the air will be solved; velocipedes and steam carriages for common roads will be as common as horse conveyances are at present; grades can be established on railways that are now perfectly impractical, and other improvements made in mechanics and engineering that are not now imagined by the most far-seeing thinker. For in the metal aluminum we have combined the maximum of strength and durability with the maximum of weight. The day is not distant when some person will discover the right process. Many more wonderful, and seemingly more difficult processes, have been brought to light in the past few years. Now, in order to give the inventive public (who all take the SCIENTIFIC AMERICAN, or ought to) a cue to the future process, please give them all the information you can in reference to the subject, and let them go to work, and they will soon ferret out the simple process needed.

I believe you like to have hints thrown out to inventors, so while I am in that line of business allow me to suggest that some inventor get up a machine to fold quarto and octavo papers; for instance, the SCIENTIFIC AMERICAN comes to me sometimes terribly askew. I am always too anxious to read it to take time to refold it and straighten out the creases before cutting, and therefore spoil the paper for the binder, and sometimes even cut the reading matter. I think you will bear me out in my assertion that some sure and easy way of accurate folding is a desideratum to both the publishers and readers of newspapers of a "several-fold-up" form.

Please hurry up your prospectus. Our club was euchred out of six numbers of the SCIENTIFIC AMERICAN by being so far away that we were not in time, and we cannot afford it again; besides, the "Noble Red Man" was in quest of science, and overhauled the mails, depriving us of eight or ten more copies. The SCIENTIFIC AMERICAN is just as welcome a visitor out here in the Rocky Mountains as it was back in "America." Our prayers are for our weekly SCIENTIFIC AMERIFAN," as well as for our "daily grub." "ALUMINIST."

Helena, Montana.

[Aluminum is prepared from cryolite, a compound of sodium, fluorine, and aluminum, procured mainly in Greenland. It is mixed with common salt and sodium, in the proportion of about 270 parts by weight of cryolite, 150 of salt, and 72 of sodium, and melted in a crucible. No feasible and cheap method of reducing the metal from ordinary clay has yet been discovered.

Folding machines for newspapers are in common use, but as a general thing they do not equal, in exactness of work, hand labor.—EDS.]

Extermination of Cockroaches.

MESSRS. EDITORS:—We have been greatly troubled for two or three years by roaches, the real, big, black fellows. By continued exertion we confined them to the vicinity of the furnace and range, but to exterminate them all sorts of traps and exterminators proved ineffectual. Somebody told us of Paris green, and it has done the work. We feel so rejoiced that we desire to give the knowledge to the public. Paris green can be procured at any apothecary store. Just sprinkle it round where "they most do congregate."

B. F. BURGESS, JR.

Boston, Mass.

NAPHTHALIN AND ITS USE.

Naphthalin was discovered in 1820, by Garden, among the products of distillation of coal, and has since been the subject of thorough investigations of Faraday, Liebig, Woehler and many other chemists. Laurent occupied himself especially with its derivates, and founded thereupon his new theory of organic compounds. Up to the present time naphthalin only was of scientific interest, and of a very limited practical use, when in 1860 Roussin, a French chemist, by his repeated experiments at once drew the attention of the scientific world to this hitherto so-considered worthless substance. He succeeded, namely, in producing a dye-stuff from it which he considered the *alizarine* of the madder, but which, though identical in its chemical composition with the natural *alizarine*, has subsequently been found to be very dissimilar to it. It therefore became suddenly lowered in the estimation of those whose interest was connected with it, and was subsequently looked upon as being as worthless as before, the more as other coloring matters which had been prepared from the same substance met with the same fate. Quite recently, however, European investigators have succeeded in producing benzoic acid from this hydrocarbon, a substance largely used in the preparation of tobacco sauces, in calico printing, in the manufacture of aniline blue and benzol, respectively nitrobenzol and aniline; and it is therefore that I call attention to this subject. I first will describe the

PREPARATION OF NAPHTHALIN.

