very resisting material will require the block to be split. These operations proceed at the rate of from seventy to eighty bunches per minute.

In order to bring the hole in the block exactly under the cone pointed hollow cylinder extending from the bottom of the hook, a guide, K, is employed which descends upon the block while the bristles are entering one of the holes. A slight movement of the guide by the operator causes the point of the guide to engage the next hole in the series. As soon as the plunger rises, the guide automatically draws the hole it engages to the exact position required to receive the next bunch.

We think the reader will agree with us that a machine, that performs so many distinct movements harmoniously and, at the same time, has nothing flimsy or weak in its construction, is a masterpiece of invention, and one which is doubtless destined to effect a complete revolution in the important industry of brush making. By its use, the difficulty of making the bunches of uniform size and fastening them thoroughly in the block, as well as all other difficulties unsurmounted in other machines hitherto designed to accomplish the same purpose, are entirely overcome. The machine, although including so many movements, is extremely simple and compact, the space being most ingeniously economized. The power required is very small. The table, S, Fig. 1, upon which the block is held, may be inclined at any angle and held by the notched arc, M, so that bristles may be inserted in blocks of any contour or pattern. Patented April 26, 1870, and Dec. 27, 1870. For further information, address Woodbury Brush Machine Co., 30 Cortland street, New York. Concerning European rights, address H. C. Covert, proprietor of the foreign patents, 643 Broadway, New York, or care of H. E. Towle & Co., 20 Budge Row, London.

## SMELL.

The *Moniteur Scientifique* contains a paper by M. Papillon on this subject, having reference to recent discoveries in chemistry and physiology. We extract from it the following:

The seat of the sense of smell is, as we know, in the lining membrane of the nostrils. This membrane has a mucous and irregular surface, over which spread a number of nerves with delicate terminations. It secretes a lubricating liquid. By means of muscles, the apparatus of smell is dilated or contracted, like that of sight.

The mechanics of smell are, simply, the contact of odorous particles and the olfactory nerve. These particles are carried by the air into the nostrils. If, on the one hand, the nerve is injured, or even compressed: if, on the other, the air is prevented from passing into the nostrils, there is an absence of smell. The upper part of the nostrils is the most sensitive as regards odor. The sense of smell varies much in different people. Some are entirely without it. Others are quite insensible to certain odors, a case similar to that of Daltonism, in which some eyes fail to perceive certain colors. It is recorded of a certain priest that he perceived no odors but those of smoke and decayed cabbage, and to another person vanilla seemed quite inodorous. Blumenbach speaks of an Englishman who could not perceive the fragrance of mignonette.

Smell is sometimes voluntary, sometimes involuntary. In the former case, to obtain a lively sensation, we close the mouth, and make a long inspiration, or a series of short and jerking ones. The muscles contract the orifices of the nostrils, and thus increase the intensity of the current of air. On the other hand, when we wish not to smell, we exspire through the nose, so as to drive away the odorous air, and inspire by the opened mouth.

Smell and odors are closely connected with the phenomena of taste or gustation. Most savors perceived by us arise from a combination of sensations of smell with those of taste. There are, indeed, only four primitive and radical kinds of taste—acid, sweet, salt, and bitter. This may be shown by experiment. If we close our nostrils on tasting any sapid substance, the perceived taste will come under one or other of these four heads. Thus, when the olfactory membrane is diseased, the savor of food is altered.

How do odorous substances act with reference to the matter which separates them from the organ of smell? Prevost, in 1799, showed that if an odorous body were put in a saucer full of water, the emanations from it agitated the molecules of the water visibly. These motions, of which camphor gives a very good example, have been recently studied by M. Liégeois.

He found that some substances caused movements of gyration and translation over the water surface, similar to those of camphor. Of this class are benzoic acid, succinic acid, and orange bark. In the case of others, this motion ceases very soon, as they become encased in an oily layer over their surface.

