suring; his walk light, active, and firm. His chief characteristics were remarkable quickness and accuracy of observation, wonderful shrewdness, common sense, and frankness; boldness, decision, and enterprise; rare mechanical skill and constructive powers; special talent for arrange ment and organization, and rapid and sound judgment on all matters that came before him.

We are indebted to the *Practical Magazine* for the admirable portrait of this remarkable man.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year $3 00

One copy, six months 1 50

CLUB RATES { Ten copies, one year, each $2 50 .... 25 00
Over ten copies, same rate, each .... 2 50 }

VOL. XXIX., No. 18. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, NOVEMBER 1, 1873.

Contents :

(Illustrated articles are marked with an asterisk.)

SECRET SOCIETIES AMONG COLLEGE STUDENTS.

Mortimer M. Leggett, the youngest son of the Commissioner of Patents and a student at Cornell University, was recently accidentally killed during the progress of his so-called initiation into the "mysteries" of a college secret society known as the *Kappa-Alphas*. The circumstances were that the deceased went with a party of members of the above fraternity to a creek just outside the town of Ithaca; and there, blindfolded, he was left, with two companions, standing on the brink of a gorge through which the stream runs. Shortly after, a crashing of bushes, followed by groans, was heard, when the remainder of the party, hastening to the spot, found that the three boys had fallen over a precipice some fifty feet in hight. Young Leggett, it seems struck on his head, sustaining such severe injuries that death ensued in half an hour, while the others were both seriously hurt.

As one of these college fraternities has thus been the indirect means of causing this terrible calamity, we desire just here to express our opinion on the system of secret societies as generally practiced in our institutions of learning. These associations are bodies of students, organized in principle something after the orders of free-masonry or odd-fellowship. In many, the members are numbered by hundreds, and chapters of a single society often exist in a score of colleges at once. The records are handed down from class to class; and out of each set of freshmen, a few individuals are selected for the privilege of membership. When the plan was started (during, we believe, the year 1827) the idea was simply to form clubs of young men, for mutual improvement in debate and such kindred studies as are better pursued by numbers than by single persons, and to keep alive, among *alumni*, pleasant associations of college life. In course of time, the former innocent and laudable object has been lost sight of, or rather relegated to other associations, now existing in many colleges and not included in the list of secret societies; while the cardinal principle of the younger chapters of the latter organizations seems to be nothing more nor less than simple mischief, rendered attractive by a little mystery and concealed under the cloak of such cognomens (symbolized by Greek letters) as "union of souls," "circle of stars," "lovers of wisdom," etc. If the boyish nonsense resulted in the usual students' pranks, it might be passed over with a smile; but such is not the case. The influence exerted, upon boys fresh from school and for the first time free from direct home influence, we believe (from repeated instances within our personal knowledge, and in connection with one of the oldest colleges in this country) to be in a high degree baneful and demoralizing. Unless a youth has well filled pockets, (in which case rival societies vie with each other to see who shall secure him, or rather his money) he is not invited to membership at all. Once joined, however, and held by working upon his fears through the blasphemous oaths of secresy that he is forced to take, he is inducted, by sheer force of example, through a routine of profanity, intemperance and gambling; while in many cases, if young and innocent, his course leads to graver faults, committed more through a sense of shame and false pride than depravity, and due to the tacit if not open instigation of his unscrupulous elders,

The sad and untimely fate of Mr. Leggett, just at the outset of doubtless a brilliant and honorable career in the calling which his father has so ably adorned, will, from the circumstances under which it occurred, excite a lively and widespread sympathy. It is the first death, which, to our knowledge, has been owing, though indirectly, to the proceedings of these student organizations; though we have heard of numerous cases of maiming and injury thus caused, and of idiocy and cerebral disease due to the effect of hideous and ghastly paraphernalia upon the imagination of weak minded boys.

There is a notion, which is becoming entirely too prevalent, that colleges are merely convenient places for sending young men to while they are passing through that uncertain and troublesome age, leading to manhood, during which they are expected to sow their traditional wild oats. To this idea, we believe, may be mainly ascribed the barbarities of "hazing," and the no less reprehensible practices of secret societies; while to it also may be traced many of the complaints that our seminaries are inferior in an educational point of view to those of foreign countries. Hazing, already crushed out in the government naval and military schools, is exciting so large a share of public condemnation that there is a fair prospect of its stern repression in colleges generally. The secret societies, we trust, may meet hereafter with similar treatment, at least through the influence of parents if not at the hands of faculties. Harvard forbids their existence among her students, and Cornell at this time would do well to follow her example.