Although this hydrocarbon (its formula is C_{20}, H_8) is a product of the distillation of coal, it does not pre-exist in them, as is the case with paraffin. [I have, in the laboratory of Prof. Bolley, in Züric, extracted small quantities of paraffin from boghead coal. The coal was previously pulverized very finely, and the extraction was performed by cold ether.] It is only generated at a high heat, such as that of the retorts in gas works when in full operation. In the manufacture of gas comparatively large quantities of tar are obtained, the conversion of which into permanent gas has puzzled the ingenuity of inventors since the first introduction of gas illumination on a large scale, and still remains an unsolved if not an insoluble problem. In distilling this tar, and in only gathering those portions which run over between 400° and 500° F., we get the so-called "pitch or dead oil," which is employed for the extraction of napthalin. The residue remaining in the still is the substance into which the blocks of Nicholson's pavement are dipped, previous to their being inserted in the street.

According to a paper recently published by Dr. Vohl, the pitch oil should be put in vats and left in a cool cellar from six to eight days, after which time most of the napthalin will have crystallized out. The latter is then filtered from the liquid portions and transferred into a centrifuge, for the purpose of separating it from the adhering oil, but as this cannot be arrived at at once, the crude naphthalin is then subjected to hydrostatic pressure, commencing with a light pressure and increasing gradually until completed.

The pressed mass is then put into an iron vessel, which is heated by steam; in order to take up the creosote, the phenylic acid and other impurities, it is first melted with a small percentage of caustic lye, and stirred well; after a while the lye is drawn off, the same process being then repeated. After this the napthalin is washed with boiling water, then it is treated with oil of vitriol of 45° Baumé, and finally mingled again with lye and left at 212° F. for three hours.

The naphthalin being thus treated is poured into a cast iron still, which can be heated on an open fire. It commences to flow over at 410° F., in a thick stream, and in twenty minutes generally 20 to 25 per cent of napthalin may be obtained. The water of the condensing tank must be kept at 170° F., the receiver being also kept in water of this temperature. When the latter reaches 450° the distillation is fractioned, as then an oily yellow product is obtained. Finally the liquid and purified distillate is run into conical cylinders of glass, metal or moistened wood, in which it solidifies rapidly, and in contracting separates from the sides. It is thereby obtained in sticks, like solid brimstone.

PROPERTIES OF NAPHTHALIN.

The naphthalin thus obtained is of great beauty. It forms brilliant, white, crystalline sticks, in which the interstices and crystalline vegetations have the appearance of spirals. Its specific weight is 1.151 73, its melting point 174°, and its boiling point 452°. The following new properties are added to the already known ones by Dr. Vohl, in Cologne. When a naphthalin stick is rubbed with a silk cloth it gets strongly negative electric. Melted naphthalin absorbs a great amount of atmospheric air, which it gives off in cooling. When put in quantities of from one to two pounds the expulsion of the air is so turbulent at this stage that the liquid appears to be boiling. The air absorbed by melted naphthalin is abounding in oxygen; perhaps it is pure oxygen. This phenomenon has therefore a great similarity with the peculiar movement taking place in the cooling of silver, and called "spratzen," in German. Melted naphthalin dissolves indigo with great ease, forming a dark-blue violet liquid, from which, in cooling, the indigo separates again, in brilliant copper-like needles. The sulphurets of arsenic, tin and antimony are taken up abundantly in their amorphous state, in cooling they separate in crystals. Phosphorus and sulphur are also solved rapidly by liquid napthalin.

TEST FOR NAPHTHALIN.

To detect this hydrocarbon in a product of distillation, the latter is, according to the writer of this, treated with fuming nitric acid, in order to transform the napthalin into its nitrocompound; this being insoluble in and lighter than water, it will rise to the top. It is then gathered and converted into naphthylamin, by any known method. The best is that of Béchamp, who uses iron filings and acetic acid. In adding chloride of iron to an alcoholic solution of the naphthylamin a deep blue color will be produced.

ITS TRANSFORMATION INTO BENZOIC ACID.

