swing spans as our modern steel battle ships are of the old wooden war vessels of Paul Jones or our new steel structures are of the old frame colonial buildings. It has removed all the difficulties attendant upon center piers and has given rise to no new ones. The one act of opening the bridge provides for the passage of vessels along the river and at once checks traffic in the streets, obviating the possibility of one being on the bridge or of anyone plunging into the river from the street while it is open. The operation is easy and quick. In its early form, it was an improvement on the pivot or trunnion type of bascule bridge, which in itself had many disadvantages and was very expensive, both in construction and operation, of which an example is shown by the Tower Bridge at London, England, and the small trunnion bridge at Clybourn place, Chicago.

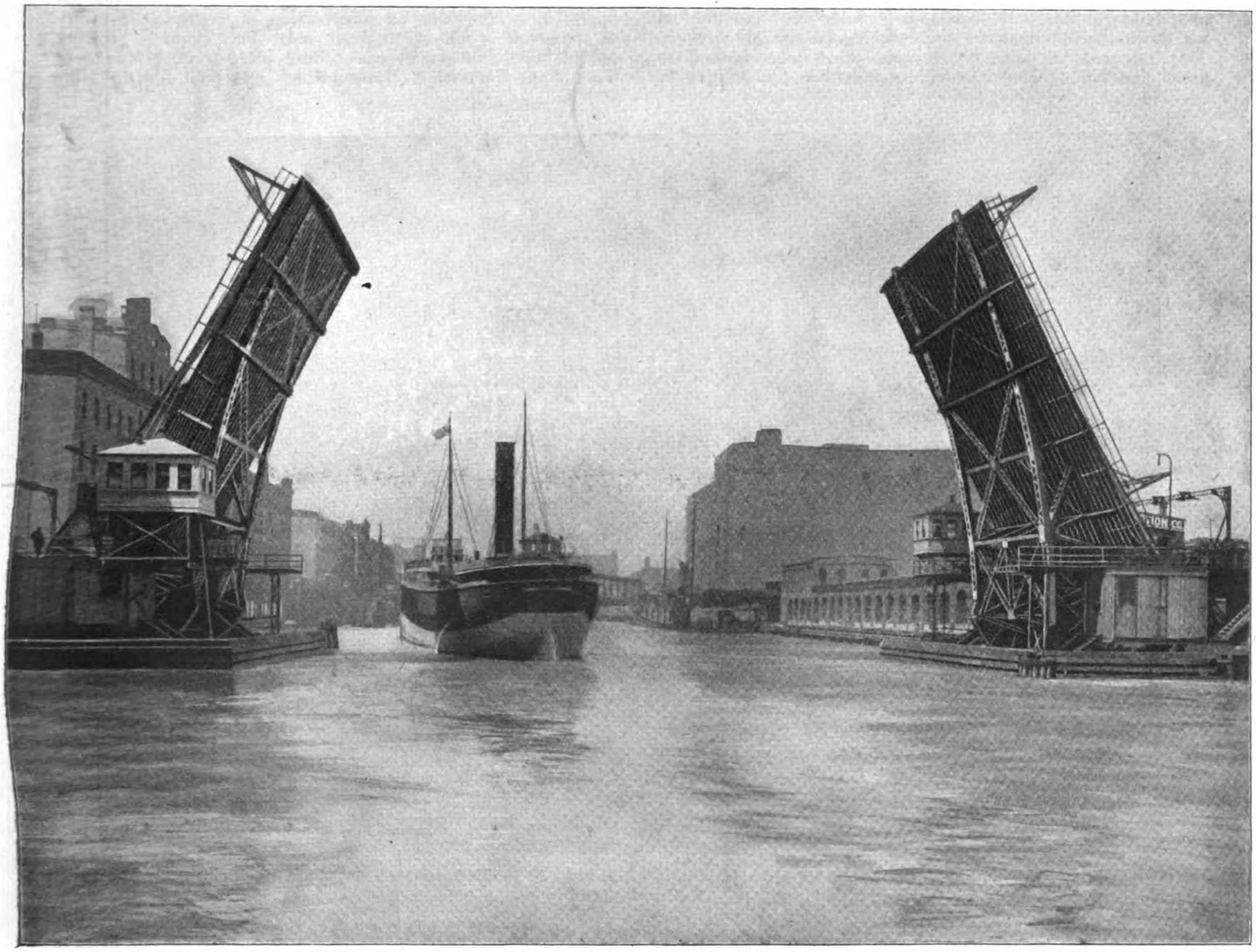
The Scherzer rolling lift bridge, then, is really the modern bascule bridge, and as such it takes its place among the recent notable mechanical inventions. It was a result of the thought of William Scherzer, a civil engineer of considerable note. He completed the plans for the Metropolitan Elevated Railroad bridge and the adjacent highway bridge at Van Buren street, Chicago, which were the first two types of this kind. Shortly afterward, Mr. Scherzer died. The business, founded by him, continued under the capable direction of his brother, Albert H. Scherzer, who is known as president and chief engineer of the Scherzer Rolling Lift Bridge Company. In as far as it will admit, constant improvements are being made in the construction of the bridge. It is being adapted to complicated conditions and the company, responsible for it, has even gone so far as to formulate plans for the commercial distribution of certain large cities and the more effective use of metropolitan waterways by great manufacturing industries. Therefore, it is seen that the firm is not only alive to the engineering possibilities of their product, but there is also coupled with the distinctly mechanical phase of their business the understanding and the careful treatment of the economical problems that have anything to do whatever with the utilization of commercial waterways in this country and abroad. As a result, the institution of these bridges is becoming a matter of world-wide interest, and to this end we will take up the description of them as a subject of prime importance and serious interest to engineers and laymen throughout the civilized world.



