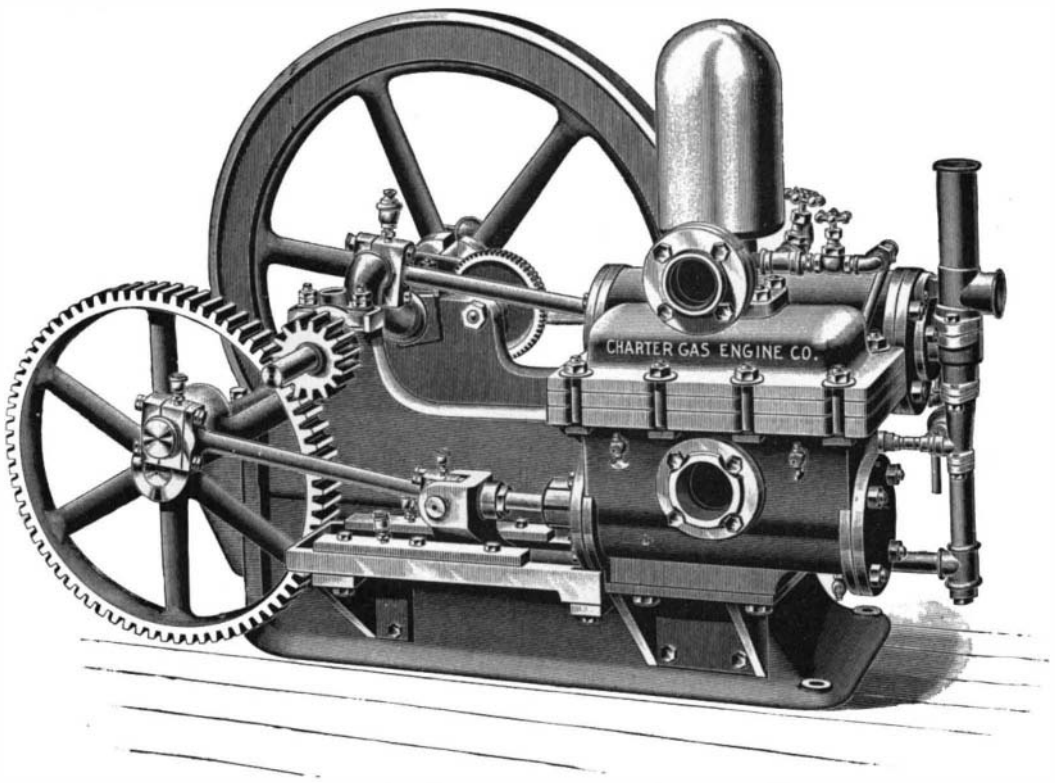
GASOLINE PUMPING ENGINE.

We give an engraving of the Charter gasoline engine and pump combined. This combination was designed for any kind of service that piston pumps are capable of. It is compactly built, a feature which, in places where floor space is valuable, is especially desirable. It is easily operated. When through pumping, nothing remains to do but shut off the gasoline. As no special attendant is required, it is especially desirable for filling railroad tanks, as the station agent or his assistant can take care of the engine and see that the pumping is done without interfering with their regular duties, thus saving the expense of employing a man to go from station to station to fill the tanks. The workmanship and material are the best obtainable. The gears are all machine cut, the pump cylinder is brass lined, and everything about the engine and pump is built on the interchangeable plan. The cut illustrates an engine and pump capable of delivering 60 gallons of water per minute against 100 or 200 feet head, or equivalent pressure. It is self-contained and may be set in operation almost anywhere. This engine is made by the Charter Gas Engine Company, Sterling, Illinois.



COMBINED GASOLINE ENGINE AND PUMP.

The Endurance of Rotating Shafts.

Some of the results arrived at by recent tests made at the Watertown Arsenal are regarded as of special importance in relation to the endurance of rotating shafts. While it has been found that great improvements in tensile strength and elastic limit have been obtained, it has not been shown whether the limit of endurance under repeated strains has been increased. In the rotating tests of cylindrical shafts, alternate tensile and compressive strains are successively applied, and under these conditions of loading no steel has yet been experimented with which will endure a continuous fiber stress of 40,000 pounds per square inch without rupturing, and this result has been reached after a total number of repetitions of from four to seven millions for steels of high elastic limit and tensile strength.