The first step in the two or three processes known, is the production of naphthalic acid, a body of the chemical formula C_{16}, H_4, O_6. While, however, the brothers Depouilly, in Paris, directly convert the latter into benzoete of lime, separating therefrom the benzoic acid, Laurent and Casthelay change the naphthalic acid successively into phtalamid, benzonitoil and benzoate of soda, a process lately fully described by me in one of the meetings of the New York Polytechnic Association. The method recommended now by high scientific authorities is a combination of a French and German one, namely, of

a. The process of Dr. Vohl for the preparation of naphthalic acid, and

b. That of the brothers Depouilly, as indicated.

Naphthalic Acid.—While hitherto naphthalic acid was obtained by a very tedious way of preparation, which was not only injurious by the highly irritating gases escaping, but also yielded a small percentage, it may now conveniently and cheaply be produced by the process invented by Dr. Vohl. According to the same, 12 parts of naphthalin are dissolved in 109 parts of concentrated oil of vitriol, and to this 89 parts of finely pulverized bichromate of potassa are gradually added. The reaction ensuing being over, the product is solved in boiling water, and the liquor thus obtained is oversaturated with carbonate of soda; it is then left to settle for a quarter of an hour. By filtration, a rich orange-colored liquid is obtained, which, in evaporating on the water bath, yields the naphthalic acid.

Benzoic Acid from Naphthalic Acid.—This process is based upon the fact that naphthalic acid in presence of a surplus of an alkaline base (lime), and at a temperature of 625° to 660° F., is changed into benzoic acid. The process, however, has to be performed in vacuum.

The brothers Depouilly indicate the reaction taking place as follows:

Naphthalate of lime=C_{16}, H_4, O_6+2 Ca, O, and hydrate of lime=Ca, O, H, O, yield in heating to the above temperature.

Benzoate of lime=C_{14}, H_5, O_3+Ca, O, and carbonate of lime=2 (Ca O, C O_2).

As seen from this equation, decomposition of water and formation of carbonic acid is taking place. As the success of this operation, however, is often depending upon mere chance, it requires great skill and practice. From the benzoate of lime, the benzoic acid is separated by hydrochloric acid. In distilling the naphthalate of lime in presence of lime, *benzol* is formed, an operation which is nearly always of success.

NAPHTHYLCARMIN.

If the orange-colored liquor, containing the naphthalic acid—vide above—is oversaturated either by hydrochloric or sulphuric acid a precipitate in floes of a most beautiful carmoisin red is obtained. The same is undoubtedly identical with the *carminnaphte* of Laurent, which this investigator obtained once in heating naphthalin with bichromate of potassa and sulphuric acid, but could not produce again at any subsequent trial. This substance combines readily with alkalies, yielding yellowish-red lacs, and dyes silk and woolen without mordants, either orange or violet red. It is soluble in acetic acid and alcohol, and is precipitated again from its compounds by mineral acids.

On the Formation of the Diamond.

Researches on this subject have lately been made by Messrs. Goeppert and D. Brewster. The black diamond of Bahia is, according to Mr. Goeppert, a mixture of amorphous carbon and diamond. M. Liebig's experiments on its combustion also agree with this statement. It often happens that the diamond incloses other crystals; iron pyrites, particularly, have been noticed in it by Mr. Hartwig. Sir David Brewster calls attention to the microscopic cavities existing in this as well as in other gems, as in the topaz and emerald. These cavities are found to be often very numerous in certain dark diamonds, they thus dispersing the rays of the light, are therefore of no value in jewelry. Mr. Goeppert remarks that the diamond must originally have possessed a certain plasticity; we notice, in fact, in a diamond belonging to the emperor of Brazil, the impression yet of a sand grain. The black as well as the crystallized white ones bear also the signs of analogous impressions produced by foreign bodies. Some investigators believe to have recognized the cellular tissue of plants in the ashes resulting from the combustion of this gem. Mr. Goeppert, however, has not yet detected with certainty any traces of organization, neither in the diamond nor in its amorphous form, the plumbago. As to the question so often discussed, whether the diamond be formed by platonic or neptunic action, the latter naturalist is of the opinion that the first hypothesis is scarcely admissable, the experiments of Depietz having shown that the diamond is changed into a kind of coke, whenever exposed to the intense heat of a galvanic battery. The second hypothesis, attributing its formation to neptunic action, is sustained by the authorities of Newton, Brewster, and Liebig, being also that which is best in accordance with all that is known about the gneiss, itacolumite, and the metamorphic rock in which it is found. The character of these rocks, however, do not allow us to attribute to them a plutonic origin.—*Cosmos.*