He thinks these motions are due, not to a disengagement of gas, causing something like recoil, but to the separation and rapid diffusion of the odorous particles in the water. The fluid shows affinity for these. Similarly, a drop of oil falling on water sends out an infinite number of very small globules, which spread through the liquid, while the volume of the drop is not sensibly diminished. So with aromatic essences. Though insoluble in water, the small odorous particles tend to disperse themselves in it. A small quantity of odorous powder will thus impart perfume to a large body of water.

It is these same odorous molecules which are carried to our nostrils. And the action of water is thought by M. Liégeois to assist in the formation of them. In the morning, when the ground is moist, and the flowers are covered with dew drops, there is a large exhalation of perfume, and similarly after a shower of rain. In gustation, we have something analogous; the saliva is fitted to diffuse the odorant principle; by the motion of the tongue in the cavity of the mouth, this diffusion is promoted, for the surface of evaporation is enlarged. Now, in the same way as the small particles diffuse themselves in water do they diffuse themselves in air, which then becomes the vehicle carrying them to our nostrils.

Some odorous substances have a very great diffusibility. Ambergris, newly cast on the shore, is smelt a long way off. Bertholin states that the odor of rosemary off the Spanish coast is perceptible long before the land comes in sight. The degree of division of the particles is in some cases marvelous. A grain of musk will perfume an apartment for a whole year without sensibly losing weight. Haller mentions having kept for forty years some pieces of paper perfumed with a grain of ambergris, and at the end of that time they still retained their odor.

It is to be noted that the odorous particles are sent out, and the body emitting them does not act as a center of agitation giving rise to vibrations. It is thus a different case from those of light and heat. The odor is the odorous molecule itself; whereas light, as perceived, is not the luminous body.

We cannot tell whether oxygen has some chemical influence on the particles, nor what kind of action takes place on contact of the particle with the nerve, whether a mechanical agitation or a chemical decomposition. But the distinction of the senses into physical (sight, touch, and hearing) and chemical (taste and smell) is a just one. In the latter, contact is always implied.

An able writer has recently tried to prove a kind of music in odors. That is, different odors, according to him, affect the olfactory nerve in various degrees, corresponding to those in which sound affects the auditory nerve. Thus we may have octaves of odors. He enumerates various substances that produce the same impression, but in different degrees; for instance, these four, almond, heliotrope, vanilla, and clematis. By combination he obtains semi odors, corresponding to semitones: for instance, a rose with a geranium. He points out principles of harmony in perfumes corresponding to those in colors, and thinks it possible to produce a desired perfume from a mixture of others.

The theory is ingenious and worthy of attention, but it is open to grave objections. For the harmony in colors and sounds depends on exact numerical relations, which may be accurately determined; whereas, in the case of smell, the criterion is capricious and uncertain, and it is not possible to reduce to formula what our sense reveals.

There are many cases of hallucination as regards smell, united, generally, with insanity on other points. Lunatics have been met with who constantly complained of a fetid odor; others rejoiced in the most delicious, though imaginary, perfumes. M. Lelut tells of a patient, in the Salpêtrière, who was continually troubled with the smell of dead bodies, which she thought to have been buried in the establishment.

Capellini mentions the case of a lady who could not bear the smell of a rose, and fainted one day when a friend came in with one in her hand. Many other instances could be given. It seems to be well authenticated that in lunatic asylums these delusions as to smell are very frequent.

The intensity and delicacy of the sense of smell vary in different individuals and races. In some it is wonderfully sensitive. Woodwart tells of a woman who predicted storms, several hours in advance, from the sulphurous odor (due to ozone probably) which she perceived in the air. A young American, who was deaf, dumb, and blind, became a good botanist simply by the sense of smell. It is, however, in some of the lower animals that we find the sense most highly developed, ruminants, pachydermous animals, and above all, carnivorous mammifers. Smell is, with some of them, like an eye, which sees objects, not only where they are but where they have been. The keen scent of the dog is well known.

Humboldt mentions that when, in his travels in South America, it was desired to attract condors, all they had to do was to slaughter an ox or a horse, and in a short time the odor attracted a number of these birds, though none were visible previously. Of birds, waders have the largest olfactory nerves, and their sense of smell is most highly developed.