PROGRESS OF PATENTS.

The following were the number of applications for patents made to the principal governments of the world in the year 1872, as given in the published statistics of the British Patent Office:

	Number of Patents Applied for in 1872.
United States	18,243
France	4,872
Great Britain	3,970
Belgium	1,921
Austria	922
Canada	671
Italy	521
Saxony	259
Sweden and Norway	200
Bavaria	164
Wurtemburg	141
Baden	113
British India	71
Victoria	60
Prussia	56
New South Wales	42
British Guiana (allowed)	28
Cape of Good Hope, from 1860 to 1869	18
New Zealand	18
Mauritius	11
Ceylon	5
Tasmania	5
Jamaica	4

The aggregate number of patents applied for in all of the countries above named, in 1872, except the United States, was 14,072, thus showing that in this country the number of patents annually applied for exceeds, by 4,171, the combined number applied for in all other countries above named. The reason for the surprising difference in favor of this country, in the inventive productions of the world, we believe to be due to the superior theory which prevails here concerning the object and uses of patents. We grant patents for the purpose of encouraging the useful arts. We regard the inventor as a benefactor, and place him under no restrictions in the sale or working of his improvement. We grant patents at so low a price that the masses, the poorer classes, among whom the best inventors are found, may readily obtain and hold them.

WOOD AND STRAW PAPER MAKING IN FRANCE.

The improved processes of making paper from wood, straw, and various grasses, as practiced in France now enables the manufacturers to recover 85 per cent of the caustic alkali, used in the reduction of the raw material into pulp. This is a very important economy.

In order to convert wood into pulp, a strong solution of the alkali is necessary. One pound of carbonate of soda is required to produce four pounds of pulp.

By steeping the wood or straw in the alkali solution, the resinous and other gummy matters are separated from the fibers of the material, and become mixed with the solution. To regain the soda for re-use is now the object of the manufacturer. This is done by evaporating the water by heat, then charring the resulting mass, which yields carbonate of soda, then converting the latter into caustic soda.

The evaporation is effected by passing the products of combustion from the fire which heats the alkaline solution through the liquid which is to be evaporated. For this purpose the liquid is thrown up in the form of a thin spray, by paddle wheels. 12½ pounds of the solution, it is stated, are evaporated for each pound of coal consumed. The carbonate of soda is then subjected to long continued washing in a peculiar apparatus until it is fit for burning, and at last 85 per cent of the original quantity of the alkali is recovered. The former methods only permitted the recovery of from 50 to 60 per cent of the alkali.

TWO INTERESTING DISCOVERIES.

The *America*, a daily journal of Bogota, in a recent issue publishes a letter of Don Joaquin Alvez da Costa, in which he states that his slaves, while working upon the plantation of Porto Alto, Parahyba district, Peru, have discovered a monumental stone, erected by a small colony of Phœnicians who had wandered thither from their native country in the ninth or tenth year in the reign of Hiram, a monarch contemporary with Solomon and who flourished about ten centuries before the Christian era. The monolith bears an inscription of eight lines, written in clear Phœnician characters, without punctuation marks or any visible separation of the words. This has been imperfectly deciphered, but enough has been made out to learn that a party of Canaanites left the port of Aziongaher (Boy-Akaba) and navigated about the coast of Egypt for twelve moons (one year), but were drawn by currents off their course and eventually carried to the present site of Guayaquil, Peru. The stone gives the names of these unfortunate travellers, both male and female, and probably further investigations will shed more light on the records they have left.

Another and more astonishing discovery, we find announced in *Les Mondes*. It appears that some Russian colonists, having penetrated into hitherto unexplored parts of Siberia, have found three living mastodons, identical with those heretofore dug up in that country from frozen sand. No particulars are given as to this, we fear, somewhat questionable find. From the statments of M. Dupont, of the Brussels Royal Academy, it would seem that, like the reindeer, the mastodon should not now be extinct, and that the animal is naturally the contemporary of the horse, sheep and pig. Hence the announcement is not without some shadow of probability.

NEW ORDER BY THE COMMISSIONER OF PATENTS.

The subjoined order, recently issued by the Commissioner of Patents, will be fully appreciated by inventors and their representatives, exhibiting, as it does, a determination at headquarters that the chronic indolence heretofore prevailing among certain examiners, shall no longer be tolerated.