A Daring Explorer.

At the last meeting of the California Academy of Science, a letter was read from William H. Dall, Chief of the Scientific Corps of the Western Union Telegraph Company, dated at St. Michaels, Alaska Territory, and acknowledging his election as corresponding member of the Academy. When the telegraphic party returned from the wilds of those northern regions, as we noticed in a late issue, this gentleman remained behind to prosecute scientific researches and gather information respecting this country. That the work he has undertaken to perform is no easy one, an extract from his letter will show. He says:

"I have traveled on snow shoes about 400 miles, camping in the open air, with the thermometer from 8° to 40° below zero. I have seen the thermometer down to 68° below zero. In the spring I started from Nulato, on the Yonkon River, where poor Kennicutt died, and paddled up stream 650 miles in an open canoe to Fort Yonkon. being the first American to make the trip, and one of the only four men out of the whole expedition who have been there. We met two adventurers returning from a trip of 600 miles further, and all hands came down together to the sea and round to St. Michael—a nice little trip in an open canoe of 1,300 miles. We had plenty of rain the last part of the journey, and made the trip in 16 days. This is the first trip ever made to the sea from Fort Yonkon direct. I have acquired sufficient knowledge of Russian and one or two Indian dialects to get along very well. I do not like the country. It is full of mosquitoes in spring; the summer is constant rain and fog, and the only pleasant time is the winter, when it is very cold. But in consideration of the work, I can stand it another year."

NEW GALVANIC BATTERY.—We have had in use in our laboratory a most singular looking piece of apparatus, devised by Moses G. Farmer, Esq., the well known electrician of this city. It is a new form of instrument for converting heat into electricity, and most satisfactorily does it perform its work. All that is necessary to put it into active operation is to light a gas jet, and in a few moments the electrical impulses are manifested, and the battery is ready to be set to work. It deposits metals with great facility, and the development of the agent is constant and uniform so long as the heat is supplied. It resembles a "fretted porcupine" as much as anything we can compare it with. The metals employed in its construction are antimony and copper. The strips or arms of copper protrude outward from the bars of antimony, so as to secure the cooling influence of an air current, while the gas is heating the other extremity. A portion of the heat of the flame is transformed over into electricity, thus showing the easy convertibility of one imponderable into another, and the correlation of the forces.—*Boston Journal of Chemistry*

Skating Rink.