SCHERZER ROLLING LIFT BRIDGE AT GRAND CENTRAL STATION, CHICAGO—View after the removal of Swing Bridge.

The mode of operation of the rolling lift bridge is as follows: Upon the approach of a vessel, the bridge opens in the center, halves on either side, turning upward and being inclined at nearly an angle of 90°. The principle has been described by the striking illustration of a walking stick with a curved handle lying on the horizontal plane with the handle upward. Pressure on the end of the handle, pulling it down, will cause the stick to be elevated and stand erect. The corresponding movement of the bridge is what is called the "rolling lift." Briefly, the bridge is lifted by the rolling of its lower extremity upon a horizontal plane or set of rails. In cases where a counter-balance overcomes the dead weight of the ponderous structure, the very excellent idea has provided a large bearing surface and, therefore, it is obvious that there is practically no friction caused by the operation of the draw. The sight of the operation of the bridge is exceedingly novel when the whole structure, weighing in the neighborhood of possibly 5,000,000 pounds, is elevated skyward and sometimes reaches an altitude higher than that of the tops of some of our big office buildings. The balancing adjustment enables the quired for the whole operation of opening and closing the spans. On one of the Boston bridges, each double track span is operated by means of a 50 H. P. electric motor and the bridge is easily opened or closed in less than 30 seconds, which includes the time for locking or unlocking. This entire bridge is operated by one man.

The rapidity of movement and insurance of the safety of the working parts has been the result of a clever provision: The movable leaves are so counter-weighted that they are at rest when at an inclination of about 40° instead of in the horizontal position. Thus, it is seen that when the locks are withdrawn the leaves, without requiring any power whatever, will roll back and up and allow a channel sufficient for the passage of boats. The movement of the bridge is by means of a large wheel rocking on a level track.



SCHERZER ROLLING LIFT BRIDGE ACROSS THE CHICAGO RIVER AT STATE STREET, CHICAGO.