The olfactory organ in reptiles is large. Fishes also have an olfactory membrane, and fishermen have observed that they are driven away when certain odorous substances are thrown into the water. Sharks and other voracious fishes often gather from great distances when a carcass is thrown into the sea. Crustaceans are not insensible to emanations which come in contact with their olfactory fibers.

Entomologists say that the sense of smell in insects is very subtle, but it is difficult to determine the seat of it. When meat is exposed in the air, flies soon appear in great numbers, though none were seen before. The carcases of animals left on the ground attract hosts of insects, which find nourishment in them, and deposit their eggs. This will often happen when the object is concealed, so that their search cannot be guided by sight.

The flower of the cuckoo fruit gives forth a fetid odor, and a number of flies and other insects are often seen moving about on the corolla, in search, it is said, of decayed matter, from which, they imagine, the odor proceeds.

## How Long should a Man Stick to his Engine?

A correspondent of the *Locomotive Engineers' Journal*, writing from Rutland, Vt., speaking of the duty and extent of the responsibility of an engine man in case of accident, says:

"Where an accident takes place, such as going down the dump or colliding with another train—a bridge may be gone, a culvert washed away—he may see the fatal leap; I ask you, thinking your experience is worth as much as mine, would there be anything heroic for me to stand on the foot board and plunge with my engine into certain and dreadful death? Is there anything brave about it? Have you no responsibilities here on earth, no matter if you have ten cars loaded with passengers that must follow the engine as the case may be? Now I consider an engineer's responsibility ceases, in such cases, when he has sounded his whistle properly and reversed his engine, opened his throttle, pulled open his sandbox. He has done his whole duty to God and man as far as he can to stop the train, and if he has time and opportunity, if he is true to himself, he will try to get off and not go down to the bottom calling for brakes. Many engineers go down and collide and are killed, for the reason they do not have time after doing their duty. I never should feel as if a man was fit to run an engine if he had not courage to do his whole duty. But after he has stood to his post and done all that has been put into his hands to do, then I say he is a man that will try and save his own life."

## Two Miles of Track Laid in One Night.

The new Baltimore and Potomac Railway, which Colonel Thomas Scott and the Pennsylvania Central are now building as a rival to the Baltimore and Ohio, a through line between the East and Washington, was completed through to Baltimore last week in a novel and characteristic manner. The opponents of the road, having failed in all other expedients, had determined to get out an injunction to prevent its passage through Baltimore. Their project becoming known to the officers of the company, all hands—some 300—were massed from all along the line, and, as soon as the court adjourned on Monday, work was begun in earnest in construct ing the road and laying the track through the city. Night setting in, they were retarded a little; but the moon soon came out, and they went on the same as ever. At twelve o'clock, nearly half the track was completed, and the men, tired and hungry from their excessive labor, pitched into four wagon loads of provisions, that had been brought along, with a fine relish. Work was renewed with vigor, and before nine o'clock in the morning—the time when it was supposed the injunction was to have been made—the last spike had been driven. The distance of the track laid was about two miles, and crossed three streets, Calverton Road, Franklin and Townsend. At the two latter, double tracks were laid. The hands belonging on the lower section of the road embarked on the train for their quarters, and they moved off amid a chorus of yells and screaming of engine whistles.

## Improvement in Street Watering.

An official trial lately took place at Hyde Park Corner, Knightsbridge, Eng., of the system for watering streets, public parks, and market gardens, patented by Messrs. Isaac Brown & Co., Edinburgh. The patented apparatus was shown upon the drive at the east end of Rotten Row, Hyde Park, and upon one of the large enclosed flower plots, which has been fitted with it by order of Mr. Ayrton, her Majesty's First Commissioner of Works. In one of the illustrations of the new mode of road watering, one and one half inch lead pipes are laid along close to each kerb stone, these subordinate pipes being supplied from the mains. At intervals of about two feet apart, the pipes are drilled with small holes of from a sixteenth to a thirty second of an inch, in groups of three, each of which is pierced at a different angle. These apertures from the pipes command the complete road, which at the place where they are exhibited is about nineteen yards wide. The water is, of course, supplied under pressure, with a head of about 100 feet, and a shower of a quarter of a mile in length can be commanded with a one and one half inch pipe. The other experiment for road watering was by a central pipe in the middle of the road, which throws its jets towards the kerb stones. The pipes are protected by shields, and provision is made for the surface water being sent past the sides of the pipe to the bottom, where it finds a passage. The central pipe is of course upon the crown of the road, and is protected by an asphalt covering. An apparent objection may be that the small apertures may get choked up by the *débris* of the roads. In practice, however, this is found not to be the case, as the pressure of the water, when it is put on, keeps the drilled holes open. In winter, when there is the danger of freezing, the watering pipes are kept empty, which is not found to be a matter of much practical difficulty.