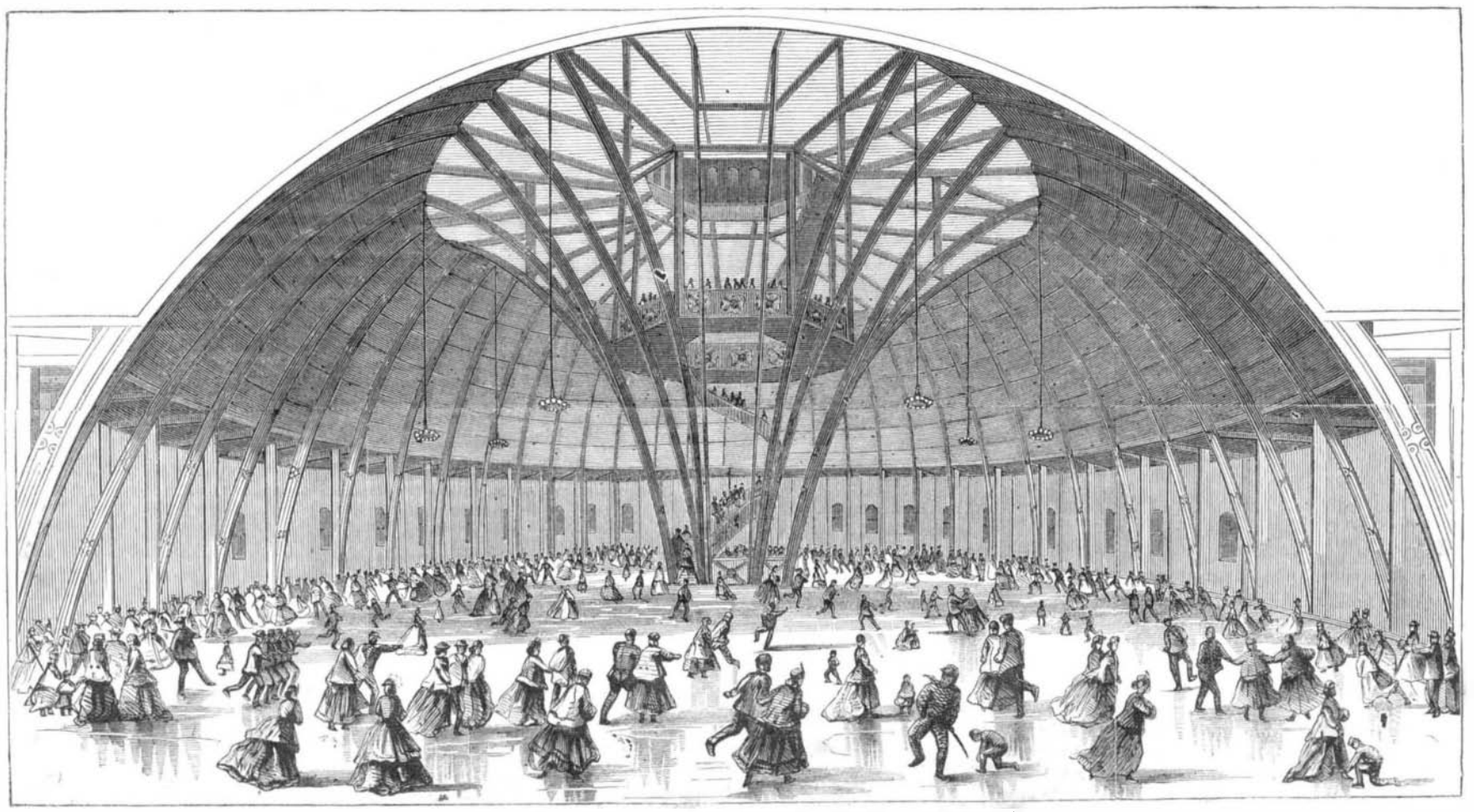
In the vicinity of the Central Park, New York City, several enterprising persons have caused whole blocks of ground to be flooded, and on the margin of the pond have erected temporary buildings, for the use and comfort of skaters, and the bands of musicians who play enlivening airs during the afternoons and evenings of the skating season. The proprietors call their respective places skating rinks; but in true terms they are simply skating ponds, unprotected from the weather. But young and old, in large numbers, patronize these ponds when the ice is good, and the scene is very enlivening to the beholder, and exhilarating and improving to the skater, the "poetry of motion," as in dancing, being kept in harmony with the music.

But our British neighbors are far in advance of us in providing comfortable and artistic places for the enjoyment of skaters; and we hope, by presenting a view of the best skating rink we know of, to stimulate the exertions of our people to making similar erections in our own cities. Our climate is not so favorable as our neighbors' for enterprises of this kind, but the receipts for even a short season would be very good in a city of the size of New York, and we think it would pay.