APPARATUS FOR MEASURING THE INTENSITY OF THE PERFUME OF FLOWERS.

Mr. Eugene Mesnard, one of our most clever botanists, has for several years past been making profound researches upon the perfumes emitted by flowers, and which are interesting not only from the standpoint of plant biology, but also from that of the perfumer's art. In fact, the art that consists in extracting the aroma of odoriferous bodies, and in making mixtures thereof agreeable to the smell, is a matter of no ordinary empiricism. It is only through daily practice and multiple comparisons that perfumers have succeeded in establishing the rules that define the combinations of odors that are to enter into bouquets or different toilet articles. On another hand, as regards the production of perfume by flowers, one might seek in vain for the smallest work upon the question.

The idea of an attentive study of the phenomenon, from a biological and industrial standpoint, must necessarily have presented itself to the mind of a botanist. Let us congratulate Mr. Mesnard for having taken it up, and especially for having pursued it with success. Such a study, in fact, was not one of the easiest of matters. The perfume of flowers is something so subtile, so impalpable and so difficult of comparison, that we ask ourselves how it is rendered manageable. The important point to be established in the first place is its intensity, that is to say, the greater or less action that it exerts upon the olfactory organ. The measurement of this is a very delicate matter.

The indirect method that Mr. Mesnard employed for measuring such intensity is very precise. As he remarks, although the sense of smell is not capable, as might be supposed, à priori, of estimating the intensity of an odor in absolute measure, it may be a wonderful comparer. The perfumer who has five or six hundred varieties of odors in his store is perfectly able to distinguish one from another, while it is not in his power to define their intensity with certainty. So, too, it is possible, by the sense of smell, to recognize the existence of a great number of chemical substances, but without it being possible in any way to prejudge of the quantity of such substances that are found distributed through the air. Let us suppose, then, says Mr. Mesnard, that we cause air charged with a certain perfume and air that has passed over a special volatile oil (oil of turpentine, for example) to enter a given receptacle, In this way we may obtain a mixture in which the sense of smell will detect only a neutral odor, that is to say, an odor such that it will suffice to slightly vary the proportion of the volatile oils in one direction or the other in order to detect either the perfume or the oil of turpentine. It may then be admitted that the odors are equivalent, and if we have at our disposal a method that permits of measuring the intensity of the turpentine, we shall obtain by that very fact the intensity of the perfume.

In order to estimate the intensity of the turpentine, there is taken as a basis the property that the latter possesses of extinguishing the phosphorescence of phosphorus. To this effect, there is used a little starch soaked in some sulphide of carbon in which phosphorus has been dissolved. The sulphide evaporates, and the starch, which is a very homogeneous substance, becomes impregnated with phosphorus, which becomes luminous in the air. Mr. Mesnard has shown that in order to prevent the phosphorus from glowing in a given space it is necessary to introduce therein a volume of air that is so much the greater in proportion as it is charged with a lesser weight of vapor of turpentine oil.

Oil of turpentine thus becomes a common standard for the various volatile oils, and the intensity of the perfume emitted by a given weight of volatile oil may be called the ratio between the weight of the oil of turpentine that neutralizes the perfume and the weight of this same oil which, employed alone under the same conditions, acts upon phosphorescence with the same energy.

In all experiments it is necessary to carry along the odors (which are generally heavy) mechanically by a strong current of air.

