These consist of the so-called diver's suit and the fire mask, with which the fireman is able to make his way into a burning building in spite of steam and smoke, and sometimes to save those who have been given up as lost. The danger of suffocation is greatest where the fire occurs in the cellar, and in such cases even the firemen have to use the utmost caution. The smoke often collects in masses which would extinguish any ordinary light, but the zinc flambeau invented some time ago by Chief Inspector Stritzel works very well under these conditions.

THE TYPE-WRITER A FRENCH INVENTION.

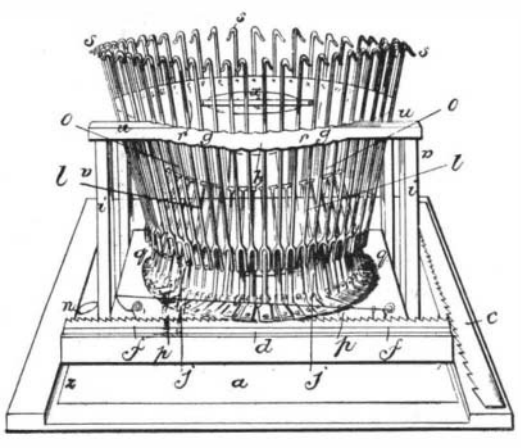
Heretofore the earliest invention of type-writers has been attributed to the English, and the first working machine showing the pot of letter levers striking at a common center was supposed to be of American origin. But the French appear to stand first in this respect. In 1833 a French patent was granted to Mons. Progrin (Xavier), of Marseilles, for a type-writer, which he called a Typographic machine or Pen. It is engraved and described in *Brevets d'Invention*, vol. 37, First Series, plate 36. We give an engraving of the drawings. All of the figures in the original patent drawings are probably not given, but we present all that are published. The description refers to a number of parts not represented in the published drawings, and hence the account of the machine is somewhat obscure. Still enough is given to show that the machine was an operative one, by which type-writing could be well executed.

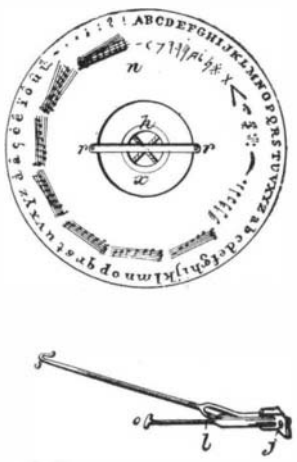
Instead of having the paper rendered movable and the machine stationary, as in the modern style of machines, our French inventor held the paper fast and flat, and moved his machine over the surface of the paper. With this device he not only executed type-writing, but also wrote music and made printing plates. The following is an abstract from the inventor's specification:

This typographic machine or pen serves: 1. To print almost as rapidly as one can write with an ordinary pen. 2. To form stereotype plates for the use of ordinary presses. 3. To copy music or to form stereotype plates of music.

s are metallic levers which rise obliquely around the plate, *n*, and terminate in a fork at their lower end, which takes the shank of the hammer to raise or lower it at will. If one of these levers is pressed, it pushes the shank of the hammer over which its fork passes, causing it to be inclined like the radius of a circle.

When this shank is thus extended on the plate, the hammer remains in a vertical position on the paper, where in falling it has imprinted its figure; the number of levers is equal to that of the double alphabet and the rest of the characters of printing. Each lever corresponds to one of the signs drawn on the plate, *n*, so that, if it is desired to form any letter in the center of the opening, *k*, it is only necessary to find the letter on the plate, *n*, and press lightly on the lever near it, and immediately it will be seen formed on the paper in the center of the opening, *k*, then the plate, *q*, is moved the distance of one notch, a finger is placed on another lever, which is caused to descend and strike its hammer beside the other letter, where it imprints the letter which it carries; thus the same operations are repeated and words and lines of printing are formed. We have explained how it is necessary to push the plate, *q*, one notch for the space of the letter to be printed, and two notches after the letter has been formed to obtain the space for a capital letter or for the distance between two words; as the center of the opening, *k*, must necessarily follow, in a straight line, the movement of the plate, *q*, it should always trace a straight line of printing by means of all the characters which their hammers print successively thereon.