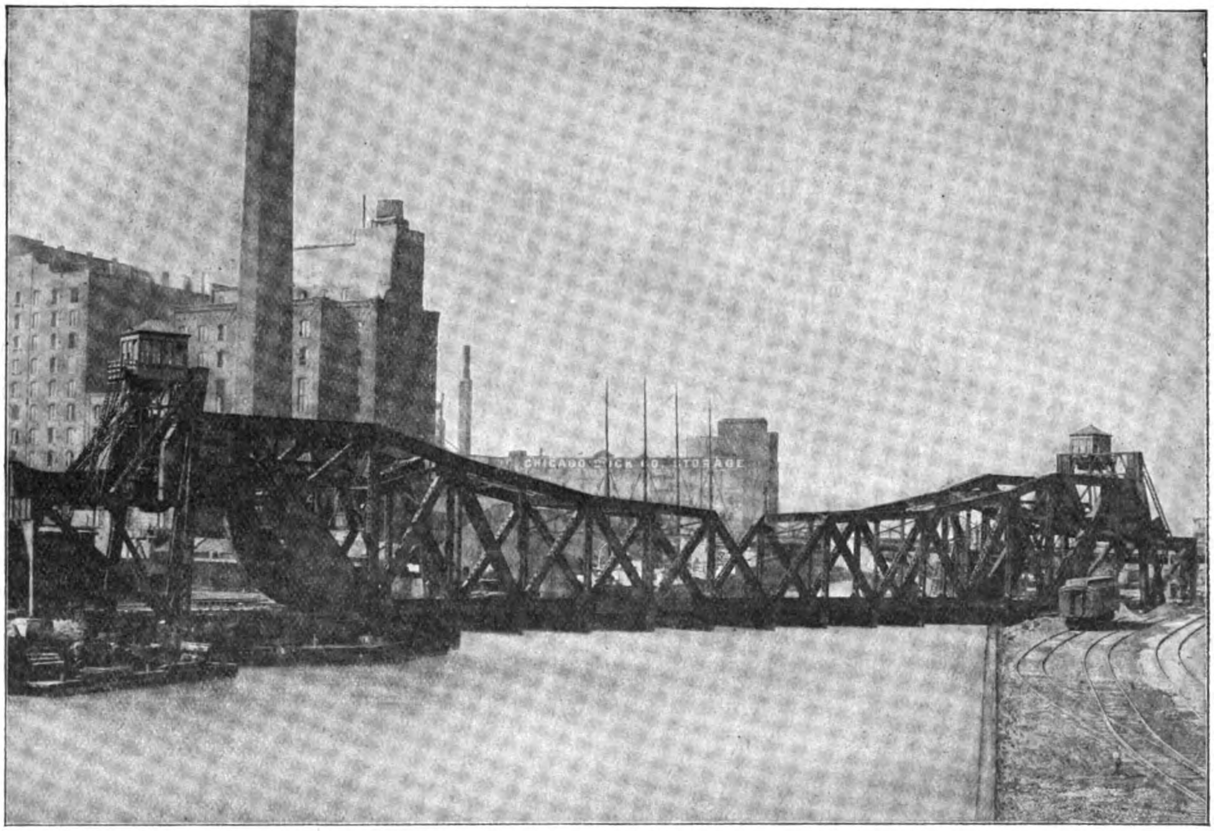
bridge to rise with the help of practically little power, the force required being used to draw the bridge down rather than to elevate it. In cases where these bridges have been built in cities, electric motors have been used, owing to the cheapness of operation, and the power is supplied by an operating "strut" whose point of contact is at the center of the rolling circle and which is pulled back by a rack and pinion. It has a special resting frame-work in view of the great strain, noting the inertia which it is necessary to overcome and the force of the wind when the bridge is up, which latter may be a considerable factor. In fastening down the free end a large steel anchor is let twenty feet into the masonry; the bridge itself is secured by a lock which, when the bridge is let down, clasps the end of the anchor. It has been shown in certain cases that less than twenty seconds is re-

It is interesting to note that the State Street bridge, at Chicago, during an average season of lake navigation, which means a little over eight months, is opened between 10,000 and 11,000 times, or fully 40 times every 24 hours. The power expense incurred by the operation of this bridge by electricity does not exceed 67 cents a day. Another Chicago rolling lift bridge daily accommodates the passage of some 1,200 trains.

The counter-weight of the bridge is made of blocks of cast-iron, although in certain cases some have hollow iron boxes filled with concrete. Snow and ice, during the winter months, adds another ton or two of counter-weight, which is a factor in the balancing. The blocks used are of a size which can be handled easily by two men with a tackle. The blocks are bolted onto the structural work.

Safety devices include the tieing up of the machinery for operating the bridge with the regular system of track signalling. It is impossible to open a draw if the signals are at danger. This does away with the possibility of traffic plunging through the open draw. In case the danger signal should be disregarded by an engineer, his engine would be derailed by a certain device in common use near the switches in large yards. The cabin of the bridge-tender notes all kinds of electrical appliances which indicate to him all the positions of the bridge without his seeing the bridge itself.