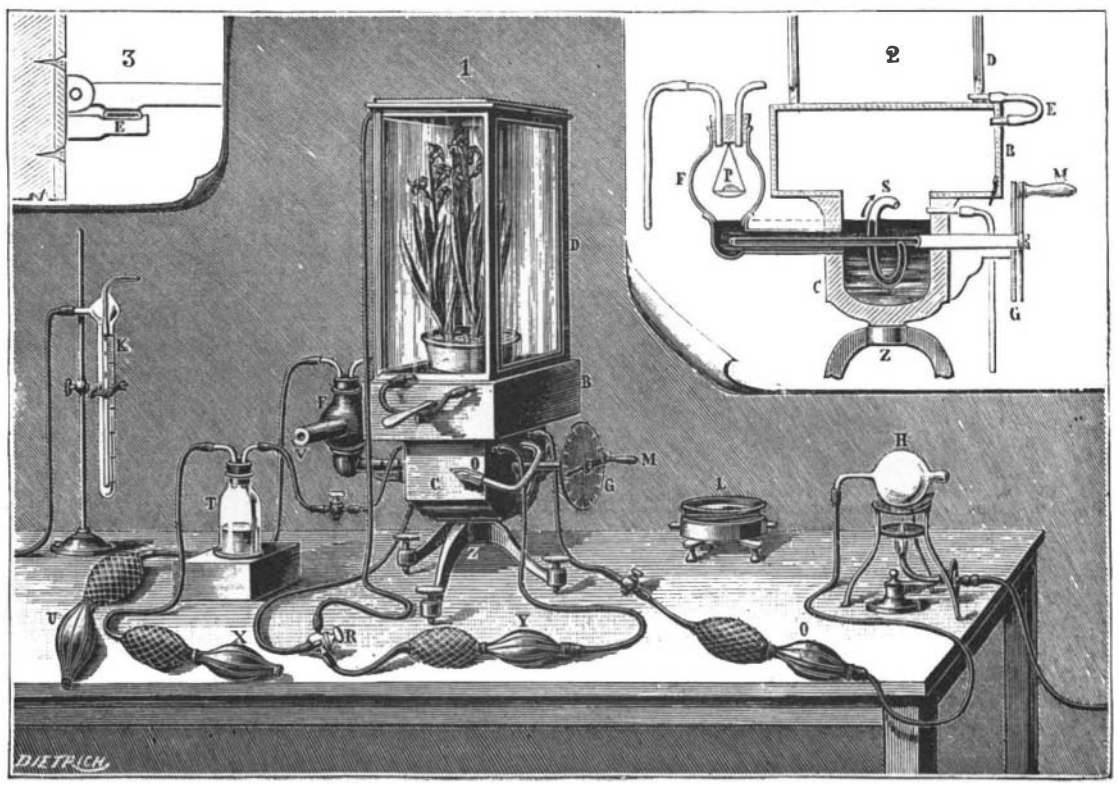
The following is the way in which Mr. Mesnard realizes all these conditions in an apparatus constructed at the laboratory of Mr. Gaston Bonnier.

The flowers, the intensity of the perfume of which is to be determined, are inclosed in a large glass case (No. 1 of the figure) placed upon a pedestal which is itself supported by a metallic tripod, Z, provided with leveling screws. This pedestal consists of two parts: (1) a narrow one, C, hollow in the interior, into which mercury is put, and (2) a wide one, B, which is separated from the glass case by a partition. These two parts form but one and the same receptacle. A rubber tube that may be closed by a lever (E, No. 3) establishes a communication between the case, D, and the mercury reservoir (No. 2). In this same receptacle likewise debouch different conduits, one of which is designed to lead the air charged with oil of turpentine coming from the bottle, T. The odors are detected in the apparatus through the tube, O.

Through the manipulation of a rubber bulb provided in front and behind with ajutages and with a three-way cock, R, it is possible at will to agitate the air either in the case, D, and the mercury reservoir communicating with it, or in each of these two parts isolatedly.

The neutral odor having been obtained as previously stated, it is a question of measuring the charge of the oil of turpentine that has produced this result. The phosphorescent substance is suspended in a blackened glass bulb, F, of about 100 c. cm. capacity that communicates, at its base, with the reservoir through a horizontal tube full of mercury. A black cardboard tube, V, permits the phosphorescence to be observed, even in the full light. For the transfer of the perfumed air from the mercury reservoir to the bulb, F, the following arrangement is employed. In the same axis of the connecting tube is placed a smaller tube, one of the extremities of which opens in the mercury just beneath the bulb. The other extremity of this tube is prolonged by a solid axis provided with a winch, M. Toward the center of the reservoir, it receives a spirally curved branch, S. In a certain initial position, the spiral and the tube that prolongs it may be entirely filled with mercury; but, if the winch be revolved, the extremity of the spiral will enter the atmosphere, and, at every revolution, withdraw therefrom a certain quantity of perfumed air, which it will carry along through the mercury to the extremity of the tube, where the air will escape, bubble by bubble, and become diffused through the bulb.