From *Harpers' Weekly* we extract the following description of the rink at St. Johns, N. B.:—

"In the British Provinces, where the rink exists in its full and sublime perfection, we find structures as spacious and graceful as a World's Fair palace, whose crystal floors are nightly renewed and polished to gleaming by the biting frost. Each night the icy arena is planed by a machine and flooded to the depth of an inch; and then, through every opened door and window, the keen air is admitted to harden and glaze the surface for the next day's sport. From December until March, throughout the long and dreary winter, the rink affords the chief and constant center of attraction; before it all other festivities pale their fires.

"All the chief cities of Canada boast their skating rinks. Montreal has a model one; but for extent, adaptation to the purposes for which it is designed, and beauty of detail, that at St. Johns, N. B., unquestionably bears off the palm. This rink is owned by an incorporated stock company. The main structure is of circular form, 160 feet in diameter, and covers an area of 20,000 superficial feet. It is an immense dome, resting upon perpendicular walls 20 feet high and pierced with 39 windows, and is surmounted by a graceful cupola, or lantern, the apex of which is 80 feet from the ground. This lantern contains 24 windows, throwing light directly into the interior of the structure. Within, and girting the extreme circumference, is a platform, or promenade, 10 feet wide, for the accommodation of spectators. In the center is a circular framework containing a spacious stand for the band, from which a spiral iron staircase ascends to two circular galleries, one above the other, the highest 50 feet from the ground, whence a bird's-eye view of all that is passing below can be had at a glance. From this focal point also spring the supporting rafters that form the huge dome which constitutes the chief feature of the design, producing an effect airy and graceful in the extreme: it cannot be better described in terms unarchitectural than to liken it to a fountain whose waters, springing from the center, fall in majestically-sweeping curves to the outer perimeter. All the area between the hand-stand and the circular promenade is covered with ice, which is flooded daily from the City Water-works. The outside front is two stories high, with decorated entablature, and contains waiting and refreshment rooms, dressing-rooms, and the residence of the janitor. The whole edifice cost about $12,000, and is in every respect creditable to the projectors and an ornament to the city.



SKATING RINK AT ST. JOHNS, NEW BRUNSWICK.

The Dignity of Labor.

"Spice," of the Boston *Commercial Bulletin*, relates the following: "We were never more impressed with the dignity of labor than while witnessing, a few days since, a group of 'down-trodden workingmen' engaged in setting up some machinery. There were five of them, or rather four men and a boy, and when they came under our notice, 5:30 P. M., one was engaged in slowly turning over the contents of a box, in search of a screw; two were looking with much interest for the result of the labors of No. 1; the fourth was slowly scratching a piece of iron with a file, and the boy was scratching his head. No. 1 finally found a screw to suit him, but during the search his pipe had gone out. Laying down the screw, he began to investigate his pocket for a match. Nos. 2 and 3 searched theirs in sympathy, while the filer paused to see the result. Finally No. 2 found a match, ignited it, and handed it to No. 1, who, having accomplished a light, smoked for a few minutes to assure himself of the fact, while the boy went to the other end of the room to look at the clock. No. 1 then looked at his watch, and compared time with No. 3. Time, 5:40. No. 1 then leisurely put the screw into position to fasten a bar. No. 2 held the bar; No. 3 squinted at it from the other side of the machine; No. 4 inspected the whole operation reflectively, as he slowly resumed the filing, and the boy wiped the oil from his fingers. Time, 5:45. The entire labor was now suspended, while the boy was sent across the room for a necessary tool. Just then it occurred to No. 2 that a chew of tobacoo was necessary to his comfort, and, as his supply was out, he applied to No. 3 for the weed, and to No. 2 for a knife to cut it with. No. 1 consulted his watch again. Time, 5:50. And labor was resumed, the screw was turned home; No. 1 tried the bar; Nos. 2 and 3 engaged in a playful scuffle, and the boy looked on with a grin of admiration. The filer laid down his work and looked at his watch, and announced it six o'clock. Tools were instantly dropped, and the five, having accomplished the work of two ordinary men, went cheerfully home."

Editorial Summary.

