use, and Fig. 2 is a vertical cross section of the saw mounted upon a mandrel between two collars. The mandrel has a screw thread which extends nearly to the saw, with an outside washer or collar, and a nut to hold the latter in position. Fixed in the saw plate on each side, or integral therewith, are projecting knobs adapted to bear against the collar and the washer near their outer edges, these knobs being opposite to each other, and acting as pivots upon which the saw may be tilted. At right angles with the knobs, and at about the same distance from the center of the saw, are bolts of equal length projecting through the saw plate. One of these bolts may be simply a pin, fitting loosely in a hole in the saw plate, and its ends bearing against the collar and washer, but the other bolt has a screw thread fitting a thread in the saw plate, and has a flat-sided head to which a wrench may be applied. When the saw is placed in position on the mandrel, the outside washer is forced firmly against the ends of the bolts and knobs, by means of the outer nut, and the angle of the saw is then readily changed by turning the screw threaded bolt which engages the screw-threaded aperture in the saw-plate.

Naphtha Locomotives.

The Bellefontaine Street Railway Line, of St. Louis, have concluded to give what is known as the Connelly gas motor a fair trial. This is a motor first put into use in Elizabeth, N. J. One motor was run over six months experimentally, developed abundant power for the heaviest loads and a speed of 12 miles per hour, but there were many mechanical defects which had to be overcome. Two new motors were constructed, every improvement being tested by actual service on the road, and it is claimed that the experimental stage is now passed, and there is no longer any doubt as to the new motor's success. Preparations are being made to manufacture the motors in Chicago and Elizabeth, and possibly in St. Louis.

Upon first thought it would seem to be an easy thing to attach a gas engine to a street car, but, in fact, it has been a very difficult problem, owing to the lack of a suitable appliance for transmitting power from the engine to the car axle differentially. A gas engine geared direct to the car axle as the locomotive is connected to its driving wheels would require an engine of such bulk and power that it would be entirely impracticable. A gas engine of 25 h. p. has been applied to this purpose, geared direct, and proved an entire failure. It completely failed to start a street car on a grade or a curve. The usual mechanism furnishes direct transmission of power, but this practice conveys the least power just at the time when the greatest power is required. The most power is needed when a car is starting or on grades. It was evident that a variable transmission, permitting the engine to develop its maximum power when starting or driving a car at minimum speed, was the one essential thing needed for a gas motor. The Connelly motor is said to encompass this desirable point. An ingenious piece of mechanical workmanship is used to cover the requirement. It is called a friction device, that exerts a powerful leverage, enabling an 8 h. p. engine to easily start a loaded car on grades, which could not be started by a 30 h. p. engine connected to the axle in the common manner. The compound gas engine has high and low pressure cylinders. The fuel tank is a double cylinder, the inner one containing the naphtha and an absorbent material. This is surrounded by a jacket of water, which is connected by pipes to the water jacket about the engine cylinder. The circulation of water from the cylinder to the carbureter is continuous, and it performs a double service, cooling the cylinder of the engine and warming the naphtha, producing evaporation. Air is drawn through the absorbent material, thoroughly carbureted, and supplied to the engine, compressed, and then ignited by an electric spark. The low pressure cylinder next receives the charge and becomes a motive cylinder during the first half of the outward stroke, when, the pressure being gone, it acts as a pump, drawing a fresh charge of gas into the high pressure cylinder. The method of transmitting power from the engine to the axle is quite practicable. The main shaft is set parallel with a disk 30 in. in diameter placed on the face of the fly wheel. On the shaft is a loose friction pulley 12 in. in diameter, that engages with the face of the disk. This loose pulley is prevented from revolving on the shaft by a tongue and groove, but it is moved up or down on the shaft at the will of the driver, by means of two screw rods which pass through the pulley and revolve with the shaft.

When it is required to slow up or stop, the friction pulley, still in contact with the disk, is run down to near its center, and at this point can be slightly lifted from the disk. To reverse, the friction pulley is run below the center of the disk, while the engine is left to run all the time in the same direction. The engine, it is said, requires no attention after being started, and regulates its own speed, whether the car be running or standing still. The car is started with a gentle motion and with an enormous leverage.

