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PROPOSED BRIDGE OVER THE ST. LAWRENCE RIVER.

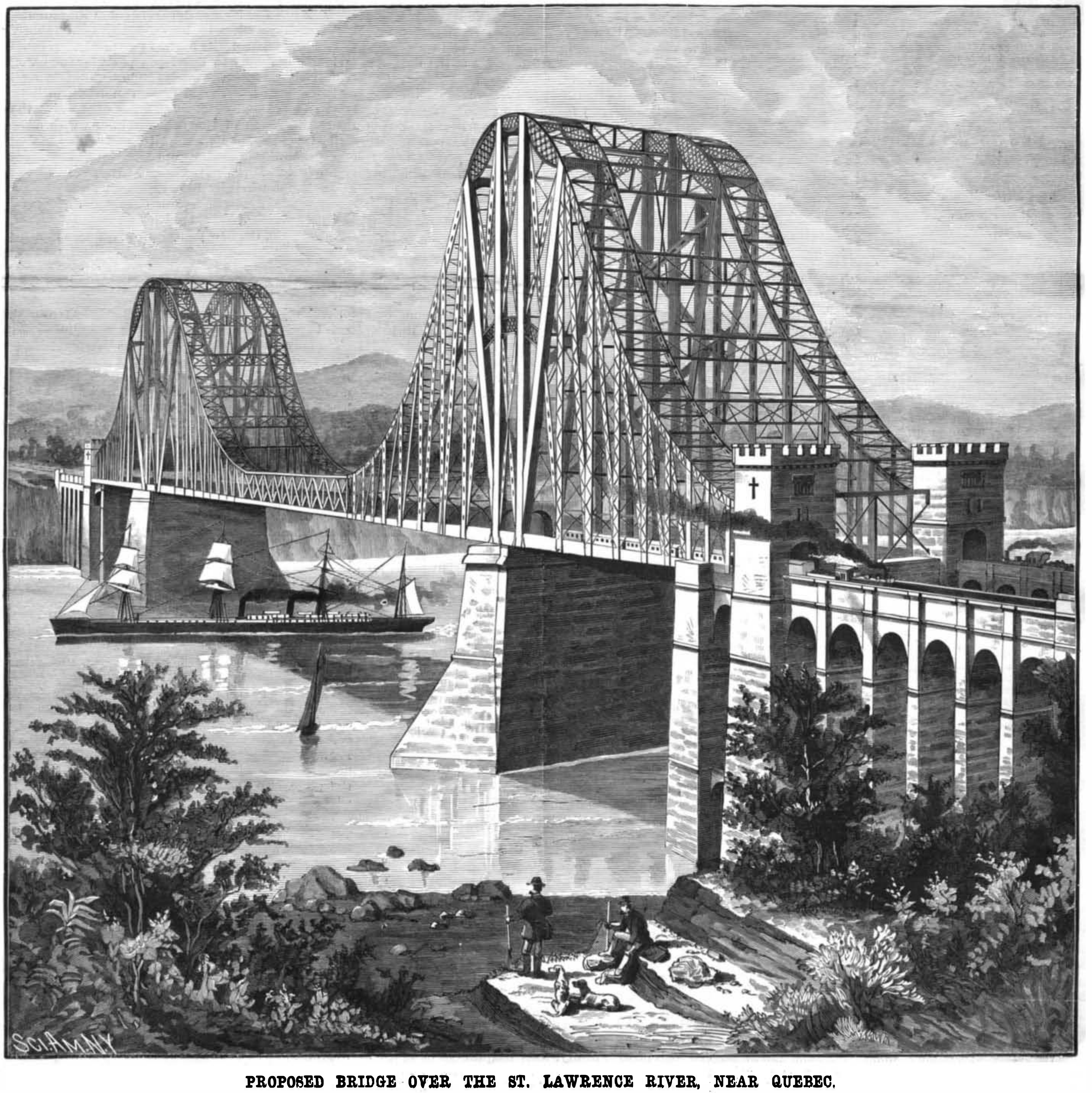
The Canadian Government, recognizing the great benefit which would be derived from a railway communication across the St. Lawrence, has sanctioned the proposal to construct a bridge at a point a few miles from Quebec. The accompanying engravings show the bridge proposed by Messrs. James Brunlees, A. Luders Light, and T. Claxton Fidler.

