

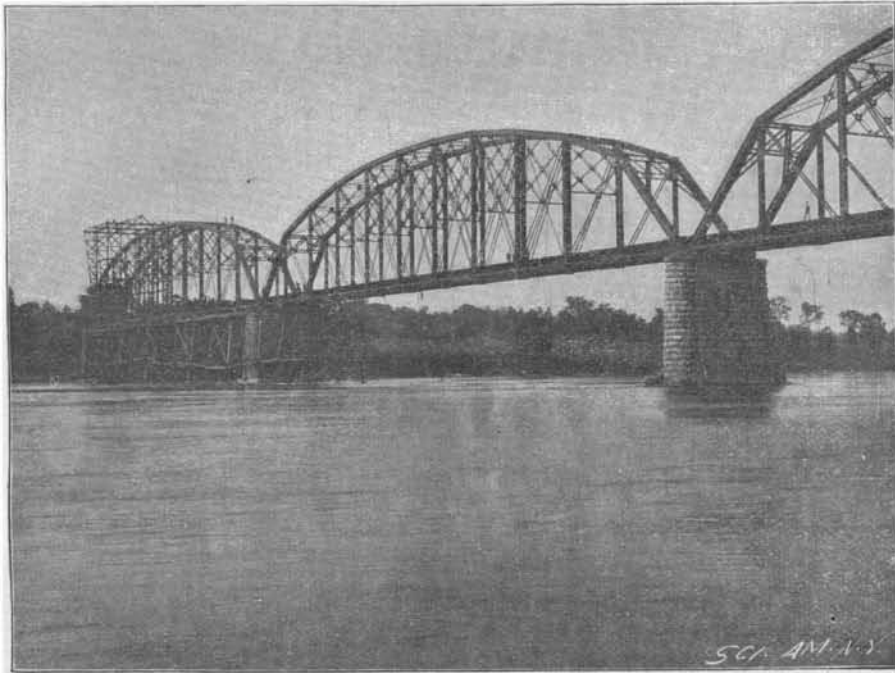
THE FALL OF A BRIDGE AT CORNWALL, ONTARIO.

The great advance which has been made of late years in the theory and construction of long span bridges is proved by the small number of accidents that has occurred to structures of the kind that have been built by first class firms and under the supervision of qualified engineers. As regards the superstructure, that is, the bridge proper, it may be said that the possibility of serious failure or complete col-

two river spans being swung and the falsework still remaining beneath the shore span.

At the time of the accident a large force of men was at work on the shore span, and the crash appears to have come without the least preliminary warning. Fifteen men were killed outright, and sixteen were seriously injured. The drawings and specifications were made and drawn up under the direction of F. D. Anthony, chief engineer of the New York and Ottawa Railway Company, for whom the bridge is being built,

feet above water. When the concrete had been carried up to within 4 feet of low water level, the crib was pumped dry, and the masonry of the pier was started. It should be mentioned that, during last winter, when work was shut down with only two courses of masonry in place, the crib was subjected to severe test by the pressure of the ice and by being struck by a swiftly moving and heavy raft of timber. Neither of these caused any movement of the structure. The masonry was completed in the spring to its full height



THE CORNWALL BRIDGE BEFORE THE DISASTER.



WRECKAGE OF THE SHORE SPAN AND FALSEWORK.

lapse due to inherent weakness has been practically eliminated; and it is only in the substructure, the foundations and piers, that any doubts as to stability may ever be said to exist. Even as regards the subaqueous foundations, it is only in rare cases that the engineer is unable to state with absolute certainty that they are permanently stable; for modern methods of diving and boring make it possible to learn with great certainty the composition of the river bottoms and determine how far it is necessary to carry down the foundations before they rest upon a durable stratum of ample bearing capacity to carry the superimposed structure.