The cost of operating the gas motor is $1.40 per day, 14 hours, 90 miles each, while the cost of operating street cars with horses averages from $5 to $6.50 per day for each two horse car, the average mileage being 60.

The motors are now being constructed, with latest improvements, in Elizabeth, N. J.—*L., H. and Power.*

IMITATION OF MAJOLICA.

Cements and sealing wax are useful for giving to paper and wooden articles a hard glaze, resembling that of majolica ware. The cylindrical vase shown in the annexed engraving consists of a paper mailing tube 3 inches in diameter and 6 inches long, furnished with a pasteboard bottom, which is glued in. The inside and bottom of the vase is provided with two or three coats of asphaltum or shellac varnish to render it waterproof. The outside is covered with jeweler's cement of different colors, or with sealing wax, or both. The bar of cement or wax is melted at the end, and applied to the paper cylinder in the same manner as it is applied in sealing packages. No particular care is required in applying the wax. It is, however, necessary that the edges of adjoining patches of wax be brought into contact with each other to insure the complete covering of the paper. In the example shown in the engraving, olive green jeweler's cement forms the covering of the lower part of the vase. This is blended into cement colored with Venetian red or Indian red, and the cement at the top is flecked with yellow.

IMITATION OF MAJOLICA.

The mass of cement is laid on in spiral lines, and when the covering is complete, the vase is held over a smokeless flame, such as that of a Bunsen burner or alcohol lamp, or it may be held over a coal fire until the cement fuses. The vase should be turned in such a way as to cause the variously colored cements to run into each other. The vase is held by means of a paper tube or a stick inserted in its open end.

Ornamentation may be applied by cutting leaves, stems, petals, etc., from pieces of thick paper, dipping them in melted cement of appropriate color, allowing them to cool, afterward arranging them upon the vase; finally softening the cement of the vase and the ornament by holding a flame or a hot iron over them until the cement softens, and the ornaments are attached. Care is required at this point to avoid the complete fusing of the cement, as this would spoil the job. Care is also required to avoid igniting the cement or wax, as it is nearly impossible to extinguish it.

How to Prevent Scarlet Fever.

At a recent meeting of the American Pediatric Society in New York, Dr. J. Lewis Smith, the president of the society, read a paper on a part of the general discussion on "How to Prevent Diphtheria and Scarlet Fever." The micro-organism of scarlet fever had not been positively ascertained, but its effects were known from clinical observation. The contagiousness probably did not cease until after desquamation had passed, and it had been said the discharges from the otitis due to it were contagious. Quarantine in a small room attached to one of the wards at the Foundling Asylum in this city had been sufficient for scarlet fever, but not for measles. The contagious element was more fixed and less diffusible in the former. It remained in clothes a long time. Most prophylactic measures consisted in isolation of the patient, disinfection of the person and air which surrounded him, and of objects and persons in close relation with him. He called particular attention to the danger in books handled by the sick with scarlet fever, for in them the contagious element remained a long time. At his first visit he wrote a prescription for carbolic acid and oil of eucalyptus, of each one ounce; spirit of turpentine, six to eight ounces; mix, add two tablespoonfuls to a quart of water, put in a broad basin and maintain a state of constant simmering over an oil stove. He also ordered an inunction of the entire surface of the patient every three hours with carbolic acid and oil of eucalyptus, each one drachm; sweet oil, seven ounces. A solution of corrosive sublimate might with advantage be applied on a probe and cotton to the tonsils and pharynx, and ten drops of a solution of two grains to the pint syringed into the nostril every two hours in the young infant. Then there should be constant ventilation during the active period of the fever, no article should be sent from the room unless properly disinfected, new families not allowed to move into the apartments before proper disinfection, the physician should disinfect his hair and entire person, and not wear the same outer clothing when going to see midwife cases.

The Plate Glass Industry in the United States.