One important feature of the Scherzer rolling lift bridge, which easily recommends itself to all American minds, and which has had much to do with its wide adoption, particularly by railroads, is that which allows the increasing of the traffic space without the destroying of the old structure. In the old days, when the common draw bridge proved too small for the increasing number of passing cars, wagons and pedestrians, it was only possible to remedy conditions by tearing down the old structure and building an entirely new one. This incurred the unusual expense of destruction and the great expense of construction. Again, the possibilities for enlargement were materially affected by the width of the stream and the position of the bridge with regard to the windings of the waterway, noting the positions of the streets on either side, which of course could not be changed under ordinary circumstances. Again, it was impossible to build under any conditions two draw bridges whose extremities in operation would come within the radius of the movement of the other. Consequently, the size of these always determined a certain distance within the limits of which it was impossible to allow space for the operation of a co-operating structure. This is best illustrated by an explanation which affords a circle as representing the plane of operation of the bridge. It is easily seen that, if two bridges were erected anywhere near together, that it would be impossible to allow the circumferences of the circles to intersect, as such intersection would mean conflict in the operation of these bridges and one could not be opened while the other was open. However, in the case of the nearness of such bridges, it is always necessary that they be opened or closed at the same time and, therefore, it is seen that it is impossible to construct two draw bridges near enough so that they accommodate the traffic of the same street. The case, however, is different with the rolling lift bridge. If it is desired to add more tracks to the bridge, this can be done without removing the structure, which feature is in itself money-saving. In the case of the swing bridge, it would be required to take up the whole movable part and supply a temporary bridge for the passage of trains and the like, the daily operation of which would have to continue. Such an arrangement would, of course, be a matter of great commercial seriousness in cases of constant traffic, which would be very exasperating. The Scherzer rolling lift bridge permits, because of its perpendicular operation, the building of another bridge beside itself. For instance, in a four-track bridge of this kind there are, in fact, two independent bridges, and, during the inoperation of one due to construction or repairs, the utility of the other is not at all destroyed. This claim is growing considerably and we note a rolling lift 6-track bridge over Fort Point Channel in Boston which was built for the New York, New Haven & Hartford Railroad. It is well to note that, in cases where the water-way is comparatively narrow, some of these bridges have been constructed with a single leaf or span. These bridges may be coupled together when the desire is to operate them as one bridge, or another equipment may permit them to be operated separately. One of these bridges crossing at Campbell Ave., in Chicago, over the Chicago Drainage and Ship Canal, is an eight-track bridge. The Boston bridge has three double-track spans. It was built in an erect position and on completion was lowered to a closed position. Conditions required that this bridge be counter-balanced for a half open position; when closed, it is locked down. When released, it rises to an angle of 45° and stays there. The movable portion weighs 5,000,000 pounds. Inasmuch as it is necessary that the counter-weight clear the water, it is placed on top of the rocking wheel since it would be impossible to place it otherwise as the center of gravity could not be preserved. Each two-track bridge has an electric motor and since there are three bridges with



SCHERZER ROLLING LIFT BRIDGE AT GRAND CENTRAL STATION, CHICAGO—View showing Bridge closed for Railroad Traffic.