The terrible disaster at Cornwall, Ontario, in which a river pier and two adjacent spans fell into the river, is a case (now happily very rare) of the collapse of a presumably first class structure which was being erected by well known contractors under the supervision of engineers of standing and reputation. For the reason that the swiftness of the current has prevented any thorough examination of the river bottom, it is impossible to determine, except by conjecture, the cause of the disaster; but such facts as can be gleaned

and they were approved by the engineers of the Canadian government and by Mr. Stewart, the consulting engineer to the railway company. The contractors for the superstructure are the Phoenix Bridge Company, and the piers were built by Soysmith & Company, of New York.

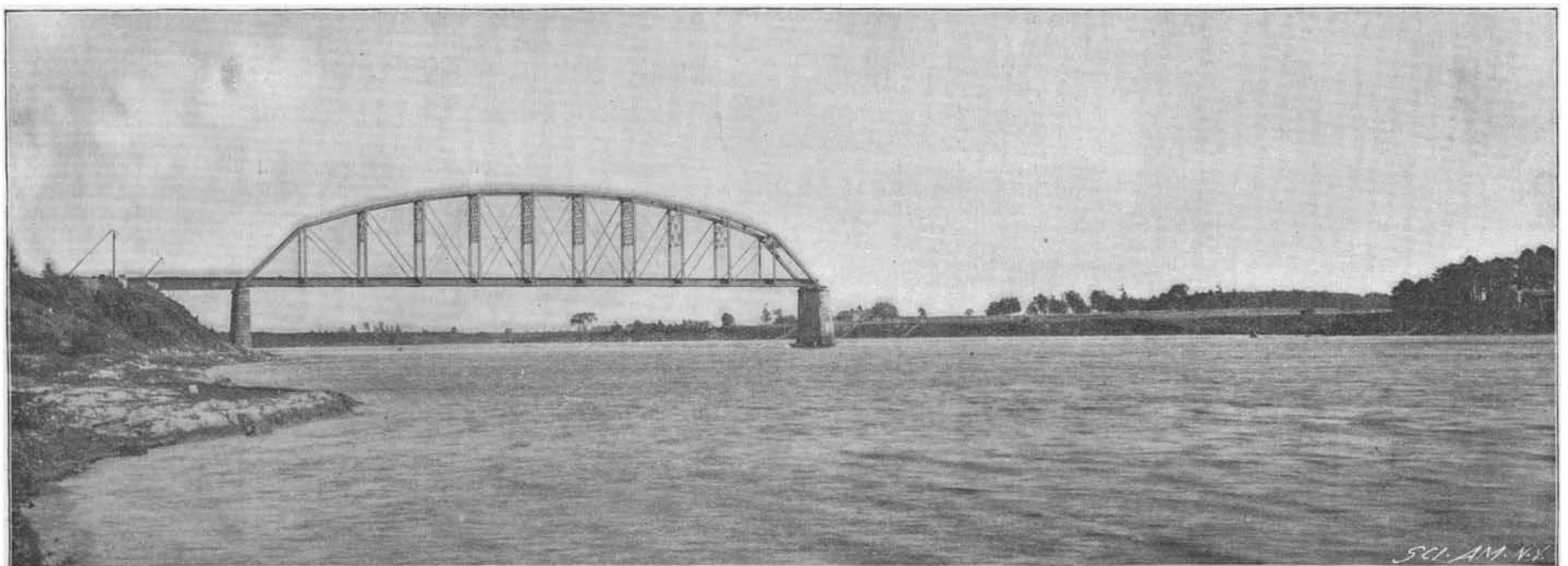
The testimony of eyewitnesses is pretty well agreed that it was the pier that collapsed first, and it is probable that the source of the mischief will be found, as we have said, at the base of the pier where it rested upon the bed of the river. The river at this point is deep and swift, the depth being from 35 to 40 feet, and the speed of the current between 5 and 8 miles per hour. It was decided to sink wooden cribs, fill them with concrete, and upon this foundation erect piers of solid masonry. As the current was too swift for examination of the bottom by divers, soundings were taken and the approximate contour obtained in this way. The timber crib was 18 feet wide by 62 feet long and 38 feet in height. When it was sunk to the bottom, divers went down and brought up samples of the bottom, which is reported to consist of clay hardpan overlaid with pebbles and boulders. It was considered

of 35 feet above the water, the total height of the pier above the bed of the river being 70 feet.