U. S. PATENT OFFICE,
Washington, D. C., October 3, 1873

I have noticed, for more than two years past, that a few of the Examiners are generally from one to two months behind with the work in their rooms. The fact that they so uniformly have about the same number of cases on hand is evidence to me that, with proper effort, they might keep their work closely up to date. The answering of letters and the making of excuses, in consequence of being so far behind, are causes of great loss of time. I shall expect the work of the Office to be promptly up to date by the tenth day of November. If, to do this, it becomes necessary for Examiners to demand of their subordinates more than six hours labor per day, they will do so; but the work must be brought up to that date, and thereafter kept up.

(Signed) M. D. LEGGETT,
Commissioner of Patents

The tedious delays in the matter of official decisions often deter inventors from applying for patents, and are equally discouraging to those having cases pending in the Patent Office. With this rule inflexibly observed, early examination and quick disposal of cases will be insured, thereby largely increasing the business of the Office.

PETROLEUM AND PINE TAR GASES.

Some time ago, it may be remembered, we called attention to the interesting and novel experiments, made by Professor Benevides of Lisbon, Portugal, upon the flame of compressed carbonized gas burning in free air. Ordinary illuminating gas and marsh gas (light carburetted hydrogen) were the subjects of the investigation. Recently the same author has conducted similar inquiries, in reference to gas extracted from the residues of petroleum and of the pine and fir tree, with even more remarkable results.

The gas derived from vegetable sources, used in the experiments, was obtained by the distillation of the residue left after the distillation of the roots, by employing a jet of steam at high tension, which was injected into the distilling cylinders. A liquid was produced from which turpentine was extracted, when there remained a black and thick fluid as residue. The latter, submitted to distillation, disengaged a combustible gas which for some time past has been employed for illuminating several lighthouses on the coast of Portugal. The petroleum gas was obtained by the distillation of the residuum of petroleum by the Hirzel system. The gases, thus arising, as well as those derived from the pine, are mixtures rich in hydrocarburets, a phenomenon analogous to that observed with ordinary illuminating gas obtained by the distillation of coal, and contain, in variable proportions, protocarburet of hydrogen, bicarburet of hydrogen, carbonic oxide, carbonic and sulphydric acids, etc.

Coal gas possesses in general much of the protocarburet and little of the bicarburet. As the proportions of these gases are variable, the density and illuminating power of the mixture likewise vary considerably. The coal gas, as employed in the city of Lisbon and used in the course of the experiments, has a density of 0·4, and its illuminating power, as indicated by the Erdmann apparatus, is 29.

Pine gas has a very pronounced odor resembling that of burned turpentine: its density is 0·8, nearly double that of coal gas. It is a mixture very rich in carbon and requires burners of special construction with very small orifices, in order to avoid the production of smoke and bad odor, as happens when consuming the gas in the ordinary illuminating gas burner.

The air which combines with the flame in the latter case is insufficient to ensure the combustion of the enormous quantity of carbon contained. The illuminating power of this pure gas is much superior to that of coal gas. In experiments with the apparatus above named, while the latter gas gave 29, the former produced an indication as more than 50. The graduation of the instrument stopping at this point (the maximum width of the slit), it was found impossible to cause the brightness of the pure gas flame to disappear entirely, so that the full intensity of its illuminating power could not be accurately ascertained by this means. With the Bunsen photometer, experiments gave 5 to 1 as the ratio of the respective luminous intensities of pine and coal gas.

Petroleum gas possesses properties analogous to those of pure gas, but has however a different and very strong odor similar to that of phosphuret of hydrogen. Its illuminating power is even stronger than that obtained from gas derived from coal. On burning petroleum gas in a Bunsen burner of ordinary dimensions, the brilliancy of the flame does not entirely depart, as the quantity of air drawn in is not sufficient to cause the consumption of all the contained carbon. When the cock of the rubber sack containing the petroleum or pine gas, under examination in the Bunsen lamp, is very slightly opened, the flame disappears from the upper portion of the burner and leaps to the inferior orifice of the tube. If, however, the said bag be pressed by the hands, the flame returns to the upper part of the burner. Although this experiment may be repeated as often as desired with the gases above named, it cannot be accomplished with coal gas, of which the flame, once produced at the inferior orifice, is not displaced, even if the same pressure be exerted upon the bag as before, thus indicating the greater mechanical energy of the former gases.