A FRENCH TYPE-WRITER, A. D. 1833.

OPERATION OF THE TYPOGRAPHIC MACHINE OR PEN FOR PRINTING.

After having placed the body of the machine at the entrance of the frame, *b*, so that the center of the plate, *q*, is beyond the upright of this frame, the letter which is to commence the word of the first line is sought on the plate, *n*, and then the lever which corresponds to this letter is pressed lightly with the right hand; this lever, in moving downward, imparts all its movements to its hammer, so that if it moves down, the hammer falls with force in the center of the opening, *k*, and there impresses, on the paper, the letter or sign which it bears; the lever is then promptly raised, and the hammer follows it, to give place to another, which, by the same operation, will impress its letter beside the first one, after care has been taken to push the body of the machine lightly with the left hand, provided that the springs, *f*, pass from one tooth to another of the notched plate, *d*. This movement, as we have said, marks the distance of the small letters, a double movement marks the distance of the capital letters or the space between two words.

When the first line of printing is finished, the strings, *y*, are pulled with the left hand, which removes the springs, *f*, a little from the plate, *d*, allowing the body, *v*, of the machine to slide back easily to the place for commencing a second line; but, in order to mark the distance between this line and the preceding one, the frame, *b*, must be pushed the distance of one notch, which frame supports the body of the machine; by this movement the center of the opening, *k*, is always found at the proper distance from the preceding line.

When a page has been printed, the frame, *b*, is made to slide back to the point indicated for the commencement of another page. This movement is facilitated by drawing lightly on the string, *n'*, which removes the spring, *e*, from the toothed plate, *c*. Each hammer, in moving down to the center of the opening, *k*, strikes against the pad, *h*, and is thus charged with ink. This pad can be removed when it has not sufficient ink. Then, before replacing it, it is rolled on a plate covered with a coating of ink. It is thus charged sufficiently to supply the hammers during the printing of two or three pages.

When the machine is to be used for forming stereotype plates, the hammers and half of their shanks are replaced by others which are considerably thicker; these latter hammers bear, in intaglio, the letters which are in relief on the others; then, in place of paper, you place on the frame, *a*, a plate of soft metal, which is 6 to 8 twelfths of an inch thick; it is cast in a mould which leaves one of its faces marked with furrows between two ridges; the furrows are of a width corresponding with the space between two lines of printing; on the projecting parts or ridges the hammers strike, leaving the imprint of the figures which they bear, in relief. The method of thus forming letters, words and lines in relief is the same as that which we have described for printing; that is, you look, in the same manner, on the plate, *n*, for the letter which you wish to form, and then you press lightly on the corresponding lever; and then the letter is immediately formed in relief on the metal. A stereotype plate can thus be formed very promptly, ready for use on ordinary presses; after it has been used for making the desired number of copies, it is again melted in its mould to be used in forming a new stereotype plate.

In order that the ktypographic machine or pen may be used for forming the signs or figures of music, the hammers with half of their shanks are removed. This half of the shank is replaced by another, longer or shorter. It is then given a hammer bearing, in intaglio or relief, one of the signs of music corresponding to a like sign which is drawn on the plate, *n*, opposite to the lever which holds and causes the movement of the said hammer. This difference in the lengths of the shanks of the hammers permits of forming the rising and descending gamuts, with the difference of notes and signs, without being obliged to push the body, *v*, of the machine up or down, to right or left; for only the same movement is made which is used in printing. When the notes formed on the end of each hammer are in relief, the machine is used for printing or copying music. When the same notes are intaglio, the machine is used for forming stereotype plates of music, by the method indicated for forming stereotype plates for printing.

With a little practice one can write as rapidly with the ktypographic pen as with the ordinary pen. I have called it ktypographic machine or pen because it prints by striking. It will give birth to a new art—that of ktypography. I invented this machine about a year ago.

Luxurious Trains.