At the site selected the St. Lawrence narrows to a width of 2,390 feet; a large part of each shore is either very shallow or dry at low water, but for about 1,400 feet the depth increases, being at the center nearly 200 feet. The side elevation of the bridge shows the contour of the river bottom, and location of the two piers.

The bridge is of the cantilever form, and will be built entirely of steel. The length of the superstructure composing the three main spans will be 2,800 feet, the two cantilevers being united by a short latticed span. The distance from center to center of piers, the upper faces of each of which will be provided with massive masonry ice breakers for a height of 60 feet to guard against the drift ice, will be 1,550 feet, and in the clear the central span will be 1,442 feet. The clear height above high water will be 150 feet. The lower members are horizontal, while the upper ones of each cantilever form parabolic curves, which, beginning at each end, rise toward the piers, where the cantilever has a depth of 258 feet. The upper member is supported from the pier by four steel pillars, the two center ones being vertical, while those at the sides are inclined. The land end of each cantilever is anchored to a masonry tower.

The superstructure consists of two single track railroad bridges, placed 90 feet from center to center, and joined together by bracing; the arched masonry approaches consist of two single track viaducts, also placed 90 feet apart. The masonry arches are 40 feet span, and 150 feet high. The extreme width of the bridge is 108 feet. At the level of the railway is the plane of the main wind bracing, the flanges of the wind girder being formed by the lower members of the cantilevers. This general arrangement offers the best and most solid construction to resist the effect of wind pressure. The towers are rigidly braced in transverse and horizontal planes, and the upper chords of each single cantilever are united by upper wind bracing, the girders so formed being 17 feet in depth. A wind pressure of 56 pounds per square foot has been provided for, and the bridge has been designed to carry the heaviest traffic covering the entire extent of both lines of railroad. The maximum stress in the steel members will be 7½ tons per square inch of sectional area, while the stress in members of the wind bracing, exposed to alternating strains in opposite directions, will be five tons.

(*Continued on page* 340.)



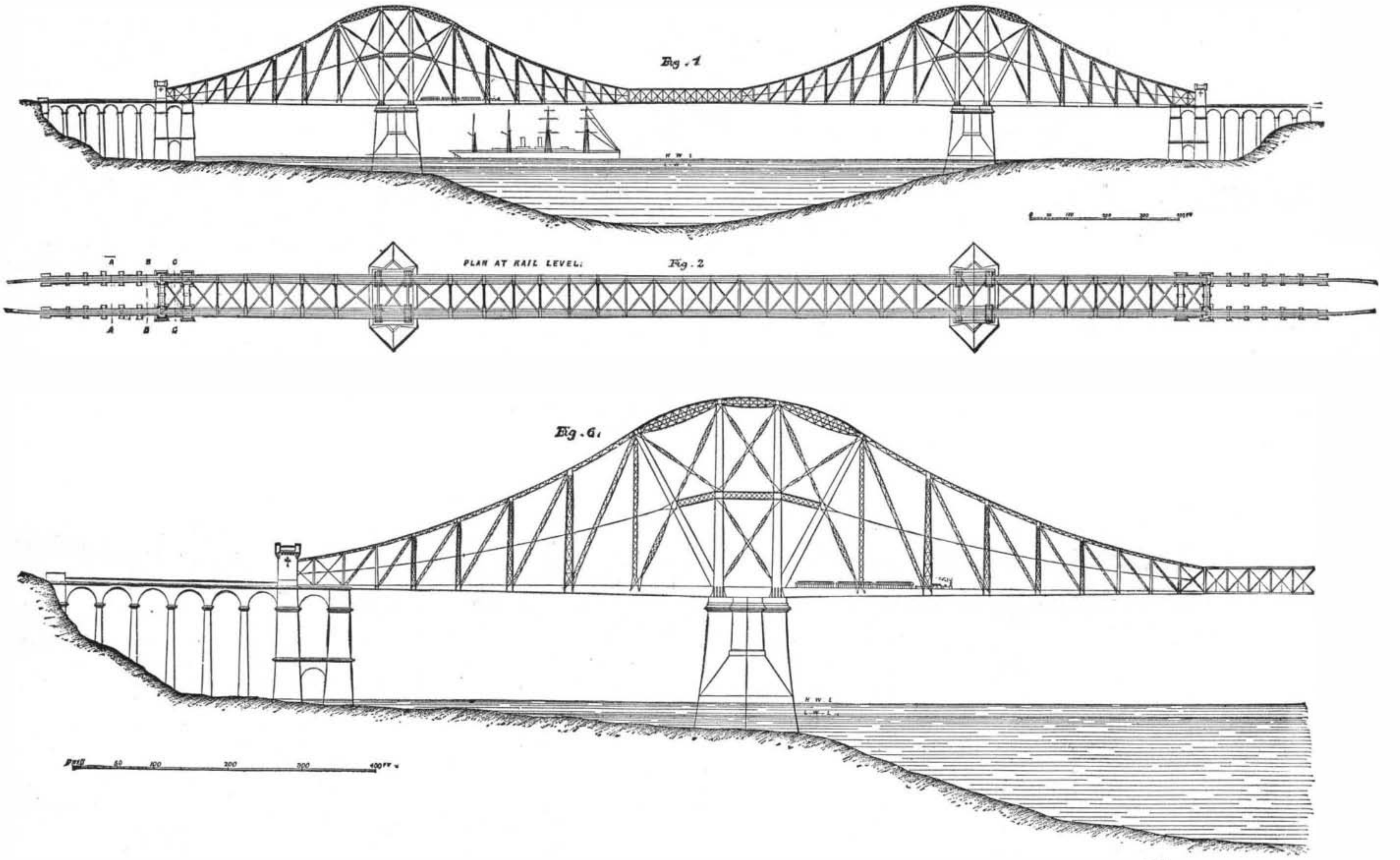
PROPOSED BRIDGE OVER THE ST. LAWRENCE RIVER, NEAR QUEBEC.