The winch is revolved until an extinction of the phosphorescence is obtained. The number of revolutions or fractions thereof is proportional to the quantity of air that has been carried along. Moreover, the spiral is graduated, and, by raising the level of the mercury in the reservoir more or less, it is possible to modify the volume. A rubber bulb, U, permits of blowing a little air upon the phosphorescent substance. Another



APPARATUS FOR MEASURING THE INTENSITY OF PERFUMES.

No. 1. D. Glass case containing the perfumes. Z. Tripod. C. Mercury reservoir. No. 2. Internal section of the pedestal that supports the case, D. No. 3. Lever for closing the tube, E, by pressure.

bulb, Q, distributes warm air throughout the apparatus. —La Nature.

Rules of the Providence Horseless Carriage Race.

The following are the rules and conditions of the horseless carriage race and exhibition which will be held on September 7, 8, 9, 10, 11, 1896, at Narragansett Park, under the auspices of the Rhode Island State Fair Association. The race will be twenty-five miles, for a $5,000 dividend. The rules are very sensible, and the race will tend to awaken public interest in the horseless carriage. It will be noted that an entrance fee of $100 is charged. This is a step in the right direction and will certainly prevent the pitiable defections from the ranks of competing vehicles which have marked both of the former races.

OFFICIAL RULES AND CONDITIONS.

Entrance fee, $100 per carriage, payable August 10. No conditional entries accepted.

The race to be five heats, of five miles each day of the fair, September 7, 8, 9, 10, 11, 1896.

Ten carriages to enter and five to start, or no race.

Vehicles must be able to show a rate of speed equal to 15 miles an hour to compete in the race.

Vehicles must carry one person in addition to the driver. (Weight carried must be 165 pounds.)

Only vehicles propelled by other than animal power allowed to compete.

Vehicles not limited in number, but no one owner can enter more than one carriage and start in the race. If the starters number ten or more, for reasons of safety the carriages may be divided into classes and started in two or more divisions.

Division of the race purse will be in the following proportion to the winners of the race: 50, 25, 15, and 10 per cent of $3,000. First, $1,500; second, $750; third, $450; fourth, $300.

To the vehicle winning the greatest number out of five heats, first money, etc., but all vehicles must stay in throughout the five heats.

Distance waived, but those vehicles which do not cover the course with an average speed of fifteen miles an hour will be disqualified.

Each vehicle will be required to carry its number in large figures; other printed matter not permitted.

Contestants will be required to conform to such rules and regulations as may be made by the association, particularly in regard to their position on the track. All legal responsibility is thrown upon the contestants, the association declining to assume any whatsoever.

In case that less than five carriages shall respond to the call of the starting judge, the race shall be declared off, and to those answering the call and who are ready with their vehicles, their entrance fees paid in shall be refunded. With ten or more entries received, the association will open, in addition to the speed contest, prizes to be competed for as an exhibition, judging to be made on points of manageability, etc., for $2,000, divided as follows:

First prize, $1,000 and the association's gold medal and diploma.

Second prize, $500 and the association's silver medal and diploma.

Third prize, $300 and the association's bronze medal and diploma.

Fourth prize, $200 and the association's diploma.

In the exhibitive competition the following percentage scale of points shall be made the basis of awards:

Speed	40 per cent.	Cost	10 per cent.
Control	20 "	Maintenance	5 "
Simplicity	10 "	Appearance	10 "

Vehicles may compete, if desired, in both racing and exhibition.

Entries will close August 10, 1896. Entry blanks will be furnished on application to Rhode Island State Fair Association, Providence, R. I.

Novel Method of Rapid Photographic Printing.

Some time ago we described and illustrated the method of automatic photographic printing as carried on in this city by the Automatic Photographic Printing Company, who print from glass negatives. Now appears another kind of apparatus, recently patented in England by Mr. Friese Green, for accomplishing the same object in a different way when using flexible negatives. He describes it in his specification as follows:

"I print successively by means of photography a number of impressions from the same photographic or other negative, or from the same series of negatives, upon a continuous band of sensitized paper or other sensitized material, as this is caused to travel continuously in contact with a translucent cylinder which bears or carries the negative or negatives, the said cylinder being lighted internally, preferably by one or more incandescing electric lamps.