The growth of the plate glass industry in this country has been such that one is forced to regard its manufacture as one of the most prosperous industries in the United States. It is a question, however, one which time alone can answer, whether it will continue to be such a prosperous industry, rise being given to the question by reason of the large increase of capacity projected. There are already eight great works in operation, viz.: Crystal City, Duquesne, Creighton, Tarentum, Ford City, New Albany, Kokomo, and Butler, capable of making from 9,000,000 to 10,000,000 square feet of glass per annum, according to recent estimates, or almost as much as the present requirements of the country call for. What, then, is to become of the heavy additional production promised is not known, without lower prices for the article can greatly augment consumption. But work on new plants and additions to old ones is going on just the same, nevertheless. At Charleroi, the newest industrial city of Pennsylvania, a huge plate glass establishment is being erected, and will be equipped with glass machinery, at a contract cost of $308,000. The Diamond Plate Glass Company, of Kokomo, Ind., through a branch $2,000,000 incorporation, is putting up a works at Elwood, Ind., to make 20,000 feet of finished glass a day and to give employment to about 2,500 men. The Pittsburg Plate Glass Company propose doubling their present plant at Ford City, at any outlay of $1,750,000, so as to surpass all competitors in the matter of output, at home or abroad. Other companies still are enlarging, and entirely new enterprises of the kind are being either actually organized or talked of in various parts of the country.—*Wheeling Manufacturer.*

The First Locomotive Manufactured in South Australia.

The town of Gawler was all alive on Friday, April 11, when the first locomotive made by the enterprising firm of James Martin & Co., limited, was formally handed over to the railway commissioners. A special train left the city at 9:30, conveying a large number of the commercial world, including the premier, members of Parliament, and his Excellency Earl Kintore. On arrival visitors found the town gayly decorated. Several arches of bunting and evergreens, with a great number of flags and other decorations, gave a most pleasing appearance.

After several hours spent in looking over the works, which were in full swing, a banquet on a very liberal scale was provided. The speeches on this occasion were all well received, especially those of his Excellency, the premier's and the venerable James Martin's. Afterward, when the engine was formally handed over, a model of the regulator handle in silver and an illuminated address were presented to Mr. James Martin, and his reply evidenced how well he appreciated the thoughtfulness of his many old and new servants in making the presentation.

Before returning to the city the governor drove the engine and a number of carriages containing the Sunday school children and many residents several times up and down Murray Street, and this will be to many one of the events of their lives. Indeed, to be driven by a real live earl is the happy lot of few.

Although Messrs. James Martin & Co., limited, of Gawler, have been long and favorably known in connection with their extensive mining and agriculture manufactures; the recent substantial additions to their buildings and plant and the increase in the number of their employes is due to their having accepted the contract to supply locomotive engines to the South Australian government. The contract was signed on May 1, 1888, and provides for the supply of fifty-two locomotives, to be delivered by installments covering a period of seven years from the date of contract.—*Pictorial Australian.*

Look Out for Your Ashes.

It would appear that the cause of the accident on board the City of Paris was the breaking of the propeller shaft, which caused a sudden increase in the velocity of the engines, leading to a general smash-up. The breaking of the shaft was due to its having ground away the lignum vitæ, and ultimately the steel in the strut supporting it. It then was out of a straight line, and in consequence of this broke by the strains brought about by its own revolution. The cause of the accident is, therefore, to be traced to the grinding away of the lignum vitæ of the bearing. One theory is that the liner on the propeller shaft being too tightly shrunk on, split, thus leaving a sharp edge to grind away the lignum vitæ. Another is that the ashes which are discharged below water on the same side as the broken shaft were continuously carried to the propeller bearings as the ship was going through the water, and that they were the original cause of the mischief. —*Nautical Magazine.*

Gas Consumption.

The business of supplying gas in this country is only in its infancy. American cities are increasing out of proportion to the general increase of population throughout the country. As evidence of this it may be stated that at the beginning of this century but three per cent of the total population were dwellers in cities. In 1880 this percentage had swelled to twenty-two per cent, and we now must have not less than thirty per cent of the whole population residents of cities and towns.