The following description of the cars composing the Pullman new trans-continental train is taken from the New York *Sun:* The trains consist of vestibule drawing room and sleeping cars, an observation car, a dining car and a composite smoking car. The vestibule composite car is a magnificent affair, and is exclusively for men. A forward end is set apart for baggage. A compartment between the baggage room and the main saloon is fitted up as a barber shop and a bath room. Adjoining the bath room is a cafe. The rear section of the car is a smoking room. The vestibule sleeping cars, of which there are four on this train, are said by the managers of the Pullman company to be the best examples of their work ever turned out. They each contain twelve sections of two double berths and two drawing rooms. Movable incandescent lights are attached to each section, in order to allow one to lie in a berth and read. In one of these sleeping cars is a bath room for ladies. The dining car, besides containing ten tables, at which forty persons can dine at once, also contains a kitchen large enough to allow four cooks to work at once. An observation car will bring up the rear. The body is an open sitting room, finished in hard wood and furnished with upholstered rattan arm chairs and lounges. Among its conveniences are a writing desk, a large case of selected books, movable tables and an upright piano. But the main feature of the car, and the one which gives it its name, is the deep recess at the end of the car. The platform will accommodate about twenty persons. In the forward portion of this car will be a small office, which will be occupied by a stenographer and type-writer, whose duty it will be to write and mail the letters of any or all of the tourists gratis.

Inventors of Perpetual Motion Machines.

Some of the most ingenious and persistent men are laboring on the hopeless task of devising perpetual motion appliances. Our educational system is in many respects responsible for so much mental energy being wasted upon fallacies. If natural philosophy and elementary mechanics received the attention in common schools that their importance demands, there would be fewer persons pestering their friends to supply funds for the development of apparatus intended to cheat nature's laws. Ignorance of the laws of nature is, no doubt, responsible for the majority of perpetual motion devotees, yet some men who are well educated become pursuers of the chimera. It is frequently difficult to understand the mechanical fallacies that creep over what are otherwise bright intellects. Electricity seems to be deceiving many men and leading them into the belief that by means of this mysterious force more power can be received than what is given. Since the electric lighting and electric transmission of power era began, there has been a great increase in the applications to the Patent Office for protection of what are electrical perpetual motion machines. For years the Patent Office income was considerably augmented annually by the receipt of fees from inventors of perpetual motion machines, but no fees are now accepted from men working on that kind of apparatus. A printed circular is sent to applicants saying that nothing short of a working model would be received, and as the inventor never gets a model of this kind to work, he can do no more with the Patent Office. A correspondent of the St. Louis *Globe-Democrat* gives particulars of some curious recent perpetual motion cases. Mr. Keely has a good many imitators in a small way. A few months ago a New York lawyer went to Washington with parts of a machine, and had quite a controversy with the office because the patent was refused. He insisted that he had seen the machine in operation, that it was running day after day, and keeping a cider press going to boot. There was no deviating from the rule. The lawyer went back to New York, saying that he would produce the machine. He was not seen again until the centennial celebration lately, when he reminded the examiner of the case and told him how he had been fooled. At the time of making application the lawyer really believed that his client had discovered the long-sought principle. But when he got back to New York and told that the patent had been refused, the client confessed. The perpetual motion was no motion at all. Power was concealed in the cider press. It ran the press, and the press made the perpetual motion machine go too. The inventor had been charging 10 cents admission to see perpetual motion. He had fooled the public and his lawyer, and he hoped to slip through a claim.—*National Car and Locomotive Builder.*

The Care of Dynamos.

Place the oil catchers under the drip of the dynamo bearings, and never allow them to overflow on the floor.

Keep the floor of the dynamo room swept clean, so that no nails or other small pieces of metal can be drawn into the armature.

Never use or leave iron or steel tools near the machine, while at work, as these also are likely to be drawn into the armature if left too near it.

Oil cans made of copper or zinc are best for use about electrical apparatus.

Never allow oil to accumulate on the armature or shafts of the dynamo.