The cause of the accident is, as we have said, purely conjectural. It is not in the least likely, as one or two witnesses have stated, that the pier was pulled down by the breaking of one of the spans. The fallen river span lies, practically intact, at the bottom of the river, and the supporting falsework was still beneath the shore span at the time of the accident. Even if a span had broken apart, it would not have pulled down the pier with it in falling, but would rather have torn away the fastenings by which it was anchored to the pier.

Some eyewitness spoke of the pier as having crumbled away in falling. This is, of course, possible, the masonry consisting of rock-faced ashlar with a backing of Portland cement concrete; but it is highly improbable, for the reason that masonry that fails through overloading invariably gives some premonitory signs in the way of cracks and crumbling of the materials, neither of which was observable in this case.

It is probable that the failure of the pier was due to the nature of the bottom on which it was built. In



CORNWALL BRIDGE, SHOWING GAP MADE BY THE FALL OF TWO SPANS

point to the probability of the swift current having undermined the first pier from the south shore, causing it to fall over, dragging the shore span and the intermediate span with it.

The bridge is located near the Long Sault Rapids of the St. Lawrence River. It consists of a draw span over the canal, a cantilever across the north channel, and three spans across the south channel of the river, each of latter being 370 feet in length. At the time of the disaster the piers had all been built, and the three 370-foot trusses had been practically completed, the

that the bottom was satisfactory, and the filling of the crib commenced forthwith. Bags of concrete were laid by the divers around the sides of the crib to the amount of 50 cubic yards, and then the concrete was deposited by means of self-discharging buckets, having a capacity of 1 cubic yard. It was deposited in 18-inch layers, and is stated to have set satisfactorily as the filling proceeded.

The cribs, which were built in the customary way of 12x12 timber walls, securely drift-bolted, and tied together by 12-inch cross timbers, were built up to a few

the first place, the method of building up a heavy pier upon the natural bed of the river is not to be commended, especially when, as in this case, the bottom consists of loose boulders overlying a handpan; for when a bulky object like a crib is opposed to the flow of such a swift river as the St. Lawrence, there is an appreciable increase in the swiftness of the current, and a powerful eddying and scouring action is set up around the base of the pier, which is liable to cut away the bed of the river. Where the foundations are carried down well below the river

bed, scouring does not necessarily imperil the stability of the pier; but when, as in this case, stability depends upon the river bottom remaining undisturbed, any scouring and undermining at once threaten to overturn the structure.

There is no question that if undermining is proved to be the cause of the disaster, it will shake the confidence of engineers in this system of foundation. Although, on account of the swift current, it would have been a more difficult and costly undertaking to use the pneumatic process, a more satisfactory foundation could have been secured, as the crib might have been carried down through the overlying material to a bearing on a firmer substance below, where its base would have been protected from the scour of the river.

Saki, the Japanese Natural Drink.

Prof. Dr. Loew, of the Munich Brewing Academy, who had abundant opportunity to become thoroughly acquainted with saki (the rice wine of the Japanese) during his four years' residence in Tokyo as professor at the university of that city, recently made the liquor the subject of an interesting talk before the Munich Faculty, says The National Druggist. Saki, says the professor, has been used in Japan for upward of two thousand years. It is made from rice, the grain being first steamed, and then impregnated with a species of ferment. As soon as the impregnation has occurred, the rice is mixed in water, and submitted to fermentation. The yeast used in the fermentation is prepared from rice straw on which the steamed and impregnated rice is spread out before it is prepared for fermentation. Under the influence of the ferment and the yeast, all of the starch of the rice is taken up, so that the product has the character of a wine, and is hence called "rice wine." It is a somewhat remarkable fact that for ages past the Japanese have used the identical process known with us as "pasteurizing," or exposing

