unite with the alkali. Even in the case of hydrocarbons, such as paraffine spirit, containing only hydrogen and carbon, the alkali combined with the hydrogen, setting free the carbon. Now, as we know, diamond is pure carbon; hence, when this element was set free from a pure substance, it was thought that conditions of pressure and temperature might eliminate it in the hard, crystalline, adamantine form, namely, as diamond. Glass tubes were first employed, but, although of great thickness in comparison with their bore, they were found to be insufficiently strong, and they were replaced by wrought iron tubes twenty inches long by one inch diameter, and having the diameter of the bore half an inch. In these lithium was heated for many hours to a high temperature in paraffine spirits, and on subsequently opening the tube carbon in a hard form was found within it. Great difficulty was experienced in getting the tubes perfectly airtight, and eventually the open end was welded at a white heat, and by that means alone did it resist leakage. Sometimes tubes would burst with an explosion like a gun. A tube twenty inches long by two and three quarters diameter and one half inch bore was filled with a hydrocarbon made from bone oil, to which some charcoal powder was added in order to keep an excess of carbon in the tube. Its open end was welded, and it was heated for fourteen hours with lithium. On opening it a quantity of gas appeared and some minute pieces of hard carbon which had evidently separated out from solution. Another similar tube burst at the end of eight hours' heating. A tube of cast iron, no less than three and three quarter inches diameter, and with a bore of only three quarters of an inch, exploded at the end of an hour with a fearful report, wrecking the furnace. Several tubes of steel also burst under the enormous pressure, at last shattering the top of the furnace. The author remarks that in nature the temperature must at one time have been much higher than anything we can now produce artificially; while the pressure obtained at a depth of two hundred miles below the earth's surface is greater than that which any of the materials from which we can form vessels can resist.

We come now to the great experiment which resulted in the artificial production of veritable diamonds. A tube twenty inches long by four inches diameter, of coiled Low-moor iron, was bored so as to have an internal diameter of half an inch. Thus the central bore was surrounded by walls of iron one and three quarter inches thick, and, of course, capable of resisting an enormous pressure. In the tube was placed a mixture of ninety per cent of bone oil and ten per cent of paraffine spirit, together with four grammes (about sixty-two grains) of the metal lithium. The open end of the tube was welded airtight and the whole was then heated to redness for fourteen hours, and allowed to cool slowly. On opening it a great volume of gas rushed from the tube, and within was found a hard, smooth mass adhering to the sides of the tube. "It was quite black, and was removed with a chisel, and as it appeared to be composed principally of iron and lithium, it was laid aside for analysis. I was pulverizing it in a mortar, when I felt that some parts of the material were extremely hard—not resisting a blow, but hard otherwise. On looking closer I saw that these were most transparent pieces embedded in the hard matrix, and on triturating them I obtained some free from the black matter. They turned out to be crystalline carbon, exactly like diamond."

Such is Mr. Hannay's account of his discovery. Subsequent chemical and optical analysis has proved that these hard shining crystals are, in every respect, true diamonds. The cost is obviously great; so, also, is the danger to life and property; and the great difficulties to be overcome render disappointments common. What we now want is to get vessels of a material sufficiently strong and non-porous to resist the high pressures and temperatures upon which the success of the experiment depends. What we have learned, among other things, from the brilliant researches of MM. Cailletet and Pictet, which led to the liquefaction of the so-called permanent gases, and from Mr. Hannay's experiments, described above, is, that we must push the forces of nature to their utmost strain by using our most powerful mechanical devices for producing pressure, our strongest materials for resisting it, and our intensest means of producing both heat and cold.

The High Buildings of the World.

The crown of the hat of the statue of William Penn, which is to surmount the tower of the new public buildings of Philadelphia, will be just 535 feet above the pavement. This is 10 feet 1 inch higher than the highest towers of the Cologne Cathedral as they now stand. The Penn Square tower, however, will ultimately be overtopped by the Cologne towers 41 feet 9 inches, their intended height being 576 feet 9 inches. The heights of the other chief lofty buildings of the world are given as follows:

Tower of St. Nicholas' Church, at Hamburg, 473 feet 1 inch; cupola of St. Peter's, Rome, 469 feet 2 inches; cathedral spire at Strassburg, 465 feet 11 inches; pyramid of Cheops, 449 feet 5 inches; tower of St. Stephen's, Vienna, 443 feet 10 inches; tower of St. Martin's, Landshut, 434 feet 8 inches; cathedral spire at Freiburg, 410 feet 1 inch; cathedral of Antwerp, 404 feet 10 inches; cathedral of Florence, 390 feet 5 inches; St. Paul's, London, 365 feet 1 inch; ridge tiles of Cologne Cathedral, 360 feet 3 inches; cathedral tower at Magdeburg, 339 feet 11 inches; tower of the new Votive church, at Vienna, 314 feet 11 inches; tower of the Rath-haus, at Berlin, 288 feet 8 inches; Trinity Church, New York city, 284 feet; and the towers of Notre Dame, at Paris, 232 feet, 11 inches.