Combustion not being complete in Bunsen lamps of ordinary dimensions, the characteristic bands are not clearly defined in the spectra of pine and petroleum gases. The upper part of the flame gives a continuous spectrum, while that of the lower portion is channeled: the lines have the colors of the bands, while red appears at the extremity of the spectrum. On lighting a jet of compressed pine or petroleum gas, escaping from a tube, similar phenomena to those caused with coal gas are observed. With the former gases, however, the effects are amplified by the greater density and larger quantity of carbon contained. The velocity and the escape being great, the flame never commences at the orifice, but an intervening obscure space is produced. If a tube be employed having an exterior opening 1 millimeter in diameter, the flame of compressed coal gas presents no obscure point near the pipe; for if the cock be opened too wide, total extinction of the flame follows. With petroleum or pine gas, the contrary is the case: a quite large non-illuminated space appears near the escape orifice, and at the same time an oscillation of the luminous jet in the direction of its axis is perceptible. If the flame be observed from the side of the tube, a hollow central space, from which combustion is absent, can be perfectly discerned. This, the author considers, confirms his explanation to the effect that the velocity of a gaseous current is greater at the center than at the surface of the jet, for the friction diminishes the velocity of the molecules of the exterior. The mechanical action of the current is also greater at the center; the flame is projected to a greater distance, and there is a stronger displacement of the air in the region near the axis of the jet than at the periphery.

Another experiment gives additional support to this theory If through a bent tube a current of air be directed upon the flame of compressed pine or petroleum gas, in the direction and path of the gaseous current, the obscure space augments and the flame, drawing away from the orifice of the burner, may be projected so far therefrom as to be extinguished. In this case the air, it is believed, augments the mechanical action of the gas, in throwing the flame to a greater distance. If, on the contrary, a draft be applied to the jet in the direction of its axis but in a path opposite to that of the current, the flame approaches the orifice, diminishing the obscure space until the same disappears and the flame begins directly at the escape opening. By this means the gaseous mass is impressed with a movement contrary to that which it possessed on leaving the compressing apparatus, which diminishes the velocity of escape of the current and consequently its mechanical action on the incandescent portion. Again, if the air be injected transversely to the flame, the latter will deviate to the opposite side, through the composition of the motion which the jet had at the point of escape with that impressed by the draft; and at the same time the dimensions and form, both of obscure space and luminous jet, will vary.

Petroleum and pine gases having more carbon than coal gas, in order completely to ensure their consumption more air is required than is necessary for the combustion of ordinary illuminating gas: and thus for compressed gases it is necessary that the velocity of escape be greater for those derived from petroleum and from pine than from coal, in order to have the highest temperature and to cause the complete disappearance of the brilliancy of the flame. It is also for the same reason that the velocity of escape of the former gases should be greater than that of others less rich in carbon, to enable the spectroscope to exhibit with clearness the spectra characteristic of the flame of compressed gas.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW SERIES OF AROMATIC HYDROCARBONS.

In the reaction of zinc powder on a mixture of benzine and chloride of benzyl, there are produced, besides diphenyl-methane (benzyl-benzine) some other hydrocarbons, which M. Zincke has recently succeeded in isolating.

After the distillation of diphenyl-methane, the temperature rises rapidly up to the limit of the indications of the mercurial thermometer, and a liquid is distilled which coagulates on cooling into a clotted and crystalline pasty mass. At the end of the distillation, a solid yellow body is passed and the residue cokes. The crystalline mass was treated with a little ether and pressed between sheets of paper to carry away the liquid portion. The etherized solution slowly deposited the crystalline crusts which were joined to the solid portion, and by complete evaporation gave a non-solidifiable oil.

In boiling alcohol the solid portion is deposited in acicular crystals: the mother waters retain a liquid product and another hydrocarbon. The acicular crystals are a mixture of two hydrocarbons; one, which appears to dominate, crystallizes in boiling alcohol in fine and very brilliant layers, or, if the solutions are extended, in rhomboidal transparent tables. This substance is slightly soluble in alcohol, quite so in benzine, chloroform, and sulphide of carbon, though somewhat less in ether. It melts at about 187° Fah. and coagulates at 172·4° into a transparent mass which becomes crystallizable by heat or friction. It does not combine with picric acid.