## The Origin of Metalliferous Deposits.

Great deposits of iron ore, says Professor T. Sterry Hunt, generally occur in the shape of beds, although waters holding the compounds of iron in solution have, in some cases, deposited them in fissures or openings in the rocks, forming true veins of ore.

The chemical history of iron is peculiar, since iron requires reducing matters to bring it into solution, and since it may be precipitated alike by oxidation and by farther reduction, provided sulphates are present. The metals copper, lead, and silver, on the contrary, form compounds more or less soluble in water, from which they are not precipitated by oxygen, but only by reducing agents, which may separate them in some cases in a metallic state, but more frequently as sulphides. The solubility of the salts and oxides of these metals in water is such that they are found in many mineral springs, in the waters that flow from certain mines, and in the ocean itself, waters of which have been found to contain copper, silver, and lead. Why then do not these metals accumulate in the sea, as the salts of soda have done during long ages? The direct agency of organic life again comes into play, precisely as in the case of phosphorus, iodine, and potash. Marine plants, which absorb these from the sea water, take up at the same time the metals just named, traces of all of which are found in the ashes of sea weeds. Copper, moreover, is met with in notable quantities in the blood of many marine molluscous animals, to which it may be as necessary as iron is to our own bodies. Indeed, the blood of man and of the higher animals appears never to be without traces of copper as well as iron.

Water, as we have seen, is a universal solvent, and the matters which it may bring and deposit in the fissures of the earth are very curious. There is scarcely a spar or an ore to be met with in the stratified rocks that is not also found in some of these veinstones, which are often very heterogeneous in composition. In some veins we find the elements of limestone or of granite, and these often include the gems, such as amethyst, topaz, garnet, hyacinth, emerald, and sapphire; while others abound in native metals, or in metallic oxides or sulphides. The nature of the materials thus deposited depends very much on conditions of temperature and of pressure, which affect the solvent power of the liquid, and still more upon the nature of the adjacent rocks and of the waters permeating them.

We are apt in explaining the appearances of the earth's crust to refer the formation of ore beds and veins to some distant and remote period when conditions very unlike the present prevailed, when great convulsions took place and mysterious forces were at work. Yet the same chemical and physical laws are now, as then, at work; in one part dissolving the iron from the sediments and forming ore beds, in another separating the rarer metals from the ocean's waters, while in still other regions the consolidated and formed sediments are permeated by heated waters, to which they give up their metallic matters, to be subsequently deposited in veins. These forces are always in operation, re-arranging the chaotic admixture of elements which results from the constant change and decay around us. The laws which the First Great Cause imposed upon this material universe on the first day are still irresistibly at work fashioning its present order. One great design and purpose is seen to bind in necessary harmony the operations of the mineral with those of the vegetable and animal worlds, and to make all of these contribute to that terrestrial circulation which maintains the life of our mother earth.

## PHENOMENA ASSOCIATED WITH A HYDROGEN FLAME.

Phenomena of much interest, and possibly of future usefulness, are associated with the combustion of ordinary hydrogen.

1. To study these phenomena free from disturbing causes, three things should be attended to, although the effects to be described can be obtained without any special precaution. (1) The gas must be stored and purified in the ordinary way namely, by passing into a glass holder through a solution of potash, and then through a solution of perchloride of mercury or nitrate of silver. (2) From the holder, the gas must be led through red or black india rubber tubing to a platinum or, better, a steatite jet. (3) And then the gas should be burnt in a perfectly dark room, and amid calm and dustless air.