When the wires coming out of the shaft to the commutator become bare from cleaning, they should be recovered with kerite or okonite tape, or gum cloth, and shellacked, and allowed to dry for about eight or ten hours before being used.—*Practical Electricity.*

Progress of Our Colored Population.

According to a recent census *Bulletin*, the race count has been made for the South Atlantic and South Central States, and for Missouri and Kansas, in advance of the main work of tabulation. The total population embraced in this count is 23,875,259, of which 16,868,205 were white, 6,996,166 colored, and 10,888 Chinese, Japanese, and Indians. In these States were found in 1890 fifteen-sixteenths of the entire colored population of the United States, so that for the purpose of immediately ascertaining the percentage of increase, the returns of these States are adequate and not likely to be materially affected by the returns of the other States and Territories, where the colored population is small.

The popular belief that the negroes were increasing at a much greater rate than the white population is erroneous.

During the past decade the colored race has not held its own against the white in a region where the climate and conditions are, of all those which the country affords, the best suited to its development. We give a table which shows the relative increase:

States.	Total population.	White.	Colored.	Per cent. 1890.	
	23,875,259	16,868,205	6,996,166	White.	Colored.
Alabama	1,513,017	830,796	681,431	54·91	45·04
Arkansas	1,128,179	816,517	311,227	72·37	27 59
Delaware	168,493	139,429	29,022	82·75	17·22
District of Columbia	230.392	154,352	75,927	66·99	32·96
Florida	391,422	224,461	166.678	57·35	42·58
Georgia	1.837,353	973,462	863,716	52·98	47·01
Kansas	1,427,096	1,374,882	51,251	96·34	3·59
Kentucky	1,858,635	1.585,526	272,981	85·30	14·69
Louisiana	1,118,587	554,712	562,893	49·59	50·32
Maryland	1,042,390	824,149	218.004	79·06	20·92
Mississippi	1,289,600	539,703	747,720	41·85	57·98
Missouri	2,679,184	2.524,468	154,131	94·23	5·75
North Carolina	1 617,947	1,049,191	567,170	64·85	35·05
South Carolina	1,151.149	458,454	692,503	39·82	60·16
Tennessee	1,767.518	1,332,971	434,300	75·42	24·57
Texas	2,235,523	1,741,190	492,837	77·89	22·04
Virginia	1,655.980	1,014,680	640,867	61·27	38·70
West Virginia	762,794	729,262	33,508	95·61	4·39

Modification of the German Patent Law.

An amendment of the patent law of 1877 has been recently passed by the Reichstag, after having been read three times, and will come into force on the 1st of October next. The chief point to be noticed in the new law is that the examination of patents with regard to novelty is not to be abolished. The new law does not decide what amount of invention is patentable, so that this question must be settled in each case by the Patent Office as heretofore. Publication, if made more than a hundred years ago, is not to act in anticipation of a patent. Patents taken out in foreign countries are to act in anticipation against the inventor, and those claiming rights under him, only after a lapse of three months, and thus an extended period of time is allowed by the act for an application for a patent in Germany. If an invention is stolen from another person, and an application for a patent has been made, the inventor is able not only to oppose the granting of a patent to the applicant, but to obtain a patent for his own application. The patent fees may be paid for the whole duration of a patent in advance, so that the lapse of a patent through delay in the payment of fees may be rendered impossible. If a patent on which the full fees have been paid should be afterward annuled, the fees will be returned to the patentee. An application for the annuling of a patent shall not be made when the patent has been in existence more than five years. For the determination of this point, however, a period of three years is provided. The very high fees now payable for a German patent have not been diminished by the new act, but it is provided that such a lowering of the fees may be made by order of Federal Council. The important provision that a patent may be revoked after the expiration of three years if the patentee fails to carry out his invention in Germany to a suitable extent, or at least to do everything that he can to carry it out, remains in force, and should be particularly noticed by foreigners. The organization of the Patent Office is to be so regulated by the new act that there may be greater security for a proper and efficient examination of patents. Before an application is refused, the applicant is to have an opportunity of answering objections to the granting of a patent. If he should fail to obtain a patent, he may then support his claim by oral evidence. At the preliminary examination expert witnesses may be called, and a statement of the various attempts which the inventor had made may be presented. If the decision of a judge puts a new aspect on the case, the applicant is to have an opportunity of answering any objection raised. A proviso which is of great importance to chemical industries is that where proceedings are taken to patent a new material, every material of similar manufacture is regarded as included in the claim until proof to the contrary is shown. The damages payable for the infringement of a patent have been increased. The Patent Office, Berlin, was established at its new building in April last. This new office is in every respect suitable for its purpose, whereas the old one was too small. The public obtain a great advantage from the new arrangement, since the important technical library is now open to all persons from 9 A. M. to 9 P. M.