PROPOSED BRIDGE OVER THE ST. LAWRENCE RIVER.

(*Continued from first page*).

The side spans, between the piers and abutments, will be erected upon staging. After the erection of the main towers, a temporary wire cable may be extended across the whole span; and from this cable or series of cables scaffolding may be suspended. Although the cantilever will support its own weight as it is carried out, this system of scaffolding would greatly aid in the assembling of the parts of the several members. In building the lower member it will be practicable to roll forward the side girders, length by length, over the completed portion. The wind bracing will be carried forward in line with the cantilevers. The center latticed span may be erected either from the temporary cables, from false work on the ice in winter, or by building from each side toward the center.

Neither the width nor height of the center span could be reduced, since the largest ocean steamers pass up and down during the summer, and on the breaking up of the ice the narrow gorge here formed is choked with enormous masses of ice brought down from the lakes.



SIDE ELEVATION, PLAN, AND ENLARGED HALF SIDE ELEVATION OF BRIDGE OVER THE ST. LAWRENCE.

The Future of the Machinery Trade.*

The machinery trade of the United States has assumed immense proportions, surprising alike to our foreign competitors and to ourselves. This trade, instead of decreasing, as some suppose it will, should have a steady and healthful increase in the coming years. There doubtless will come periods of depression. Indeed, we have for some little time past been experiencing a reactionary condition in the consumptive demand, which has served as a material check on the progress of the trade, but this, we believe, is but a brief interruption, which will prove in the end as beneficial as at present it seems harmful.

In estimating the future demands for machinery, the following things should be taken into account: First, the natural increase in its use; second, the displacement of old machinery by new and improved devices; third, the replacement of worn-out machinery; fourth, its destruction by fires or other accidents.