"In carrying out the invention, when the negative or negatives employed are photographic negatives, I use negatives which have been taken upon a flexible translucent material such as a thin sheet of celluloid, and I place this sheet upon a supporting cylinder of glass in such manner that the sheet bearing the negative or series of negatives surrounds the cylinder. Within this cylinder I place one or more lamps. Over or under the cylinder, and in contact with the celluloid sheet thereon, I carry a band of sensitized material from a roll or otherwise, this band being so guided that there is always a part, say several inches, of its length in contact with the celluloid sheet, and this part of the band being maintained taut. Rotary motion is given to the cylinder and forward motion at the same surface speed to the band, with the result that every section of the band equal to the circumference of the cylinder has printed upon it by means of the light a positive impression from the negative or negatives on the cylinder, the same picture or pictures being produced upon every successive section of the band. On leaving the cylinder the band is carried to and through fixing and developing baths; or, if it be required to print upon both sides of the band, it goes from the first cylinder to a second and similar cylinder, where it is printed in like manner upon its second side; it then passes on to the fixing and developing baths.

"When the negatives employed are not photographic negatives, they may, for example, be transparencies or sheets having the parts that do not constitute the design in black, red, or other nonactinic color, and the other parts, that is to say, the design, transparent, or vice versa.

"It is not essential to employ the glass cylinder described if the sheet that bears the negative or negatives is strong enough to be self-supporting."

HARTMANN'S SPOOL WIRE CLAMP.

To confine reeled wire upon its reel, whether it be unannealed or spring wire, holding the wire always in proper position without the necessity of fastening its free ends, the simple and inexpensive device represented in the accompanying illustration has been patented by Charles R. Hartmann, of No. 110 Cambridge Avenue, Jersey City, N. J. It consists of a U-shaped clamp whose side members are preferably connected with the reel by a central tube or pin, permitting the clamp to be readily moved along the outer surface of the reel to any point desired. The side members are provided with loops which serve as handles, and also as springs, holding down the portion of the clamp which extends over the outer surface of the reel, and this portion has downwardly extending flanges inclosing a pad of cork, rubber, leather, or other elastic material. The improvement is especially adapted for holding in place wire designed for use in stringed instruments, preventing the wire from springing off, and, at the same time, permitting any length of string to be readily drawn off, the wire remaining on the reel being held in the order in which it was originally wound.

A Railway Accident Caused by Heat.

Lieut. Col. H. A. Yorke, R.E., has reported to the Board of Trade on the accident that occurred on May 6, near Banavie junction, on the West Highland (North British) Railway. As the 7:35 A. M. passenger train from Glasgow to Fort William was running round the curve between Spean bridge and Banavie junction on that day the whole train, with the exception of the engine, left the rails and ran along the ballast for 115 yards before it came to rest. The permanent way had three rails bent, and 120 sleepers and 112 chairs, more or less, were destroyed.

Lieut. Col. Yorke says he has no hesitation in attributing this accident, which by rare good fortune was unattended by any personal injuries, to the expansion and consequent distortion of the line produced by the great heat prevalent on the day of the occurrence. During the forenoon of May 6 the temperature registered at Fort William, by a thermometer placed in the sun 2 feet above the grass, was 128 degrees. The accident happened at 12:38 P. M., when, the railway at the spot being entirely devoid of shade, the rails were exposed to the full glare of the sun. Driver Thornton says that when he was passing the 97¼ mile post he saw that the line a short distance in front of him was distorted to the left to such an extent that he anticipated that the train would leave the rails. He promptly applied the Westinghouse brake, and almost immediately after this the tender and vehicles composing the train left the rails toward the inside of the curve. Inspector Campbell had traveled over the line early that morning in the van of a ballast train, and noticed nothing wrong with it.

The fact that the engine did not leave the rails, although the train did, may probably be attributed to the flexibility imparted to the engine by the leading bogie, which was able to adjust itself to the irregular curvature of the line produced by the expansion of the rails; whereas the tender, with its six wheels and rigid wheelbase, was most probably the first vehicle to leave the metals, and dragged the rest of the train after it. The mishap must be regarded as purely accidental, and there is no evidence to prove that any blame attaches to any servant of the company in connection with it. There are, however, the report adds, some indications that this portion of the line has not been maintained in a thoroughly first class condition.—London Times.

Science Notes.

Dr. J. Doerfler, of Vienna, has published his Botaniker Adressbuch, a guide to botanists throughout the world. It contains upward of 6,000 addresses of botanists, as well as those of botanical gardens, botanical institutes, societies, and journals.