the saki, in closed vessels, to a certain degree of heat, to give it a keeping quality, which it otherwise does not possess. Saki, when ready for use, contains from 14 per cent to 16 per cent of alcohol, or is about five times as strong as our beer. The latter, however, is forging its way into the land, and in all the breweries that have been established there beer is made after the German method. This seems to be in spite of the fact that Japan has, in the main, adopted the English and American culture rather than the German.

The Fortifications Board.

The war practically suspended the operations of the Fortifications Board, but, now that peace is returning, the Board will resume its labors. The Board of Fortifications and Ordnance is peculiarly constituted. In addition to the military officers composing it, there is one lay member, Hon. Joseph Outhwaite, member of Congress from Ohio. The appointment of this gentleman was due to the fact that there was a popular idea that the people should have a civil representative on the Board. The Board is a most important one, and consists of the Major-General commanding the army, Gen. R. T. Frank, Gen. Peter C. Hains, and Col. Frank H. Phipps. The Recorder of the Board is Lieut. J. N. Lewis. The function of this Board, as originally constituted, was to prepare an elaborate scheme of coast defense and to determine the merits of rival ordnance, and to adopt the types which should be used in the army. Of course, during the war the general scheme of fortification had to be suspended and all their efforts concentrated on the defense of the exposed parts of the coast. It is believed that the war will result in great attention being paid by Congress to the recommendations of the Board, and it is to be hoped a large portion of their plans will be carried out in their entirety.

The Current Supplement.

The current SUPPLEMENT, No. 1187, contains many articles of more than usual interest, and the front page engraving, an excellent portrait of "Wilhelmina, Queen of the Netherlands," is accompanied by a biographical notice of the Queen and the ceremonies attending her coronation. "High Explosives and Smokeless Powders and their Applications in Warfare," by Hudson Maxim, is a continuation of a most important paper by a great expert on explosives. "Object Lesson Roads" describes the good work which is being done by the Office of Road Inquiry, of the Department of Agriculture. Small sections of model roads are built as examples. "Some New Hand Cameras" describes some very clever new French cameras. "Typhoid Fever in Porto Rico" is an article by Dr. Nicholas Senn. "Development of Photography and Astronomy" is an important paper by the vice-president of the American Association for the Advancement of Science, Prof. E. E. Barnard. "Liquid Air" is a very interesting paper by Prof. George F. Barker, of the University of Pennsylvania, and is concluded in this number.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

DEVICE FOR PREVENTING RAILWAY ACCIDENTS.—CORNELIS PETERS, Nymwegen, Netherlands. Although the systems of signaling on railways have attained a high degree of perfection, accidents arising from the failure to observe signals cannot be entirely prevented. It is the purpose of this invention to overcome this difficulty. The desired end is attained by connecting a movable arm to the apparatus for setting a semaphore signal or a switch, in such a manner that when the line is closed against the train the arm projects outwardly, for example, in a vertical position, and is encountered by a lever arranged on the train and operating a cock or valve when turned by the arm, so as to put the air or steam-brake on and stop the train immediately.

COMBINED SWITCH AND SIGNAL MECHANISM.—CHARLES E. HARRIS, Ellwood City, Pa. This invention is an improvement upon those mechanisms in which a signal-lever is used to throw the switch and signal-operating mechanism, the two being connected so that the signaling mechanism is thrown to "danger" before the switch is moved. The switch-operating and signal-operating mechanisms each comprise toggle-levers for moving and locking the parts. The operating-lever has taut connection with the signal-operating mechanism and slack connection with the switch-operating mechanism, whereby the movement of the signal precedes that of the switch.