In a decade the population of this country will be at the least calculation between sixty-five and seventy millions of people. During that period our exportation of manufactures must largely increase. It will be surprising if it does not double or treble. To supply the requirements of these extra millions of population and this increased trade there must be great demands upon our machinery makers. It must be remembered also that the tendency is constantly toward the use of more machinery—substituting mechanical for manual labor wherever it may successfully be done. This of itself makes an ever-increasing requirement for more and better machinery. The ease with which mechanical appliances can now be brought out has produced a tendency on the part of makers to furnish in some directions an oversupply, but obviously this applies only to general and not to special machinery. An inspection of the *Official Gazette* of the Patent Office shows that the spirit of invention is still rife, and that new mechanical contrivances are being brought forth with unusual rapidity. This means the future introduction of large numbers of new machines, the establishment of many entirely new industries, and the constant enlargement of the machinery manufacturers' field. It is safe to say that there is probably no department of this field which will not in the near future display a satisfactory increase in activity, unless, perchance, it be in those departments where old mechanical devices have been superseded by new. Old machinery is being constantly displaced by that of new and improved make. The old style engine gives way to the modern engine. The old tools are replaced with new and more accurate ones. The slow and tedious processes of the past are being revolutionized, and modern ideas and modern methods are brought into requisition. This mechanical evolution is going on all the while, and is increasing in extent yearly, as the number of mechanical improvements multiplies. The demand for new tools for replacing those in actual use is simply wonderful—so great, indeed, that few can fully appreciate the extent of this substitution. Closer competition will force upon manufacturers more and more a sense of the necessity for using better appliances. This will result naturally in an enlargement in the demand for machinists' work. There is a growing desire on the part of manufacturers to improve their plants by the substitution of better machinery, and we trust the time will come when every manufacturer will fully realize the importance of having only the very best equipment which money and skill can provide. This is the truest economy, and very many manufacturers fully understand the truth of this proposition.

The replacement of worn-out machinery will afford our manufacturers a vast amount of work. Think of all the machinery of the shops, factories, railroads, and for farm purposes that is now in use and deteriorating. The aggregate number and value of all this bulk of machinery defies calculation. What is its average life? At best but a few years, when it must all be replaced—some of it right away, but all of it in the not very distant future. Think of this mass of deteriorating machinery which is wearing or rusting out, and then conceive, if one can, of an idle machinery trade in the next quarter of a century. The plain truth is there is no more promising field in the world for the machine maker than this country. We have not mentioned the demand which will come for the replacement of machinery that is destroyed by accidents. Every day we hear of scores of accidents where boilers explode, factories with all their equipments are burned, where machines of one kind and another are broken, or where some accident produces injury to the plant, which requires new machinery to replace that damaged or destroyed. There is no reason for thinking that there will be fewer of these accidents in the future, but rather, as manufactories multiply, they will increase. There may be dull times in the future as in the past, but there cannot be permanent stagnation. The requirements of sixty to seventy millions of active and industrious people will alway be great, and, as we have shown, will furnish an increasing demand for the products of the machine shop. The machinist and the inventor will ever be important factors in our nation's history.

* The *Industrial World*.

Combustion in Dry Gases.

At a recent meeting of the Chemical Society, a paper entitled "Combustion in Dried Gases" was read by Mr. H. Brereton Baker, B.A. The author was led by the experiments of Mr. Harold B. Dixon on the explosion of certain gaseous mixtures, to investigate the effect of the presence, or otherwise, of moisture on the combustion of carbon and phosphorus in oxygen. Of these the experiments on carbon possess some interest from a gas engineer's point of view. Finely powdered charcoal was prepared for the experiment by heating to redness in a current of dried chlorine for three hours, and the tube containing it was subsequently transferred to an air bath and heated at 200° C., while a current of dried air was passed through it. Portions of a few grains each were placed in bent hard glass tubes, together with some phosphoric oxide for the purpose of absorbing any moisture that might be present; the tubes filled with dry oxygen, and sealed in the blowpipe flame.

Like portions were also placed in similar tubes, which were filled with oxygen saturated with water, and sealed. When one of each of these tubes was placed side by side over the large flame of a Bunsen burner, the carbon in the tube charged with moist oxygen burnt with bright scintillating flashes; but no apparent combustion took place in the tube containing dried gas, though it was heated to bright redness for several minutes. This experiment was successfully repeated before the meeting. The results of a series of experiments, in which the drying extended over various periods, showing the gaseous contents of the tubes after heating, were given in tabular form; and they clearly show that the burning of carbon is much retarded by drying the oxygen to the extent that is possible with the arrangement adopted by the author.

Soldering Flux.