To those intimately associated with or who have followed the advances made in the manufacture of gas, the increasing value of gas works property in this country is settled beyond all question. It is now positively known that the introduction of electricity has really cut no important figure so far as to curtail the gas output, and it is well known that since the introduction of electricity for street illumination, the loss to gas companies of a few street gas lamps has in all cases been more than offset by the marked gains from increased private consumption, directly traceable to the demand for more light in order to equal the strong, high candle powers of the electric arc lights and the dazzling brilliance of the incandescent lamps.

The following shows the consumption of gas in cubic feet:

	1885.	1890.
Denver	120,000,000	210,000,000
Macon	15,000,000	37,000,000
New Albany	15,000,000	25,000,000
Des Moines	40,000,000	60,000,000
Baltimore	900,000.000	1,200,000,000
Boston	852,000.000	1,439,000,000
Cambridge	66,000,000	120,000,000
Fall River	54,000,000	67,500,000
Lynn	40,000,000	63,000,000
Lowell	146,000,000	210,000,000
Grand Rapids	40,000,000	100,000,000
Kansas City	140,000,000	225,000,000
St. Joseph	50,000,000	70,000,000
Philadelphia	2,758,000,000	3.250,000,000
St. Louis	790,000,000	1,080,000,000
Omaha	40,000,000	150,000,000
Jersey City	160,000,000	290,000,000
Paterson	60,000,000	97,000,000
Brooklyn	510,000.000	1,250,000,000
Buffalo	95,000,000	110,000,000
New York City	2,375,000.000	8,510,000,000
Rochester	200,000,000	230,000,000
Troy	50,000,000	130,000,000
Cincinnati	730,000,000	1,000,000,000
Columbus	150,000,000	200,000,000
Providence	350,000,000	485,000,000
Nashville	90,000,000	100,000,000
Richmond	154,000,000	180,000,000

—*Progressive Age.*

Hidden Dangers in Dam Building.

In the construction of water storage dams there is an element of insecurity to be guarded against in some cases, which does not seem to have been publicly noticed. John D. Emersley, in *Mining and Scientific Press*, referring to the swelling of the ground under or near to the dam, considers it a source of danger.

A valley or wide ravine with a slight descent, and having side hills coming near to each other at its lower end, is economically favorable for water impounding purposes, provided that the collecting surfaces above are large enough to insure the supply required. In the arid regions such a valley is usually so dry that, on the side hills at least, the general water level can only be reached by deep sinking. If solid primary rock, with little permeability, is available in founding the dam, its bulk, when submerged, will not increase; but if dependence is placed on a stratified formation containing layers of clay, talc or shale, its expansion when exposed to pressured water must certainly be expected. Every old miner has had trouble with swelling or "creeping" ground, and builders of escarpment walls are aware how hard it is to keep some kinds of rock in place during wet weather.

Assuming that a dam has been built on an unstable foundation of the kind described, what will the effect be when a pressure of 50, 70, or 100 feet of water comes upon it? The whole "country rock" above the dam will, in the center of the ravine especially, both underneath and outside of the dam building, be saturated to a great depth. Under the abutments on the converging side hills the pressure will be less, yet every pore and interstice will be filled. Should there be the slightest tendency of this water-charged rock to expand, either laterally or vertically, it is easy to understand how even a dam in itself well planned and carefully built may in time give way, owing to such expansion.

The sapping and weakening effects of water percolating under high pressure may go on for years without being noticed, but if the dam erection is ultimately, though it may be imperceptibly, lifted or compressed by the slow swelling of the ravine or hillside formations, so that cracks and veinlets are formed in or beneath it, increased pressure may suddenly destroy it.

The wearing or mechanical effects resulting from a sweating process going on in a dam, or the rock underlying it, is not the only evil which is to be feared. The air acting on wet surfaces promotes chemical changes which are followed by disintegration of the affected rocks, and thus slowly yet surely there may be destructive agencies at work where least expected.

Should there be veins of porous rock dipping under a dam from its upper side, the passage of water through such veins may of itself prove a hidden cause of disaster. The escape may be small at first, but a softening and widening work going on for years cannot fail to weaken a heavy dam building not very far above it.