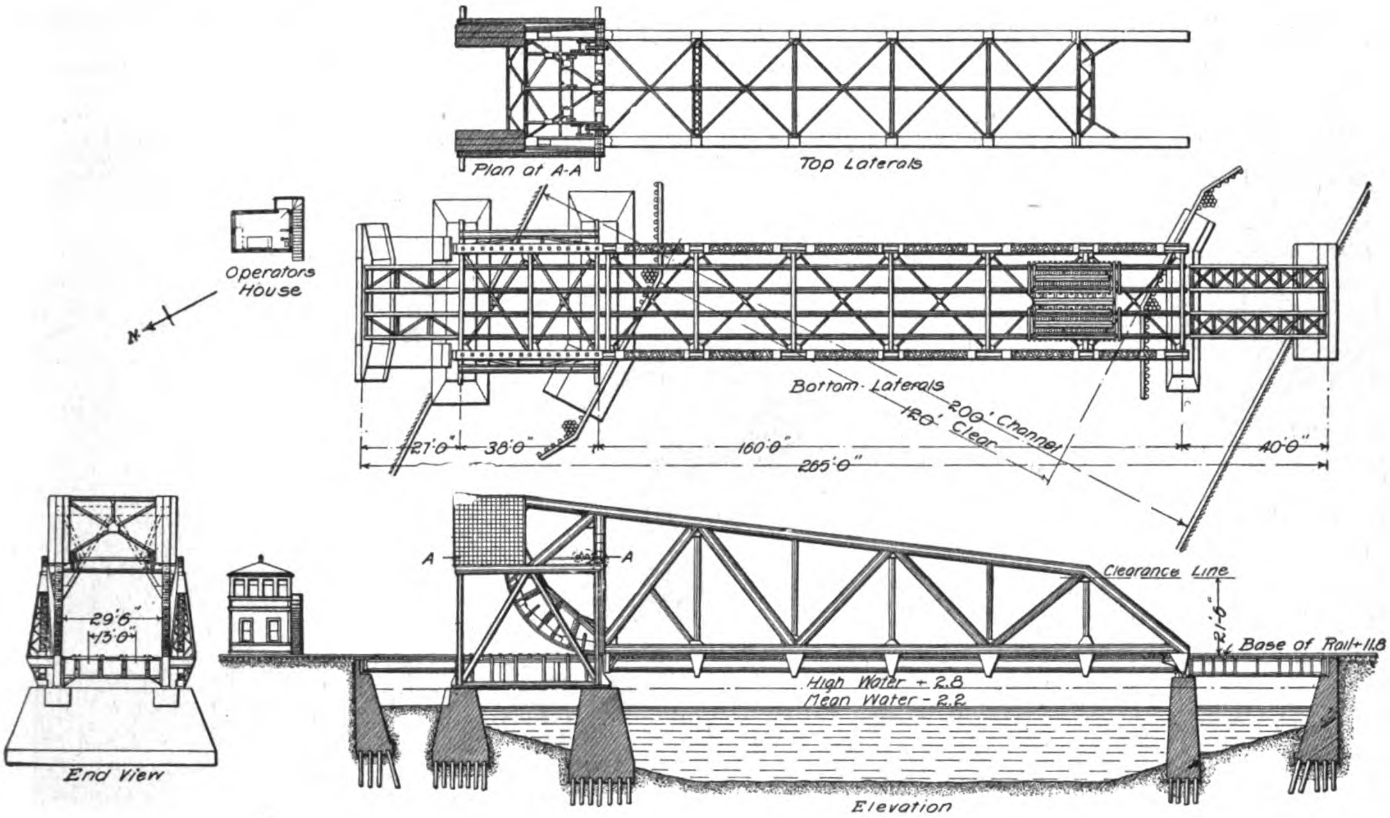
6 tracks in all, there is developed about 50 H. P., of which only about 10 H. P. is used. A strong southeasterly wind has at times caused this bridge to open. Strong wind pres-

Conn., built in 1901 and 1902 was a half-through girder structure. In this arrangement the track is placed half way up in order to save depth of structure and give clear height sure on the raised bridge has sometimes required double or triple power in closing. The Peguonoc bridge, at Bridgeport,

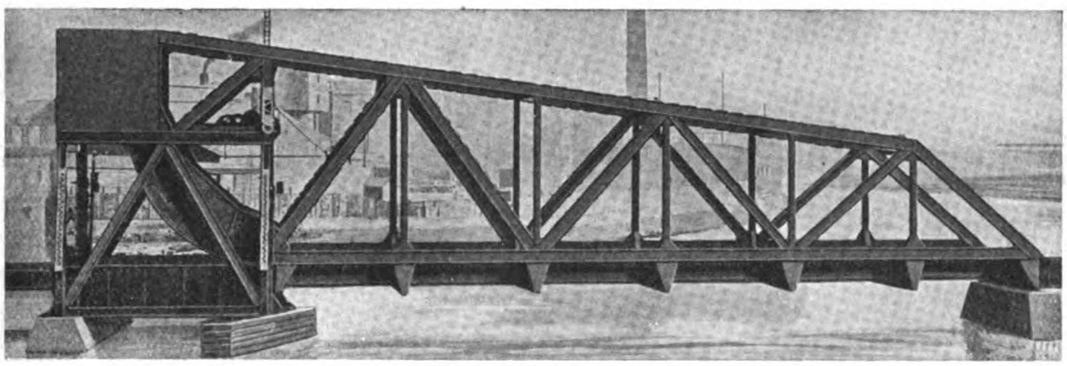
above the water. If this arrangement were not allowed, the raising of the track approaches for a long distance back would be necessitated at considerable cost. The Bridgeport bridge is 3,000 feet long, the moving part being about 126 feet long. Two double-track separate structures carry four tracks. The rocking wheel moves on a heavy steel track fastened in the pier masonry. A deep pit allows the counter-weight to swing down into it. This pit is 16 feet deep below high water mark and in width is about 23 feet. The counter-weight of the Bridgeport bridge is slightly over 50 per cent of the bridge weight, or about 33 1/3 per cent of the whole. The counter-weight is 1,100,000 pounds and the whole structure is 3,200,000 pounds.