One pound of lactic acid with one pound of glycerine and eight pounds of water is the new mixture of C. N. Waite, of Littleton, Mass., U. S. It is a substitute for chloride of zinc.

A Natural Stream of Tar.

In a rugged, almost mountainous, portion of Kentucky, embraced in the county of Breckinridge, in that State, will be found unmistakable evidences of a great upheaval of the earth, in the long distant past, in the prehistoric age. So great was this convulsion of mother earth that beds of rock miles in breadth and from one hundred and fifty to two hundred feet in thickness were forcibly torn apart and separated at varying distances of a quarter to a half mile. In the valley made by the rent in the solid rock small rivers or creeks run their tortuous course, some of them of sufficient size to afford water power to turn the wheels of various mills situated at eligible sites along the streams, the banks of which are skirted by narrow strips of fertile land level enough for cultivation and very productive, while on either side of the stream the riven rocks will be seen to rise as towering, majestic cliffs. So uniformly similar in outline are these opposing cliffs that, should the hills be forced together, the edges would interlock and fit together like the two halves of an apple which had been torn apart. Ascending to the top of the cliff, the table lands which spread out for many miles are heavily timbered, and when cleared make productive farms, the houses of prosperous farmers.

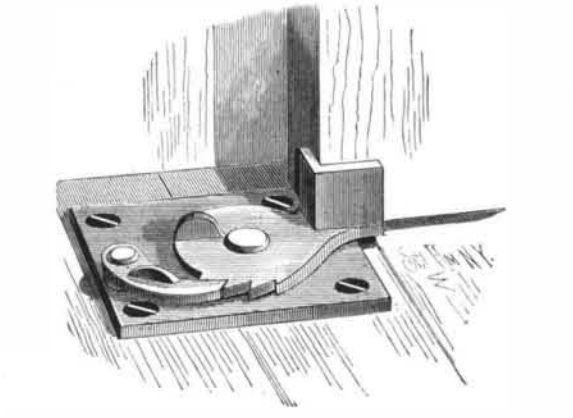
An interesting feature of these romantic cliffs will be found in the fact that when the rock beds of which they were formed were torn asunder and separated, the bottom portion was much softer than that nearer the surface, and, when exposed to the atmosphere, crumbled and fell out in piles below, leaving the surface or top of the rock overhanging and forming great rooms, some of them half a mile in length, protected by the overhanging rocks, and perfectly dry at all seasons and sufficient in size to amply accommodate large armies with complete shelter from storm and rain. They became resorts for stock in winter. So partial are the various kinds of animals to these comfortable retreats that some of them, particularly hogs, will remain under this shelter during long continued cold whether with snow, and, if not fed or driven out, will remain there and starve. These commodious rooms under the overhanging cliffs made comfortable homes for the Indians who inhabited this country before its discovery by the whites, as evinced by the discovery of large numbers of their flint arrowheads and other implements of savage life. Another notable evidence of their occupancy of these natural retreats from inclement weather is that after the softer portions of the rock nearer the ground had fallen out and crumbled to dust or sand, large portions of rock, ten or fifteen feet in length and several feet in thickness, would fall out from a position high up toward the surface, and, being of a much harder substance, would remain lying where they fell, and on the top of these the natives constructed or sank mortars to a depth of twelve or sixteen inches and about six inches at the top, gradually lessening toward the bottom. They manifested much skill in making these rock mortars exceedingly uniform and smooth in all their parts. What use they made of them is purely a matter of conjecture. Some thought they pounded their corn to hominy, others that they pulverized their material for making powder in them. Be this at it may, the mortars remain there in the rocks as inverted monuments to the skill of the red man. Many features of interest will reward the visitor to these scenes of a once violent convulsion in this part of the earth. The antiquity of this great upheaval is shown by large forest trees growing on the mounds made by the crumbling and falling out of rocks, which no doubt at first presented a clean break or perpendicular wall. In some places saltpeter is found exuding in its natural state from the rock one hundred feet from its top.

The most notable features of interest are the springs which flow from beneath these projecting cliffs. Among them are the tar and white sulphur springs, situated seven miles from the Ohio River, near Cloverport, Ky.