2. In this way, the flame gives a faint reddish brown color, invisible in bright daylight. Issuing from a narrow jet in a dark room, a stream of luminosity, more than six times the length of the flame, is seen to stretch upwards from the burning hydrogen. This weird appearance is probably caused by the swifter flow of the particles of gas in the center of the tube. The central particles as they shoot upward are protected awhile by their neighbors; metaphorically they are hindered from entering the fiery ordeal which dooms them finally to a watery grave. Dr. Tyndall has shown that the radiation from burning hydrogen is hugely ultra-red, and moreover, that it has not the quality of the radiation from an elementary body like hydrogen, but practically is found to be the radiation from molecules of incandescent steam. So that, except at its base a hydrogen flame is a hollow stream of glowing water raised to a prodigious heat.

3. Bringing the flame into contact with solid bodies, in many cases phosphorescent effects are produced. Thus, allowing the flame to play for a moment on sand paper and then promptly extinguishing the gas, a vivid green phosphorescence remains for some seconds. The appearance is a beautiful one, as a luminous and perfect section of the hollow flame is depicted. Similar phosphorescence is produced by the flame on white writing paper, or on marble, or chalk, or granite, or gypsum, etc. But no such effect is produced by coal gas, or olefiant or marsh gas. It is evidently a question of temperature, as oxygen driven through coal gas shows the phosphorescence well.

Far exceeding in generality the effect just noticed is a really magnificent blue image of the flame that starts up on almost every substance with which the flame is brought into contact. I have already drawn attention to this effect in the *Philosophical Magazine* for November, 1865, and the same effect has more recently formed the subject of a memoir, presented to M. Wurtz, of the Paris Academy of Sciences, the author of that paper evidently being unaware that the subject had already been investigated by myself.

The appearance is as follows: When the hydrogen flame is brought either vertically or sideways, say upon a white plate or a block of marble, there instantly appears a deep blue and glowing impression of the exact size and shape of the hollow flame. The moment the gas is extinguished, or the flame removed to the slightest distance from the solid, the effect as instantly ceases. If the flame be brought successively to the same spot on the solid, the effect grows fainter and finally vanishes, but instantly reappears upon an adjoining portion.

Other combustible gases, such as carbonic oxide, or marsh gas, or olefiant, or coal gas, do not yield this effect, nor does any lamp flame, luminous or otherwise; nor is it obtained in the oxidizing flame of an ordinary blowpipe; but it is imperfectly produced in the reducing flame when coal gas is used; it is not seen when oxygen is driven through coal gas, unless the latter be in excess; and it is poorer and vanishes more quickly with the oxyhydrogen flame than with hydrogen alone. This blue luminosity is therefore, not a question of heat, but some property depending either on (*a*) the chemical nature of hydrogen, or on (*b*) the physical effect of its radiation. At first I thought it was the latter, and that it was a new form of fluorescence, so closely did it resemble those phenomena. But after a weeks' incessant experimenting, the true cause was hunted down and found to be dependent on the former effect (*a*), and in every case ultimately due to the presence of sulphur. A chemically clean body, or a freshly broken surface, did not show the blue coloration; but after exposure for a short time to the air of London, the substance invariably yielded the blueness; this, however, was not the case when the clean surface was covered by a shade, or exposed to the air of the open country. The combustion of coal gas and coal fires yields sulphate of ammonia, a body often deposited in acicular crystals in the glass tube in a laboratory. Sulphate of ammonia is decomposed by a hydrogen flame, and when that salt is brought into contact with burning hydrogen, it permanently yields the blue coloresence. Hence this body is the main source of the blueness seen whenever a hydrogen flame comes into contact with glass tubes or a dirty surface. The effect must repeatedly have been seen by every one who has experimented on singing flames.

When the blueness, as is so often the case, is seen tinging the flame itself, without contact with any body, the sulphur is derived either from the vulcanized tubing, the dust of which is taken up by the passing gas, or, if the hydrogen be burnt from the bottle generating it, the blueness is due to the decomposition of the sulphuric acid spray, as will be shown further on.