AMERICAN INDUSTRIES.—No. 52.

WINE MAKING.

To have styled this branch of business an *American* industry a few years since would have provoked a smile. Now, however, it is becoming generally understood that the productions of American vineyards are affording the means by which the home demand may be supplied, and that in some cases American wines have won an enviable distinction in comparison with those of the most noted wine-producing countries of the world. The long established prejudices in favor of wines which have a foreign trade mark and an unreadable label are not, it is true, entirely removed; it will probably be many years before it will cease to be "fashionable" to give undue credit to wines that are imported, simply because they *are* imported; but the good work in this direction which has been already accomplished by the Urbana Wine Company, of Hammondsport, N. Y., gives promise of a future development of wine making in this country that cannot fail to make the business one of considerable importance among our industries. In foreign wines adulterations, often injurious to health, are so common that it is difficult to obtain a pure article, and many, among those who are not connoisseurs, have never had an opportunity to taste a pure wine. For this reason, more than any other, the establishment of the wine making industry here, in such way that all may assure themselves of the absolute purity of the wine they buy, becomes a matter of particular moment, and the engravings we give on the first page of this paper, illustrative of the location and works of the Urbana Wine Company, will undoubtedly attract the attention which a subject of such direct interest to almost every one deserves.

The first requisite in the making of a superior wine is to have the best quality and fine varieties of rich, ripe grapes. These are not grown to any great extent anywhere in the world except between the 35th and 55th degrees of north latitude. In climates more northerly the grape seldom arrives at full maturity, and the wines are weak, liable to sour, and destitute of the generous flavor which characterizes those produced from grapes grown further south; if we go further south than the 35th degree, however, there is too decided a predominance of the saccharine matter, and a perfect vinous fermentation cannot be effected. The location of the vineyards of the Urbana Wine Company, on the shores of Lake Keuka, or Crooked Lake, Steuben County, N. Y., combines all the advantages of the finest grape-growing regions of the world. The soil is a gravel on calcareous rock; the ground is undulating and even precipitous, with a general southeast exposure toward the lake, which tempers the summer breezes and gives that atmospheric equability best calculated to insure the perfect ripening of the grape. The location has been styled the Rheims of America, and has been famous for its grape production for many years, though it was not until about 1860 that this was made a regular business. Now, however, the vineyards here cover some ten thousand acres, in the heart of which, and immediately on the banks of the lake, affording ready means of cheap transportation, are the works of the Urbana Wine Company.

The principal varieties of grapes cultivated are the Catawba, Isabella, Delaware, Iona, Walter, and Concord, and it is the proper selection and combining of the fermented juices of these grapes, under conditions which are carefully regulated, that makes the various still and sparkling wines for which the company have obtained so wide a reputation. They use absolutely nothing else but these grapes, except the necessary quantity of pure sugar, so that they make no bogus or carbonized wines, the gas in the champagne being a natural product of fermentation in the bottle, and not an artificial gas injected in the wine by a machine, as is the case with some of the wines now made.

Referring to our engraving, the main building of the company's works is a very substantial stone structure, 150 feet long by 60 feet wide, with wings extending on either side, the ground floor of the whole being entirely taken up by capacious vaults, the walls of which are so thick and solid that the temperature there in summer weather never rises above 60°. The grapes, as they are brought in, principally by steamers, sloops, and flatboats from the vineyards on the lake, are first taken to the third story or top floor of the establishment, where they are carefully assorted, and all imperfect or decayed fruit removed. They are then run through mills especially designed for breaking the skins without crushing the seed, and it is the juice derived from this first operation from which the highest quality of champagne is made. From here the grapes go to the press room, an illustration of which may be seen in one of our views. There are several large presses here, where two or three workmen, with powerful leverage, subject the grapes to sufficient pressure to thoroughly extract all the juice, which is conveyed through rubber hose to large casks below, where the first fermentation takes place. For a perfect vinous fermentation the temperature has to be carefully regulated. Below fifty degrees it proceeds very slowly, and above seventy degrees it would be too rapid, with danger of passing into the acetous stage. As the fermentation proceeds the temperature of the liquor rises, it has a turbid appearance, and gives off carbonic acid gas. At length this commotion gradually diminishes, and the liquor recovers its transparency, when it is found to have exchanged its sweet taste for one of considerable pungency, and to have acquired the property of acting as a powerful stimulant on the animal system. After this first fermentation the wine is racked off into other and clean casks to remove from it all sediment or impurities, and it is now in the proper condition to combine in various ways the product of different kinds of grapes for making still wines, or for the subsequent processes necessary to make champagne.