These springs flow from the base of a cliff which is one hundred and fifty feet high, and its top projects two hundred feet over the source of the spring, which is situated at the extreme back part of a commodious room made by the overhanging rock. This room is always dry, cool, and shady. The water is beautifully clear and cold, and the sides and bottom of the channel along which it flows are lined with a velvety coating of soft, snowy white sulphur, which adds to the crystal clearness of the water; but the most remarkable feature of these springs is a stream of liquid tar, the size of a small straw, continually running on the surface of the stream of water and flowing off into the reservoir provided for its reception. There may be a break in this stream of tar at times, but it is only momentary, when it is succeeded by another stream, and flows on and on as if it would flow forever. The supply would seem to be inexhaustible. For thousands of years this stream has continued to flow, night and day without interruption, as shown by banks of pitch ten feet in thickness and a hundred feet in width made by this small stream flowing off and evaporating the fluid portion, leaving a hard, dry, pitchy residue of the magnitude above mentioned.—*J. W. Compton, The Current.*

DOOR CHECK OR HOLDER.

The device herewith illustrated, lately patented by Mr. James W. Callaway, of Temple, Texas, is for holding doors open; it is simple in construction and effective in use. A disk is pivoted on a plate secured to the floor, a ring being interposed between the plate and disk to reduce friction. On the upper surface of the disk is a handle lug, and on its edge is formed a series of ratchet teeth. On the edge of the disk is a rectangular notch, from the edges of which flanges project upward. Pivoted on the plate is a pawl to engage with the teeth, and formed with a handle lug to facilitate swinging it toward or from the disk. When the door is to be held entirely open, the plate is placed on the floor at the wall; the plate may be placed at a greater or less distance from the wall. The notch faces the direction from which the door swings, and after the door has passed the disk, the latter is swung toward the



CALLAWAY'S DOOR CHECK OR HOLDER.

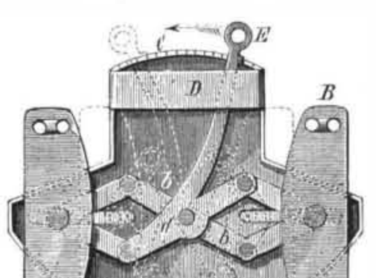
door, the flanges resting against the edge and face of the door. The disk is then locked in place by the pawl, which, when the door is to be closed, is swung back and the disk turned to swing the flanges from the door.

Cement Pipes for Drains.

Experience seems to show some special advantages in the use of cement pipes for sewers and drains, its adaptation to withstand the chemicals in sewage being satisfactorily demonstrated. It has been found that a mortar suitable for such pipe is best made by combining two parts of standard cement and three parts clean sand, the latter of various degrees of fineness, from the very finest to the size of one's finger end, and in such proportions that the finer fills up all the chinks, as the cement finally coats each particle and fills all remaining spaces. These materials are thoroughly mixed dry, and the mortar well rammed in the moulds. It is also important that the right amount of water be used; every particle of cement and sand should be wet, but the mortar be stiff enough for the rammer to bring up solidly on it, and press it firmly together instead of displacing it horizontally. The cores are usually drawn almost immediately after the pipe is finished, and in good weather the cases removed in about half an hour. The pipe is kept under cover about two weeks, and then put out into the sun and air, and well wet every day. The pipes thus made, the *Manufacturer's Gazette* concludes, may be ready for ordinary use six weeks after they are put out.

GLOVE OR SHOE FASTENER.

The edges of the metal plate, A, are bent inward to form flanges. Extending from near the ends of the tapered parts of the plate toward the middle are slots, through each of which passes a pin, also passing through the end joint of lazy tongs and held on a metal strip, B. One of the middle levers of the lazy tongs has an extension or spring handle, E, passing under a guard, D. The handle has a lateral extension adapted to engage with teeth, C, against which it is pressed by the spring tension of the handle. The strips, B, are fastened to the opposite flaps of a glove or shoe. By swinging the handle in the direction of the arrow, the pins in the slots are moved toward each other, and the flaps to which the plates are secured are brought together, and the shoe or glove is thus closed. The projection on the handle catches on one of the teeth, and locks the handle part and plates in place. The fastening is strong and durable, and by means of it the flaps can easily be drawn toward each other.