If I am right, continues the author, in assuming from reasons stated above that the building of dams on some kinds of stratified rocks renders them unsafe, I trust by calling attention to the subject to encourage investigation and the adoption of adequate engineering remedies. It would be some satisfaction to know whether the Johnstown and Walnut Grove dams were built on stratified rocks. If they were, affording evidence long before they collapsed, which they did not give when first in use, that cracks had been opened in them, it is reasonable to assume that they had been injured by the expansion of the foundation and hillside rocks.

How Rubber Bulbs are Made.

It is commonly supposed by the uninitiated that the "bead," or raised line, that encircles a bulb shows the joining of the pieces of which it is made. The fact, however, is that the pieces or original parts of the bulb are invariably joined at right angles to the bead line. Long bulbs, such as syringes and atomizers, are made of two pieces; round bulbs, as pumps and balls, are made of three pieces. New and unique styles that call for variation from the established modes are daily encountered. A competent pattern maker, however, will find little difficulty, as a general thing, in so joining the parts as to secure the best results, both in vulcanizing, where the even swelling of the article must be considered, and in wear and tear, where the seams must run so as to be protected as much as possible by the general contour of the bulb.

After the pattern maker has decided by measurement and experiment upon the shape and size of the parts which go to form the bulb, zinc or galvanized iron patterns are made and given into the hands of the cutters. Mixed sheets of the required thickness being spread and afterward cut into convenient sides or squares, the bulb making begins. Each piece cut must have distinctly skived edges. Considerable care is necessary in this, as the strength of the seam depends upon the smooth fitting of the edges. The three parts for hollow balls may, however, be cut with a die. The pieces when cut are arranged in large books with leaves of smooth cloth. If the bulb has a neck, small pegs of iron are first prepared by being cemented and wound with strips of rubber as a nucleus for the neck. The two or three parts of the bulb are then brushed with cement the whole length of the skived edge, after which they are thoroughly heated.

When thoroughly warmed and softened, the bulb maker, taking a prepared peg, places the neck of one piece on one side of the rubber core, and another neck piece on the opposite side, then presses them firmly together, and rolling the whole tube-shaped piece between thumb and forefinger, has finished the neck of the bulb. The next process is that of knitting the edges which form the seam. Holding the finished neck toward him in his left hand, with the thumb and forefinger of the right he pinches the edges firmly together for nearly the whole distance round. The shape is now not unlike that of a "long clam." Into the side aperture, which is left open, is poured a little water or liquid ammonia. The opening is then made still smaller, and as a final touch the maker puts his lips to the orifice, and puffing out his cheeks till they look like miniature balloons, blows full and hard into the inside of the bulb. The softened rubber under this sudden pressure expands, the flattened shape is lost in a fuller and more rounded outline, while the operator, with a quick nip of the teeth, closes the opening, the imprisoned air and water holding the sides apart in symmetrical corpulency. There are those who can never learn the knack of blowing up a bulb with the mouth, but are obliged to use a bulb to inject the air.

After the makers have done with the now partly made bulb, it is passed to the trimmers, who, armed with scissors with curved blades, carefully circle the seams, cutting away all unevenness, till the whole exterior is smooth and ready for the mould. In front of the trimmers are a number of shallow pans partly filled with chalk. Into these the bulbs are laid. A small dumb waiter takes them down to the mould room and returns the empty pans. The bulbs on leaving the chalk pans are deposited in a small cylindrical box which, turning a few times, powders them so effectually that the rubber cannot adhere to the inside of the mould. An experienced mould worker now taking one-half of a mould in his left hand, with his right gently forces the bulb into it, capping it with the second half. If the pattern maker has done his part faithfully, each will just fit its mould. If not, they will come out of the vulcanizer wrinkled, showing that it was too large; or, if glazed and imperfect, that it was too small.