IRIDESCENT GLASS.

BY GEO. M. HOPKINS.

A visitor at the Metropolitan Museum of Art in this city cannot fail to notice in his tour of the galleries the exquisite ancient Cyprian glass ware, with its gorgeous iridescence surpassing in brilliancy of color anything ever produced by artificial means. So far as is at present known, this effect can be produced only by the corrosive action of the air and moisture of the soil in which these objects have been buried for centuries.

Glass having a similar appearance, but without the same brilliancy of color, has been found elsewhere, and a certain degree of iridescence has been imparted to glass of modern manufacture by flashing it during the annealing process with stannous chloride, thus depositing on the glass an exceedingly thin film, which decomposes the light and thus yields a pleasing color effect. Glassware of this kind is beautiful, and was at one time much in demand, but at present it can hardly be found on sale.

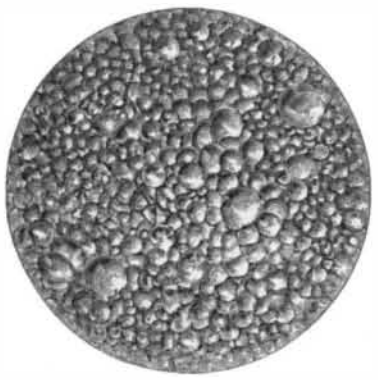


Fig. 1.—IRIDESCENT FILM—MAGNIFIED.

Through the courtesy of General L. P. Di Cesnola, director of the Metropolitan Museum of Art, the writer has been enabled to examine specimens of ancient Cyprian glass secured by him in his archæological explorations in Cyprus.

A microscopical examination of this glass shows that the surface is covered with exceedingly thin transparent films formed by matter dissolved from the glass. The body of the glass is pitted over its entire surface with minute cavities, which are circular or elliptical or oblong in outline, and either spherical, ellipsoidal, or cylindrical in respect to their concavity, and the films conform to the pitted surface of the glass. These films, of which there are many superposed, are so thin as to float in air like down when detached. They decompose the light by interference due to reflections from the front and rear surfaces of the film, and give rise to the gorgeous play of color for which these ancient specimens of glass are noted.

The appearance of the film from this glass when highly magnified is illustrated in Fig. 1. The color effect is, of course, wanting. By transmitted light the color is complementary to that shown by reflected light. Examined by polarized light, the color is heightened still more with all the changes that may be brought about by rotating the polarizer, analyzer, or the object itself. The figure under polarized light without the color is shown in Fig. 2.

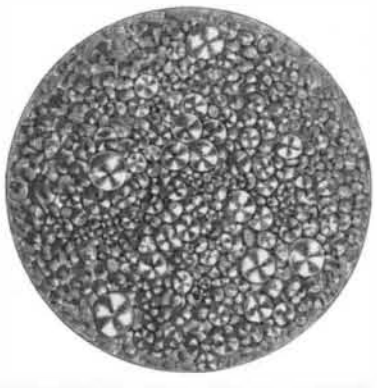


Fig. 2.—IRIDESCENT FILM—BY POLARIZED LIGHT.

If the effects secured by long ages of treatment in Nature's laboratory could be produced artificially on modern glass at a reasonable cost, it would seem to be an object well worth striving for.

Lumbering in California.

The Madera Flume and Trading Company started up its mountain saw mills recently. The roads are now being cleared and timber got out. It is expected that the output for the season will exceed 17,000,000 feet.