Jenner's silver lancet case and lancets, the former engraved with the initials and the latter with the name of the discoverer of vaccination, have been presented to the Royal College of Surgeons by a doctor who obtained them from the grandson of Jenner's assistant.

Natural Science notes that Mr. G. A. Boulenger is one of the first to use X rays for purposes of systematic zoology, having used a skiagram to determine the more important points in the skeleton of the rare toad Pelodytes caucasicus, the second known species of the genus represented by a single specimen. The skiagram showed the junction of the astragalus and calcaneum, the form and extent of the frontoparietal fontanelle, the shape of the widely expanded sacral transverse processes and the direction of those of the lumbars.

Prof. H. L. Bolley, in a paper on cleanliness in handling milk, says bacteriological considerations tell us that gelatine plate 3½ inches exposed to air one minute contained the following number of germs. Ordinary living room five minutes after sweeping, 543 germs, eight species. (Fargo.) In open meadow, when quiet, 6 germs, two species. (Madison, Wis.) Open meadow October, quiet, 8, three species. College cow stable between the cows after feeding time, October, 570, eleven species. (Madison, Wis.) University creamery and cheese factory, pasteurization room after scrubbing, August 21, 5 germs, three species. (Madison.) Refrigerator, storeroom temperature 40° F., one species. (Madison, Wis.) (Bull. 21, N. Dakota Agr. Exp. Sta.)

The Lancet states that a surgeon in the United States navy reports that in Japan among 1,200 soldiers 1·58 per cent were red blind and 0·833 per cent green blind. Among 373 boys 1 per cent were red blind, and among 270 girls 0·4 per cent. Among 596 men in Kyoto 5·45 showed defective color sense. Dr. Fielde, of Swatow, China, examined 1,200 Chinese of both sexes, using Thompson's wool tests. Among the 600 men were 19 who were color blind, and among 600 women only 1. The percentage of color blindness among Chinamen is then about 3 per cent, and does not vary greatly from that in Europeans. Dr. Fielde, however, found that fully half of those tested mixed up blue and green, and this investigator thinks that many of the race are quite blind to the violet colors.

Signor Palmieri, who for some years has been studying the earth currents at the observatory on Mount Vesuvius, has discovered that the direction of the current changes when the volcano is unusually active. The earth line runs from a deep well in the village of Resina, at the foot of the mountain, to the observatory, near the top. From 1889, when the experiments began, till August, 1893, the currents were from the lower station to the higher, so that Prof. Palmieri had concluded that the earth currents always ascend. In that month, however, the direction began to change and settled into the opposite of the direction since 1889, the volcano being abnormally agitated. In January and February, 1894, the mountain became quiescent, when the current again moved upward, and later turned downward once more, on an increase in the activity of Vesuvius.

As the result of his prolonged study of those striking phenomena, the thunder storms of Madras, Prof. Smith informs the Scottish Meteorological Society that the first remarkable fact observed by him was that of certain seasons of the year, when sheet lightning appeared almost every night, always in a west or southwesterly direction, and invariably near the horizon; it may be, therefore, he remarks, that these discharges occur in the region where the moist and dustless sea winds meet the dry and dusty land wind, one being, perhaps, positively electrified and the other negatively. In these lightning displays as many as 300 flashes per minute have been counted, this rate being kept up for an hour or an hour and a half. Another notable peculiarity marked of this region is that the heaviest rains are unaccompanied by thunder, while the displays of lightning are not accompanied by any rain.

W. N. Hartley has determined the composition of a coin by an ingenious adaptation of the methods of spectrographic analysis. The spectrum of the coin was photographed and the metals present first ascertained, after which their relative proportions were arrived at by comparing the photograph with a series of quantitative spectra, in which solutions of known strengths yielded spectra with a certain number of lines of definite length and strength. Alloys were then made to imitate the metal, and photographs of their spectra taken in the same way. The third trial produced an alloy, the spark spectrum of which yielded a photograph identical with that of the coin, a "white" sou of the French revolution of 1798, the composition being found by the usual methods of analysis to be: Lead, 13·93 per cent; copper, 72·35; iron, 0·85; zinc, 12·70. By this novel method of analysis the composition of antique jewelry and coins may easily be determined without injuring them in any degree.