The second hydrocarbon is much less soluble than the first, crystallizes in fine needles, melts at 172·3° Fah., and coagulates at 154·4°. The separation of these hydrocarbons is very difficult, and ether is the best agent to employ. Their composition is sensibly the same, and the author regards them as to isomeric di-benzyl-benzine, C_{20} H_{13}; one of them may, however, be tri-benzyl-benzine, C_{26} H_{24}. Their oxidation may give some indications on their molecular weights.

TO DESTROY FIELD MICE.

Smoke, it is well known, will soon destroy these little pests, but how to introduce it into their holes in an easy way may interest some of our readers. Professor Nessler, of Carlsruhe, has devised a sort of pellet which gives off great quantities of smoke when burning, so that it is only necessary to put some of these into the holes and ignite them in order to suffocate the mice. Their preparation is nearly as follows: Some fiberous substance, such as jute, is soaked in a concentrated solution of saltpeter, dried, then dipped in tar, and, when half dry, flowers of sulphur are sprinkled over it. When fully dry the jute fibers are cut into little pieces like pills and are ready for use. As soon as they are ignited they are stuffed into the hole, which is then stopped up with earth.

FLUORENE.

M. Berthelot announces, under the name of fluorene, a new and very fluorescent carburet contained in the portions of the tar of volatile oils between 300° and 340° C.

In order to extract the substance, instead of causing the portions of solid carburet which have passed the distillation between 300° and 305° C. to be crystalized in alcohol simply, a mixture of alcohol and benzine is used. By this means may be separated a small quantity of acenaphtene which remains in the mother liquor. The point of fusion of the mass, which is ordinarily 105° C. after the first distilation and crystalization in pure alcohol, increases to 112° after crystalization in alcohol mixed with benzine. The remainder of the purification consists in redistilation and crystallization in pure alcohol. The carburet possesses a quite pronounced violet fluorescence which, however, disappears promptly on its being exposed to the light. The chemical symbol is stated to be C^{26} H^{10}.

THE BRITISH ASSOCIATION.

We continue, from our last, abstracts from papers read at the late meeting at Bradford:

ON PEAT.—BY MR. F. HAHN DANCHELL.

The prime fact in relation to peat is that, in its raw condition, the combustible parts are combined with from 80 to 90 per cent of water, which, for the most part, must be removed before it can constitute fuel. The peat problem may therefore be defined as the economical separation of the two elements—the retention of the solid and the discharge of the fluid. The simplest mode of effecting this is by cutting the peat as sods or bricks, and leaving them to dry in the air and sunshine. To diminish labor, it is frequently suggested, why not dry peat by pressure? If peat were altogether composed of fibers, the water might certainly be squeezed out as from cotton, or wool, or hair; but a large portion of peat is semi-gelatinous, which, when dry, serves to cement the whole together, and which, moreover, is good for combustion. When peat is compressed, this glutinous constituent escapes with the water, indeed as easily as the water, involving a serious loss. Drying by artificial heat is also frequently proposed; but when it is considered that to obtain 100 tuns of dry peat it is necessary to find space for 500 or 600 tuns of wet peat, which space must be so heated as to permit the evaporation of 500 tuns of water, the economy of the proposition is seen to be highly questionable. But, setting economy aside, it is to be observed that peat cannot be artificially dried without deterioration in quality. The practice of maceration is so old that Pliny refers to it in his description of the inhabitants of North Germany; and yet ever and anon it is advanced as a novelty, and made the subject of patents. The reduction of peat to pulp is one of the easiest of operations. It may be done with the feet, or with any kneading or mincing machine. The most efficient mode of drying is by slow evaporation under roof. Drying goes on more rapidly in the open air if the weather be favorable; but in this country the sky cannot be reckoned upon, and with alternate exposure to wind, rain, and sunshine the quality of peat is much deteriorated. The difference in favor of peat dried under a shed is most marked, and, though the cost of production is greater, the quality affords ample compensation. How much drainage affected the cost of production may be seen from comparing the results from a drained and undrained bog. An undrained bog contains about 90 per cent of water, while a drained one contains 80 per cent. In the one case, therefore, we have 10 per cent of perfectly dry peat, and in the other double that amount. The output will, therefore, be half the quantity from an undrained bog as from a drained one, while the labor is the same. In Holland, Westphalia, Hanover, Holstein and Schleswig, Denmark, Pomerania, and the whole northern part of Germany, Russia, and many parts of Austria, Bavaria, the North of Italy, Switzerland, and extensive districts in both the North and South of France, peat is a general article of consumption, and the inhabitants would, no doubt, hear with some amazement that what is matter of course with them is matter of inquiry with us, and that we want to know whether peat is applicable to iron smelting and other industrial purposes, when they from time immemorial have used little else.