This company has a V-shaped flume sixty-two miles long, extending from the mountains to the plain. The lumber is not shipped down this flume piece by piece, but several planks are clamped together at the end, and then a train is formed from several piles and connected by small ropes. Section stations, where from two to four men are found, are located about every six miles. It is their duty to see that there are no stoppages or breakages, jams and so on. The lumber is shipped from the mountain mills during the day, and reaches the yards at Madera at night, being twelve hours in transit. The expense of this mode of transportation is much cheaper than any other that has been devised for that purpose. As high as 20,000 feet have been shipped in one day. The two saw mills are known as the California and Soquel mills, and combined have a sawing capacity of 150,000 feet per day. This work has been facilitated greatly by the construction of a narrow gauge railroad from the mill to the vicinity of the logging camps, and the logs are now hauled by a large engine, on cars made expressly for that purpose, thus doing away with many teams. At the yard located in Madera the lumber is taken from the flume and piled up to dry for the market. This yard covers a large area of ground, and millions of feet of lumber are stored there annually. A large planing mill is also operated there.

The expenses of the mill at Madera and at the mountain mills aggregate $15,000 per month during the logging season. Jack Dysdale is general superintendent of the mountain mills.—*Pacific Lumberman.*

Genesis of the Elements.

Professor William Crookes closes a most interesting address before the Institution of Electrical Engineers on the subject "Electricity in Transitu; from Plenum to Vacuum," with the following remarks on the genesis of the elements:

It is now generally acknowledged that there are several ranks in the elemental hierarchy, and that besides the well defined groups of chemical elements, there are underlying sub-groups. To these sub-groups has been given the name of "meta-elements." The original genesis of atoms assumes the action of two forms of energy working in time and space—one operating uniformly in accordance with a continuous fall of temperature, and the other having periodic cycles of ebb and swell, and intimately connected with the energy of electricity. The center of this creative force in its journey through space scattered seeds, or subatoms, that ultimately coalesced into the groupings known as chemical elements. At this genetic stage, the new-born particles vibrating in all directions and with all velocities, the faster-moving ones would still overtake the laggards, the slower would obstruct the quicker, and we should have groups formed in different parts of space. The constituents of each group whose form of energy governing atomic weight was not in accord with the mean rate of the bulk of the components of that group, would work to the outside and be thrown off to find other groups with which they were more in harmony. In time a condition of stability would be established, and we should have our present series of chemical elements, each with a definite atomic weight—definite on account of its being the average weight of an enormous number of subatoms, or meta-elements, each very near to the mean. The atomic weight of mercury, for instance, is called 200, but the atom of mercury as we know it is assumed to be made up of an enormous number of subatoms, each of which may vary slightly round the mean number 200 as a center.

We are sometimes asked why, if the elements have been evolved, we never see one of them transformed or in process of transformation into another. The question is as futile as the cavil that in the organic world we never see a horse metamorphosed into a cow. Before copper, *e. g.*, can be transmuted into gold it would have to be carried back to a simpler and more primitive state of matter, and then, so to speak, shunted on to the track which leads to gold.

This atomic scheme postulates a to and fro motion of a form of energy governing the electrical state of the atom. It is found that those elements generated as they approach the central position are electro-positive, and those on the retreat from this position are electro-negative. Moreover, the degree of positiveness or negativeness depends on the distance of the element from the central line; hence, calling the atom in the mean position electrically neutral, those subatoms which are on one side of the mean will be charged with positive electricity, and those on the other side of the mean position will be charged with negative electricity, the whole atom being neutral.

This is not a mere hypothesis, but may take the rank of a theory. It has been experimentally verified as far as possible with so baffling an enigma. Long-continued research in the laboratory has shown that in matter which has responded to every test of an element there are minute shades of difference which have admitted of selection and resolution into meta-elements, having exactly the properties required by theory. The earth yttria, which has been of such value in these electrical researches as a test of negatively excited atoms, is of no less interest in chemistry, having been the first body in which the existence of this sub-group of meta-elements was demonstrated.