As a chemical re-agent for detecting sulphur, the delicacy of a hydrogen flame is extraordinary. This fact was estimated as follows: Pure precipitated silica yields no blueness with the flame; 500 grains of silica were intimately mingled with one grain of milk of sulphur. Less than one hundredth of a grain of this mixture was thrown on the surface of pure water or placed upon chemically clean platinum foil. The water is best, but in either case the blue color (absent before) now shot forth on bringing the hydrogen flame down. Tried again and again with fresh portions, the effect was very evident, but quickly vanished. The sulphur in a similar portion of the mixture could not be detected chemically by nitro prusside of sodium. The wonderful sensitiveness of the flame may be still better seen in another way. Immediately after washing, the fingers show no color when brought for a moment into the flame, but if a white india rubber tube be touched ever so lightly, the fingers not only show a vivid blueness, but for some time any clean object touched by them, such as platinum foil, shows traces of sulphur by the appearance of the blue coloration with the flame. A block of melting ice continually weeps itself free from dust, and thus presents an excellent surface upon which to try the foregoing experiment. Or a plate of platinum, after heating to redness, may be written over with a stick of sulphur. If kept covered, the invisible letters may long after be traced out by sweeping the hydrogen flame over the surface of the platinum.

Examined through a prism, the blueness derived from any source shows blue and green bands, similar to the spectrum of sulphur, but I have noticed also a red band. This mode of obtaining a sulphur spectrum suggests further inquiry White marble smeared over with a bit of sulphur, or with vulcanized rubber tubing, is a convenient source for obtaining the effect at pleasure.

Some sulphates and sulphides show the blueness with the flame, and are evidently composed by the hydrogen. Thus sulphate of soda gives no blue appearance, while sulphate of ammonia, or alum, does.

Various liquids were tried in contact with the flame. Sulphuric acid was very notable. Here a magnificent blue effect was observed. For persistence and brilliancy of the of the color, this experiment leaves nothing to be desired; the spectrum is very fine. If the liquid is in a glass dish when the flame is brought vertically down, the blueness lights up the glass in a lovely manner.

6. But the presence of sulphur is by no means the only body that a hydrogen flame reveals. The least trace of phosphorus is detected by the production of a vivid green light. It is striking to notice the wonderful sub division of matter in these experiments, and how an immeasurable trace of an element can evoke pronounced and disproportionate effects.

Might not this ready detection of minute quantities of sulphur and phosphorus be of use in the manufacture of iron? And might not hydrogen introduced into the molten metal be employed for the removal of these great enemies of the iron worker? I speak ignorantly.

7. Among the range of substances I have tried, tin was was found to yield the most conspicuous effect, after the bodies named. A fine scarlet color is almost instantly produced when the hydrogen flame is brought into contact with tin or any alloy of tin. Tin is somewhat volatile, and its spectrum is rich in red rays. The tin must be clean; or the sulphur blue, which is much brighter, will mask the effect. A charming experiment may be made by partially scraping a soiled surface of tin; the blue and the scarlet colors mingle and a lovely purple is the result. When a trace of phosphorus is present, there may be obtained a green belt encircling a rich blue, then a purple zone, and finally a glowing scarlet at the root of the flame. These colors, it must be remembered, are not imparted to the flame, but reside on the surface of the body which the flame touches. And where the combustion of the hydrogen is complete, as in the upper part of the flame, or in the luminous stream referred to (2), these effects are not produced: they are best developed at the root of the flame.

8. Passing from liquids and solids, I next tried gases in contact with the flame of hydrogen. Many gases imparted a color to the flame, but here the effect was different to that previously noticed. The whole flame was tinged with the color imparted to it. A mere trace of hydrochloric acid gas imparts a reddish brown to the flame; ammonia gas gives a yellow, and burns freely. It is striking to note the combustion of ammonia gas rising from an unstopped bottle that contains the usual solution and which is placed below the flame.