Other bridges built for the New York, New Haven and Hartford Railroad are noteworthy. The Westport bridge will be a four-track deck structure. The tracks will run on

the top of the framework and the bridge will have a 98-foot draw. The Housatonic bridge will comprise two double-track structures. The counter-weight will be 1,595,000 pounds and the moving part, 1,550,000. The Cos Cob bridge will draw 107 feet wide, the counter-weight being 1,750,000 pounds and



SCHERZER ROLLING LIFT BRIDGE AT CLEVELAND—DETAILS.



SCHERZER ROLLING LIFT BRIDGE AT CLEVELAND—CLOSED POSITION FOR RAILROAD TRAFFIC.

the moving portion 1,270,000 pounds.

It is claimed that one of these bridges, when erect, is more stable against wind pressure than some of our large office buildings. It is admitted that the Forth bridge and the Brooklyn bridge, noting others of their kind, admit larger stresses than will be allowed by the sub-structures of long span rolling lift bridges, but on the other hand it is contended that, in the event of a longer span than either of the above being required, sufficient sub-structure, counter-weight and machinery could be provided for successful operation.

We give herewith detailed description of a Scherzer rolling lift bridge at Cleveland, Ohio: 'After a very careful investigation of the various types of movable bridges, the Newburgh

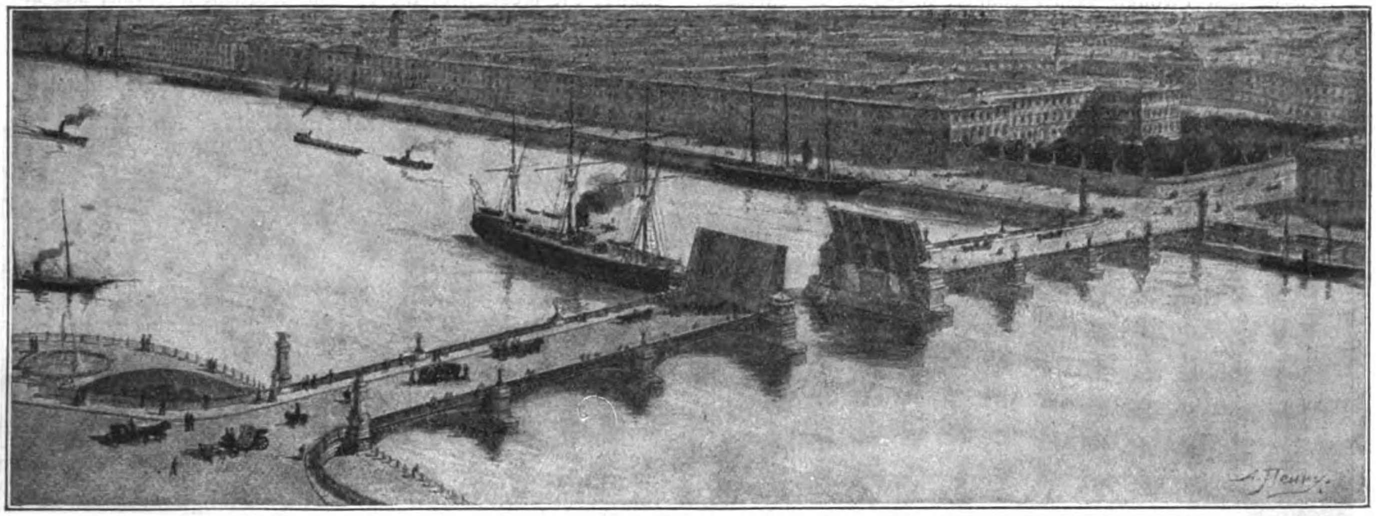
& South Shore Railway Company decided to construct a double-track Scherzer rolling lift bridge. The requirements of the city of Cleveland and the War Department called for a clear channel to accommodate navigation 120 feet wide, measured between protection fenders, at right angles to the center line of the river. This necessitated a movable span of 160 feet from center to center of bearings, as the new bridge crosses the river at an angle of 60 degrees 30 minutes and 30 seconds.