This invention has been patented by Mr. Edward W. A. Meyer, of 9 Pelham Street, Boston, Mass.

Erection of a Concrete Bridge in One Day.

The firm of Zurlinden & Co., of Aarau, having constructed a canal in connection with their works about two-thirds of a mile in length, were obliged by the town authorities to bridge it in two places. This they did by means of segmental arches of cement concrete, constructed to the designs of Professor Tetmajer, of Zurich. The dimensions of the arches—Proc. Inst. C. E.—are: Span, 39 feet 4 inches; rise, 6 feet 6¾ inches; thickness at crown, 1 foot 7¾ inches; thickness at abutment, 3 feet 3½ inches; thickness of abutments, 9 feet 10 inches; width of roadway, 13 feet 1½ inches. The foundation of both abutments is on fairly good gravel, at a depth of about 5 feet below the springing. Spandrel walls are carried up to the level of the roadway, and surmounted by an iron handrail, the space between the spandrel walls being filled in with gravel covered with ordinary road metaling. The total weight of the structure between the abutments is 194 tons, or including a live road of 300 kilog. per square meter—61·5 pounds per square foot—211 tons. The first bridge was erected in two days in June, 1884, the two abutments being formed on the first, and the arch and spandrel walls on the second day. The bridge was brought into use after standing for about two months, and has been in constant service ever since for heavy-wheeled traffic without any sign of settlement or cracking. On the 9th of October the second bridge was completed between 6 A.M. and 6 P.M. by 65 men. The concrete was mixed in accordance with the recommendation of Professor Tetmajer, as follows: The cement and sand were first mixed dry, then the gravel added, water being gradually added during the mixing in such quantities that when the punning of the concrete was completed a thin film of water showed upon the surface. The concrete was mixed as follows:

	Cement vol.	Sand vol.	Gravel vol.	Pounds of cement per cubic yard of concrete.
Abutments	1	3	7	337·2
Arch	1	2	4	505·8
Spandrels	1	2	6	421·5

The cost of such a bridge is given as:

	£.	s.	d.
Excavation 50 cubic meters (65 cubic yards) at 10 d.	2	1	8
Concrete, including centering, etc., 80 cubic meters (104 cubic yards) at 25 s.	100	0	0
Filling in over arch, forming road	8	6	8
Iron hand railing	10	8	4
	120	16	8

New Rates of Postage.

On July 1 the following important changes will be made in the rates of postage:

1. Any article in a newspaper or other publication may be marked for observation, except by written or printed words, without increase of postage.

2. All newspapers sent from the office of publication, including sample copies, or when sent from a news agency, to actual subscribers thereto, or to other news agents, shall be entitled to transmission at the rate of one cent per pound or fraction thereof, the postage to be prepaid.

3. The weight of all single-rate letters is increased from one-half of one ounce each or fraction thereof to one ounce each or fraction thereof. The same increase of weight is allowed for drop letters, whether mailed at stations where there is a free delivery or where carrier service is not established.

4. A special stamp of the value of ten cents may be issued, which when attached to a letter, in addition to the lawful postage thereon, shall entitle the letter to immediate delivery at any place containing 4,000 population or over according to the Federal census, within the carrier limit of any free delivery office, or within one mile of the post office coming within the provisions of this law, which may in like manner be designated as a special delivery office; that such specially stamped letters shall be delivered between 7 A. M. and midnight; that a book shall be provided in which the person to whom the letter is addressed shall acknowledge its receipt; that messengers for this special delivery are to be paid eighty per cent. of the face value of all the stamps received and recorded in a month, provided that the aggregate compensation paid to any one person for such service shall not exceed $30 per month, and provided further that the regulations for the delivery of these specially stamped letters shall in no way interfere with the prompt delivery of letters as provided by existing law or regulations.

How Germs Get in the Lungs.

In the ordinary healthy lungs, perhaps even in persons who have a consumptive heredity, the germ which causes the breakdown of the lung may not be able to make an impression; but if the physical integrity is destroyed by poor food, or any debilitating influence, or by a cold, then the germ is able to get in its work, and to multiply and produce its kind, and fill the lungs with tubercles.—*Dr. Curtis.*