ON THE EFFECT WHICH THE DEPTH OF IMMERSION HAS ON THE RESISTANCE OF A SCREW.—BY PROFESSOR OSBORNE REYNOLDS, M. A.

It has been stated by several writers on the screw propeller, and is, I think, generally supposed, that the resistance of the water to a screw increases with the depth of immersion below the surface. Improvements have been made by Mr. Rennie and Mr. Maudslay which appear to prove this, but I do not think that any theoretical reason has ever been given. Now this idea is so contrary to our fundamental notions of hydraulics that I thought it would be worth while to make experiments. These experiments show us that there is not any increase beyond a certain point, and that this point is that at which the screw ceases to break the surface and get air. In a paper read before the Institution of Naval Architects, I explained how the air getting down to the screw is the cause of racing. In the same way it may be shown that it was the air that was the cause of the diminished resistance near the surface, found by Mr. Rennie and Mr. Maudslay.

The conclusion is that, when a screw is once fairly down below the surface, depth of immersion is of no advantage. Experiments on the effect of immersion on the resistance of screw propeller were made June 8, 1873. The screw was 2 inches in diameter, driven by a spring, which, when wound up, caused it to make 240 revolutions. The resistance at the different depths was measured by the time taken for the spring to run down.

FIRTH'S COAL CUTTING MACHINE.—BY MR. WILLIAM FIRTH, OF LEEDS.

Enough has been said respecting compressed air as a motor to justify the expectation that it is the key to vast and important improvements upon the present system of working coal; and bearing in mind that the wealth, the power, and the greatness of this nation depend primarily upon an abundant supply of coal, it is hardly possible to over rate the importance or over value the advantage which this power places at our disposal. I now turn to the consideration of the machine for cutting the coal, which has for several years been employed at West Ardsley without any interruption. The weight is about 15 hundred weight for an ordinary sized machine; its length, 4 feet; its hight, 2 feet 2 inches; and the gage, 1 foot 6 inches to 2 feet; it is very portable, and easily transferred from one bank to another. The front and hind wheels of the machine are coupled together in a similar manner to the coupled locomotive engines. The "pick" or cutter is double headed, whereby the penetrating power is considerably increased. The groove is now cut to a depth of 3 feet to 3 feet 6 inches at one course, whereas, by the old form of a single blade, we had to pass the machine twice over the face of the coal to accomplish the same depth. The points are loose and cottered into the boss, so that, when one is blunted or broken, it can be replaced in a few moments. It dispenses with the necessity of sending the heavy tools out of the pit to be sharpened, and is an immense improvement upon the old pick.

When all is in readiness for work, the air is admitted and the reciprocating action commences. It works at a speed of sixty to ninety strokes per minute, varying according to the density of the compressed air, the hardness of the strata to be cut, or the expertness of the attendant. As to the quantity of work in "longwall," a machine can, under favorable circumstances, cut 20 yards in an hour, to a depth of 3 feet, but we consider 10 yards per hour very good work, or say 60 yards in a shift. This is about equal to a day's work of twelve average men, and the persons employed to work the machine are one man, one youth, and one boy, who remove and lay down the road and clear away the *débris*. The machines are built so strong that they rarely get out of working condition. Some of those now working at West Ardsley, and other places, have been in constant use for three or four years. At that colliery there are about eight machines in use. One of the seams is so hard and difficult to manage that it could not be done by hand, and the proprietors had to abandon it; but now, by the employment of the machines, it is worked with perfect ease. It is a thin cannel seam with layers of ironstone, and the machines now "hole" for about 1,200 tuns per week. The groove made by the machine is only 2 to 3 inches wide at the face, and 1½ inch at the back; whereas by hand, it is 12 to 18 inches on the face, and 2 to 3 inches at the back. In thick seams worked by hand the holing is often done to a depth of 4 feet 6 inches to 5 feet, and the getter is quite within the hole that he has made; and where the coal does not stick well up to the roof, or where there is a natural parting, there is great difficulty and danger from "falls of coal."

THE consumption of coal for the purpose of gas illumination in Great Britain is estimated at fourteen millions of tuns per annum, valued at sixty millions of dollars. The total annual production of coal in England is one hundred millions of tuns.