CAR-TRUCK.—BENJAMIN F. ALLEN, Mobile, Ala. In this invention a car-truck is provided having two short axles at the forward end independently journaled in boxes on swiveling pedestals. The axles and their wheels are provided with means for holding these wheels aligned with the rear wheels of the truck while the truck is traveling on a straight track and for permitting the front wheels to move laterally a proper degree when running on curves. The frictional resistance of the wheel flanges on the track is thus obviated. Novel means are also provided for supporting an electric motor on the truck-frame, so as to cushion the motor from shocks of percussion and adapt it to have a geared connection with the rear axle of the car-truck.

CAR-COUPLING.—RICHARD C. BECKETT, West Point, Miss. This invention is an improvement in automatic pivoted-jaw car-couplings, the novelty residing chiefly in the construction and arrangement of the springs and disengaging devices. The coupling is composed of hollow draw-heads, having their ends halved and forming abutting shoulders. Beveled catches are pivoted in the draw-heads and are provided with spring attachments. These attachments consist of hooked stop-rods, secured to the free front portions of the catches and extend through adjacent holes in the draw-heads. Helical springs encircle these rods and are seated in sockets in the draw-heads. Lever-triggers, composed of straight bars, are pivoted in a slot in the catches and pull-rods extend through holes in the draw-heads.

CAR-FENDER.—WILLIAM T. WATSON, Victoria, British Columbia, Canada. The car-fender provided by this inventor has a frame comprising a main-section with tubular side-bars. The spring-pressed side-bars of a sliding section enter the side-bars of the main section of the frame. Brackets are secured to the rear portion of the main frame-section at its sides and carry a cross-bar. Standards are pivotally attached to the brackets. A yielding bed is attached to the standards and the forward portion of the main section of the frame. A second yielding bed is attached to the forward portion of the sliding section of the frame and to the bed carried by the main frame-section, the attachment of the latter bed being near its center. This car-fender can be transferred from one end of a car to the other and can be conveniently folded up in front of the dashboard.

ROLLER BEARING.—GEORGE W. DICKINSON, Tacoma, Washington. This invention is designed more especially for car-axes, to prevent overheating. It consists of a series of steel rollers in place of ball bearings, ranged around the end of the car-axle in the axle-box, the interior construction of the latter being such as to prevent undue friction and hold the rollers in position, so they cannot become clogged or caught, while the end thrust is also provided for.

Bicycle Improvements.

BICYCLE STAND.—PERCY W. KIRKPATRICK, Belair, Fla. This bicycle stand is so constructed that it can be readily carried on a bicycle without appreciably increasing the weight and at the same time be always ready for use. It consists of two tubes, one sliding over the other telescopically, the lower tube working inside of the upper tube and having at its bottom a horizontal foot. The top of the upper tube is suspended from the bicycle frame, between the seat and handle bars. A spring extends from the top of the lower inside tube to the under side of the upper end of the outer tube, and tends to force down the foot tube onto the ground. The movement of this tube is regulated by a catch of special construction which travels in a longitudinal groove in the stationary tube, the groove having at each end bayonet-like grooves for locking the movable tube when the foot is up or down. As the foot tube carrying at the bottom end the horizontal foot is raised, the latter is at the same time rotated to be in the same plane as the bicycle frame and out of the way of the rider's feet. When, however, the catch is turned in the groove releasing the tube, the interior spring forces the foot downward upon the ground, rotating it meanwhile so that it shall strike the ground transversely to the plane of the bicycle, and thus hold the latter securely in a vertical position.

Miscellaneous Inventions.

COMBING MACHINE.—ALFRED WENNING and CHARLES HUBERT GEGAUFF, Mulhouse, Germany. The object of this invention is to counteract the tendency of drawing rollers to flex apart and to lose their nipping power at their central portions. This is accomplished by forcing the ends of the rollers apart, and locating, between the devices which have this separating function, additional pressure-exerting devices tending to force one roller toward the other. With this arrangement, the rollers may be made much longer than usual, without any loss of nipping power, and thus the output of the machine can be increased.