The movable superstructure is composed of a single-leaf simple truss span, having a length of 160 feet from center to center of bearings. It differs from some of the former railroad Scherzer rolling lift bridges in that the operating machinery and electric motors are placed upon the movable span. The pinion at the center of the rolling segment engages with the rack, which is fixed and supported alongside of the track girder. This improvement tends to shorten the total length of bridge required and simplifies the machinery and operation. The bridge is designed in accordance with Coopers' specifications for steel railroad bridges and viaducts, new and revised edition, 1901, to carry two 177½-ton locomotives, followed by a uniform load of 5,000 pounds per lineal foot on each track. The operating power provided is composed of two 50-horsepower continuous current electric motors, but this large bridge has from the beginning operated so easily that it is stated that less than 20 horsepower is actually used in ordinary weather. The tracks are interlocked with mechanism for locking the bridge, so that the operator cannot operate the bridge until the proper signals and derailing switches are set to prevent the passage of trains. The bridge is counterbalanced so as to be at rest in all positions, and when closed to receive railroad traffic forms a simple and very rigid truss span, resting firmly on two supports. The rails weigh 100 pounds per yard, and, unlike the shifting rails common to swing bridges, are firmly fastened at all points.

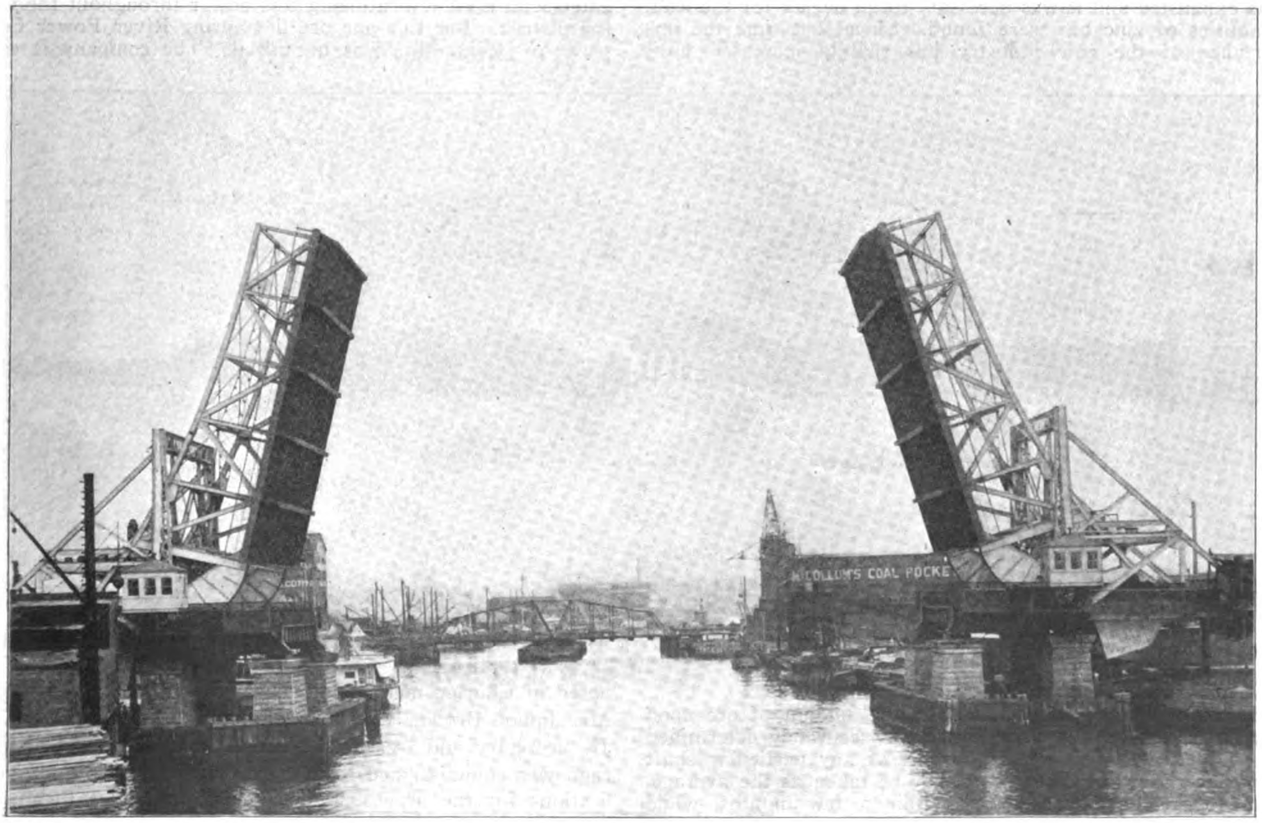
The Scherzer rolling lift bridge in construction permits of a wider differentation in the choice of design and ornamentation than any other style of bridge. Happily for the metropolitan movement toward civic art, this bridge may conform to the tastes of the most exacting in the way of classic art or in any other direction or it may permit of the strong severe lines required in the practical railroad bridge that spans a stream far away from any large city. The bridge at Cleveland is a good illustration of the latter and the new bridge to be built in Russia is a good illustration of the former. The Cleveland bridge has a single lift and is very plain and strong in construction inasmuch as it is a railroad bridge whereas the Russian bridge across the Neva near St. Petersburg, in traversing the wide part of the river, consists of progressive, fixed spans and, in the center of the river, the rolling lift section is provided, permitting the passage of vessels. This bridge is very artistic, exclusive in design and pleasing to the eye. No doubt, important bridges in metropolitan centers of the old and new worlds will be built on this plan. Many of the foreigners are sticklers for art and many of the moving spirits of American civic life are fast coming to the same condition.