AMPUTATION NOT ALWAYS NECESSARY.—The *British Medical Journal* calls attention to the fact that several of the men who were wounded in the New Zealand campaign, have brought home arms and legs, which, according to the standard rule of military surgery, they ought to have left behind. Out of six cases of gunshot fracture of the femur, five recovered without amputation, four of them with very useful legs. Of ten cases of gunshot fracture of the humures, eight reunited solidly, and in only one case was amputation resorted to, and that was primary. Guided by the experience of these cases, the surgeon-general says, it would be fair to expect, that, when eighty per cent of gunshot fractures of the humerus recover without difficulty, that amputation in such cases might be delayed for a second operation, if after all found necessary.

UTILIZING SEWAGE.—At Sandon, Isle of Wight, the sewage is conveyed in pipes clear of the town into cesspits, where it is filtered and deodorized by a chemical process. The clear portion finds its way into the sea miles away from the town, and the solid residue is mixed with ashes and road sweepings, and forms good manure.

ARTIFICIAL TEETH.—They should never, under any circumstances, be worn at night, and for this reason: it is a physiological fact that bone, in a normal condition, is constantly undergoing a process of removal and replacement of particles, and that continuous pressure pervents the complete restoration of the parts, causing what is commonly called absorption. The osseous structure of the mouth is protected only by a thin covering of muscular tissue and mucus membrane, on the firmness and elasticity of which it depends for protection against the pressure of the plate; but when constantly excluded from the atmosphere, especially by hard rubber, which being a poor conductor of heat, keeps the part covered at nearly an equable temperature, these tissues lose their elasticity and become spongy and fungoid. Two very nndesirable results are thus arrived at. The mouth is reduced to an abnormal condition, and the plate no longer fits well, which is just what the patient has been trying to avoid by wearing his plate at night.—*Dental Cosmos.*

A CANAL ON FIRE.—In an investigation as to the condition of the rivers Ayre and Calder, which water the great towns of Yorkshire, it was found that the fluid of Bradford Beck, the source of supply to the Bradford canal, was so corrupt from sewerage, that in summer large volumes of inflammable gases were given off; and although it has usually been considered an impossible feat to "set the river Thames on fire," the boys found it practicable to set the canal on fire, the flames rising six feet high, and running along the surface of the water for many yards, enveloping the canal boats, to the great terror of their passengers. That this state of things is not limited to one district was abundantly proved by inquiries at other towns.

THE SUEZ CANAL.—It has been announced that this great undertaking was in such an advanced stage of completion, that already an English vessel had passed through to the Red Sea. It now appears that the vessel was a Government tug-boat, which was to assist in the embarkation of the Indian troops at Suez, and, that after being lightened as much as possible, even to the removal of the paddle wheels, a number of empty casks were placed under her, and in this manner she reached Suez.

SHFET IRON RAILROAD SLEEPERS.—A curious plan for a temporary railway, to be laid for the benefit of the English forces in their excursion to Abyssinia, has been proposed by a Mr. Hadden. The peculiarity consists in making the sleepers of flattened cylinders of sheet iron, closed at one end, and which are to be filled with sand or gravel well packed. The sleepers are then to be laid on the ground with little or no ballast, and the rails secured to them by clip pieces, so as to be easily removed when desired.

THE thin metallic tubes used for holding artists' colors, are made by placing a disk of block tin in a die or cylinder into which a punch is slowly forced by hydraulic or other pressure. The punch fits the cylinder almost exactly, and the tin rises into the intervening annulus, as if it were a liquid, its constituent particles being made to move over each other as they would do if the tin were melted by heat.

AN OLD PIECE OF ORDNANCE.—The Turkish Sultan has given to the British government, in exchange for two large Armstrong guns, a monster gun, twelve feet long, thirty to thirty-six inches in exterior diameter, and weighing from twelve to fifteen tuns. Its chief value is its historical one, being one of the pieces of ordnance used in the memorable siege of Constantinople, by Mahomet II., in the year 1453.