WATER-TRAP.—JOSEPH PATTON, Sharpville, Pa. This device is designed to receive and discharge automatically the water of condensation from steam-engine cylinders, and comprises a reservoir with an elevated dome, a reticulated baffle-plate located transversely in the reservoir and provided with a vertical slot-guide, a waste-pipe attached on the under side, and an inlet pipe extending from the dome to connect with the engine cylinders. Pivoted in the reservoir and movable in the guide mentioned, is a lever to which a valve and stem are connected for controlling the waste. Connected with the lever and extending above its free end is a float movable in the dome, thus leaving the reservoir chamber mainly unobstructed.

WATER-HEATER AND STEAM-GENERATOR.—JAMES McCARTNEY, Oakland, Cal. The purpose of the present invention is to provide an improved water-heater and steam-generator arranged to insure a proper circulation of the water. The invention consists primarily of a conical water-chamber, the base of which is arranged directly over the burning fuel in the fire-box, and a spreader placed within the chamber above the base and having a central inlet for the water to enter the chamber. The sides of the spreader form with the sides of the chamber, an upwardly extending outlet for the heated water.

HYDRAULIC PUMP.—CHARLES F. CARTY, Washington, N. C. The pump of this inventor comprises a pair of casings each having a suction-pipe and a discharge. In the casings, reels are mounted to turn, and on the casings stuffing-boxes are held. A band or wire passes through the stuffing-boxes and is connected at its ends with the reels, so that, upon rotating the reels, one winds up the band while the other unwinds it. A pulley is adjustably mounted outside of the casing, and over this pulley the band passes on its way from one casing to the other. The diameter of the pulley corresponds to the distance between the centers of the stuffing-boxes.

SLEIGH ATTACHMENT FOR VEHICLES.—ANDREW C. NYGAARD, Rawlins, Wyo. This sleigh is so constructed that the sleigh-runners may be folded up beneath the running gear, permitting the wheels to travel on the ground, or that the runners may be made to engage with the surface over which the vehicle is to be passed, at which time the wheels of the vehicle will be raised from the surface. By this arrangement the vehicle is enabled to travel over snow-covered surfaces through the medium of the runners and to travel over clear surfaces through the medium of the wheels.

CANDELABRUM.—HERMAN F. NEHR, New York city. The candelabrum forming the subject of this invention consists of a standard made in adjustable sections, reversible and interchangeable arms carried by one section of the standard and means for securing the arms to this section of the standard. Each arm is provided with sockets located at its upper and lower longitudinal surfaces, the sockets receiving the candlesticks. By this arrangement the design of the candelabrum may be varied at will and the necessary changes be quickly made.

CIGAR-BOX ATTACHMENT.—JOSEPH R. GRINFELDER, Spokane, Wash. This invention provides a simple device capable of being expeditiously attached to a cover of a cigar-box and serving to hold the cover open at an angle to the body of the box. The device supports a price-card or any other card in such a manner as not to interfere with the reading of the cigar-box label. The device is so constructed that when it is applied to a cigar-box cover, the box may be handled by the lid without interfering with the device.

NUT-LOCK.—CULLEN E. LARAWAY, Plaquemine, La. This nut-lock belongs to that class in which the nut is held by a dog engaging the bolt to prevent the turning of the nut. The invention embodies a nut-casing carrying the dog and an eccentrically bored collar, which collar, upon being turned independently of the casing, throws the dog into engagement with the bolt.

LOCK-BOTTLE.—GEORGE W. BETJEMANN and WILLIAM CANDLAND, London, England. The purpose of this invention is to provide a lock-bottle to contain perfume, liquors, and the like, which bottle is arranged to permit the owner to lock the stopper in place. The bottle has a lock with its casing secured on the neck of the bottle. A lock-plate is movable on the casing and is adapted to be engaged by the lock-bolt of the lock to hold the plate against movement. The plate is also adapted to lock the stopper to the neck of the bottle when the plate is locked by the bolt.