SCHERZER ROLLING LIFT BRIDGE AT CLEVELAND—PARTLY OPEN FOR PASSAGE OF VESSEL.

Europe has been and promises to be very receptive to the rolling lift bridge. In fact, the original types known as the medieval pivot or trunnion bascule bridges were used to span moats surrounding fortresses or castles. During the first half of the century, a number of pivot bascule bridges were built, the spans ranging from 20 to 50 feet. In 1869, there was completed a tremendous bascule bridge at Copenhagen, Denmark. It consisted of two movable leaves operated by hydraulic power and gave a channel of nearly 57 feet. It had a total width of 31 feet. Nine years afterward Rotterdam, Holland, boasted a structure 34 feet wide which gave a clear channel of over 75 feet. The Tower Bridge at London, before mentioned, brought the progression within the limits of modern construction. This bridge was completed in 1894. It provides a 200 foot water-way and cost more than $4,000,000. The advance of recent years is indicated by contrast with the Grand Central Station bridge at Chicago. The iron and steel weight of the London bridge is 14,000 tons; that of the Chicago bridge is 2,250 tons. The entire cost of the Chicago bridge was $126,000 less than the cost of operating machinery of the London bridge alone. The Scherzer rolling lift bridge, as it is now developed, is invading several of the countries of Europe, besides being adopted widely in America and other sections of the two hemispheres. Several are being built in England and several on the continent, and some in South America and Africa. The numerous water-ways of Holland invite speculation as to the extent Scherzer bridges will be adopted in this little, thriving country. The truly modern conception of the Scherzer rolling lift bridge is one that has all the ear-marks of being one of the great engineering successes of the century and, without any exaggeration, there has not come to our notice any other style of bridge which is so suited to present day conditions, that from all points of view, practical, theoretical, operative, humane and artistic, is so satisfying to varying demands.



SCHERZER ROLLING LIFT BRIDGE PROJECTED ACROSS THE GREAT NEVA RIVER, ST. PETERSBURG, RUSSIA, AT THE WINTER PALACE OF THE CZAR.



SCHERZER ROLLING LIFT BRIDGE ACROSS NEWTON CREEK AT VERNON AVENUE, NEW YORK CITY.