But carbonic acid gas yields the most striking result in contact with the flame. A pale lilac tinge is instantly produced by a stream of this gas. This, I imagine, is due to the decomposition of the carbonic acid by the hydrogen, and the production and combustion of carbonic oxide. For it is at the lower part of the flame that the effect is most marked. One per cent of pure carbonic acid, admitted to a jar of air, can be detected on holding the jar over the flame. The breath, of course, shows the effect most strikingly.

9. Here then is an eminently practical method of noting the presence of vitiated air in rooms or public buildings. A continuous hydrogen apparatus might be employed with a wash bulb attached. The flame might be burnt from a brass burner or lava jet, placed within a blackened tin cylinder. Opposite the flame a hole might be pierced in the cylinder and closed by a lens for better viewing the flame within. As soon as the atmosphere in a room becomes unpleasantly vitiated, the flame would indicate the fact by its changed color. A similar apparatus might likewise be employed by miners, in metal mines as a warning against impure air, and in coal mines as a detector of fire damp. In this latter case the ends of the cylinder could be covered with wire gauze.

### Irrigation Canal of the Rhone.

The proper irrigation of the four departments of France, the Drôme, Garde, Hérault, and Vaucluse, has been for many years under consideration, and at last the Minister of Public Works has granted a credit of small amount for the necessary preliminary steps to be taken to carry out the plans of M. Aristide Dumont, Engineer in Chief of *Ponts et Chaussées*, who proposes to cut a canal for irrigation from the Rhone, at Condrieu, to Mornas.

The length of the canal from its source to Mornas will be about one hundred and twelve miles; all the towns by which it passes can be supplied with water, and it is anticipated that many new factories will spring up in consequence. From a reservoir at Mornas, the canal passes to the right bank of the Rhone by means of a siphon aqueduct. After passing Uyés through a tunnel more than three miles long, it reaches Montpellier at the hight of 180 feet above the level of the sea, irrigating the whole of the environs of this town by means of numerous channels which will distribute the water over the vast plains, which suffer terribly and frequently from drought, that lie between Montpellier and the sea.

The amount of water to be taken from the Rhone at its lowest level is set down at 33 tuns per second, but during about half the year the volume will be increased to 40 or 45 tuns.

The distribution is calculated in the following proportions: 20 tuns for agricultural irrigation, 10 for irrigation in the vicinity of towns, and 3 tuns for evaporation and loss.

The great importance of this canal consists in the fact that, while in the summer all the other rivers in the South of France are nearly dry, the Rhone, being fed by the snow and glaciers of the Alps, pours a grand stream into the sea, which would make the fortune of agriculture. At extreme low water, this noble river passes Lyons at the rate of 235 tuns per second, Tournon at the rate of 310 tuns, Valence at 410, Avignon at 450, and Beaucuire at the rate of 530 tuns per second. At average states of the river, the flow at the spot where the canal is to commence is equal to more than 600 tuns per second; there is little fear then of exhausting such a supply as this, and it is asserted that the abstraction of the volume of water above named will have no effect, even upon the shallowest parts.

The estimated cost of this important work is equal to ten millions of dollars for the formation of the canal and its distributing conduits, and the time required for its execution is three years.

The great hight of the source of this proposed canal will allow the irrigation to be carried to poor dry lands on the slopes of the hills, and thus greatly increase their value and the author of the plan sets down the increased value of such lands at about sixty dollars.

Grand as this scheme is, there is nothing extraordinary or even novel in it; the canal of the Muzza takes 77 tuns of water per second from the Adda, and the grand canal of the Techino, 48 tuns per second from that river.

The great quantity of water proposed to be taken from the Rhone will require the canal to be very little larger than an ordinary one for navigation.

RESTORING WASTE RUBBER.—Among the recent patent extensions is that of Baschnagel's patent of 1858, for restoring waste vulcanized rubber. The invention consists in subjecting the old rubber to a heat of from 150° to 600° F, either with or without immersion in water or other cooling liquid. This process so restores the qualities of the gum that it can be used again in the manufacture of rubber goods.

THE density of the four satellites of Jupiter has been ascertained to be nearly fifty per cent greater than that of the planet itself.