TILE.—WILLIAM THOMSON, Manchester, England. This improved tile is made either from opal or other glass. On the back or on the side of the tile small pieces of granite, marble, or like material, are fixed, by means of which the tiles thus produced can be readily and firmly fastened in place. In order to make the tile readily attachable, the inventor applies to the surface a solution of soluble glass mixed with an insoluble silicate and with zinc oxide. The tile is then heated to a temperature slightly above that of boiling water, causing the mixture to form an enamel-like coating.

GRATE.—WILLIAM EDGAR, Mobile, Ala. The purpose of this invention is to provide a grate especially adapted for burning sawdust. The top plates of this grate are so connected with the supporting ribs that an efficient draft is obtained. The invention consists prin-

cipally in forming the top plate with a series of circular openings in close proximity to one another. Each opening has its walls extended above the main top surface of the plate. By this means there is formed an annular conical ring or projection around each opening so as to prevent the sawdust from running through.

DEVICE FOR HEATING SAD-IRONS.—FRANCIS W. NEWTON, Gainesville, Texas. According to this invention, a body mounted on a base is provided with faces against which irons are adapted to be placed and with openings below the faces. Inclosing covers there are for these openings, one side of the covers being open. A slide is adjustably mounted on each cover and is arranged to close the open side thereof. By manipulating the slides, the desired degree of heat can be sustained with the consumption of a minimum amount of fuel, and the sad-irons resting against the faces thus receive a uniform degree of heat.

GATE-HINGE.—HERMAN F. NEHR, New York city. This hinge is provided with a cap mounted to rotate on the upper end of a post. Between the cap and post, a block of hard metal is interposed. A casing surrounds the post, is secured to the cap, and is supported solely by the cap. The construction is such as to adapt this hinge to the heavy doors and gates used in churches.

FLASH LIGHT APPARATUS.—ISRAEL COHN, New York city. The idea of this invention is to facilitate the measurement and use of specified charges of magnesium powder obtained from a larger magazine, yet so constructed that there will be no danger of the powder in the larger magazine being ignited. The larger magazine consists of a long tube, having attached to the top a short revolvable tube, sufficient in length to hold a charge of powder enough for making a flash-light photograph. Attached near the lower end of the short tube is a small, flexible pipe leading to a mouthpiece. On one side of the tube, parallel with its length, is a small wick tube holding a wick which projects slightly at the top, and filled with alcohol. To fill the small tube it is revolved till the hole in the bottom coincides with the hole in the top of the magazine supply tube; then the thumb is put over the mouth of the small tube, and the whole is inverted, the magnesium in the large tube falling, by gravity, into the small tube. The latter is now revolved, which cuts off the magnesium and the whole is reversed in position. The wick is lighted, the mouthpiece placed in the mouth, and the charge of magnesium in the small tube is blown upward into the flame, producing the flash. At the time the small tube is revolved for filling, it also cuts off connection with the air tube and prevents the powder from going into that.

FILTER.—WILLIAM A. MADDIN, Mosco, Indian Territory. This invention consists essentially of a filter made in three separate sections, each provided with varying thicknesses of filtering substances and the whole, when put together, inclosed in an outer casing, leaving an air space between them for the air to circulate freely around the filtering portion. The upper section of the filter is filled with coarse sand held between wire gauze of suitable mesh. The center and largest section has broken charcoal supported by a perforated bottom, while the lowest section is filled with coarse sand and gravel between gauze wire ends. It is designed to filter rain water from spouts, is readily taken apart for cleaning, and the sections are reversible, while the ventilation feature is one of its chief merits.

Designs.

FABRIC.—ALICE A. AZEEZ, New York city. The leading feature of this design consists of a fabric having a raised elongated figure rounded at its lower end and converging toward its upper end and having a ribbed surface.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.