A flat iron ring or clamp holds the two sections of the mould together when in the vulcanizer. This is tightened by iron wedges which are driven between the mould ends and the clamp. The moulds after being keyed are piled on cars that run upon small tracks into the vulcanizers, and are cured by steam heat. When the curing process is completed the vulcanizers are opened, and the cars, by a short extension of the track, are run under a simple shower bath which quickly cools them. They are then unkeyed, the moulds twisted open and the bulbs taken out. If the work be well done, the swelling of the liquid within its rubber prison has exerted so intense a force that every line and letter within the mould is reproduced upon the outside of the bulb, while the sulphur combining with the heat has sealed the copies with its magic spell.

The iron peg in the neck is next loosened by means of a blunt awl, and slipped out, leaving the bulb perfect in shape. In the mould room are large car-like boxes into which the bulbs are thrown. A box being full, it is trundled away to the cylinder room, where it undergoes a thorough scouring and polishing in huge slowly revolving cylinders.

When taken out of the cylinders, the dirty yellow color which the bulb bore on leaving the mould has wholly disappeared. It now looks smooth, white, and finished. The neck being cut off the required length by a small adjustable cutter—devised expressly for the purpose—the bulb is ready for market, or for the various fittings which accompany it as adjuncts to the syringe, atomizer, or other bulb. Where a smooth, clear-cut hole is needed in any part of the bulb, except the neck, it is cut by a swiftly revolving punch. The neck hole is left by the iron peg as already described.

A good illustration of the power of the imprisoned steam within the bulb may be obtained by knocking a clamp off a mould before it has been treated to the shower bath. The two hemispheres of iron will fly apart as if by magic, the bulb swells to treble its normal size, and explodes with a loud report. The mould workers are sometimes badly burned by hot water which bursting bulbs scatter in all directions.

A well made bulb, one that has a good, energetic spring, that has just the right smoothness of outline, that is not scarred by imperfections in the mould, and that has the whiteness of a healthy cure, is an object that always wins the respectful admiration of rubber men. Toys, balls, and hollow goods generally, are all made in the same manner as bulbs.—*India Rubber World.*

Asafœtida.

The asafœtida region is thought to include not only the whole of Southern and Eastern Persia, but also the greater part of Belochistan and Afghanistan, Turkestan, and the region, now under Russian control, eastward of the Sea of Aral. It is, we believe, cultivated in the Punjaub also, and the bulk of it, at any rate, is brought into commerce *via* Bombay, where it is received either by way of the Persian Gulf or through British India. The proportion of the drug consumed in the East is enormously larger than that shipped to Western countries. We find from the statistical tables of the trade of British India which have just been issued, that whereas the total imports of asafœtida into that country during the last five years have been 37,306 cwts., the aggregate exports have only been 2,014 cwts., or barely 5 per cent of the whole. The first trustworthy account of the collection of asafœtida in Persia was given about 200 years ago by one Engelbert Kaempfer, a German scientist; but from the reports of recent visitors who have observed the mode of collection of the drug, this still remains the same in all essential particulars as in Kaempfer's time. According to that authority, the collection begins about the middle of April, when the earth is removed from the roots, which vary in thickness from a carrot to that of a man's leg, and the leaves of the plant are removed. Toward the end of May the top of the root is sliced away, and the juice exudes and is scraped off. A few days later another incision is made, and this process is repeated at intervals until the beginning of July, when the crop is at an end. It has been asserted that the usual asafœtida of commerce in the agglutinated tears is that which exudes from the root when the whole top is sliced off, while the tears are the solidified juice obtained from incisions only.—*Chem. and Drug.*

Kansas Railroads.

Kansas has more miles of railroads than all the New England States put together. She has 1,159 more miles than the great Empire State of New York, whose population and wealth surpasses Kansas four to one. She has more than the great States of Pennsylvania, Iowa or Texas. Kansas to-day has 8,754 miles of railroads. Illinois alone surpasses her with her 9,900 miles. Next comes Iowa with 8.364. Following her is Pennsylvania with 8,224. Then comes Texas with 8,210 miles. Only think of it! During the three years from 1886 to 1888 inclusive Kansas constructed 4,535 miles of railroads, which is more than any one of the 27 of her sister States have in operation to-day, and there are only 13 States in the Union who have a greater mileage of railroads than Kansas built in these three years.