In the selecting of the different grape products which will so blend as to give the best effects as regards spirit, flavor, acidity, etc., both in champagne and still wines, great care and experience are necessary. The proper combination being decided upon, the wine is bottled accordingly, as shown in the "bottling" room. This is done by the aid of an automatic bottle filler, the corks being held by a metallic fastening styled an agraff, always used in first corking, and the filled bottles are then piled up to await the second fermentation. The department in which this takes place should be kept at an even temperature, and for this purpose it is fitted up with steam pipes. The air being of the required warmth causes a second fermentation in the bottle, and this produces the carbonic acid gas which makes the sparkle; absolutely nothing else but this natural product of the grape being used to make the life and effervescence of the wines of the Urbana Company. As the process approaches completion it is marked by the frequent breakage of bottles, which are burst by the gas produced in them by the fermentation, about 5 per cent of all the wine made being lost in this way. In France and other wine-producing countries the natural heat of the atmosphere is depended upon to effect the fermentation, so that when the weather is exceptionally cool during the wine-making months the operation proceeds in a very tardy and uncertain way, while here it goes on as regularly as clockwork, and the results can be definitely calculated upon, although there is no difference in principle between the methods followed by this company and those in use by the best French wine manufacturers.

When the second fermentation has been completed the bottles are lowered into cool vaults, where they are allowed to quietly rest and mature for two years. When wanted for use the bottles are placed on sediment racks, necks downward, workmen passing through and shaking them gently twice a day for three or four weeks. In this way any sediment which has been produced by the fermentation is gradually worked down on the cork in the neck of the bottle. From here the bottles go to the finishing room, which is shown in the large view at the bottom of the page. Here the cork is removed by an expert, and as it flies out carries with it a small quantity of champagne and the sediment which had settled there. It is then passed to a "doser," who, with a small machine, injects a sirup made of white sugar candy dissolved in champagne. The quantity so injected is very small, but care is taken that the contents of each bottle shall be exactly the same. The bottle next goes to the corker, who, with the aid of a machine, closes it with a large cork, after which come the tying and wiring, all of the operations, however, being conducted in much less time than it takes to describe them. The bottle is now well shaken, to mix the sirup thoroughly with the wine, and then comes the labeling, putting on the foil, wrapping, packing, etc.

In the manufacture of sweet and dry Catawba, port, etc., particular care is taken in all the processes and in putting up the wine to make an article which will keep in every climate. The Catawba is a heavy, fine-flavored wine, and to a large extent takes the place of imported hocks. The port wine made by the company is from several varieties of grapes fermented on the skins, which gives it a heavy dark color. One of our sketches gives a view of one of the large vaults, where, in immense casks of about 3,000 gallons capacity each, the still wines are kept until they have been properly matured and mellowed.

The vaults and building of the Urbana Wine Company, originally the largest in this country, were last summer greatly increased, giving to the establishment quite double its former capacity. The entire new vaults, under the new stone south wing, are 80x40, with artificial ice houses behind the lower walls, capable of reducing the temperature if desired. These are wholly devoted to champagne manuture. The fermentation room above them is 80x40, fitted with steam boiler and works, controlling the temperature at any desired point, and is claimed to be the most complete fermenting room in any wine-making establishment in America. The storage capacity for wine was also nearly doubled by the addition of casks. Above this are the new finishing rooms, and on the floor above the store and rooms where grapes are received. These buildings are made of solid stone, with walls of great thickness. The crop last fall was exceptionally prolific and very superior in quality, and the company decided to put in a very large stock. More than twice the amount of grapes ever before purchased were crushed last autumn by this company.

At the late Paris Exhibition the "Gold Seal" and "Gold Seal Extra Dry" champagnes of the Urbana Wine Company were exhibited in direct comparison with the best champagnes of France. This was the first time there had been a real comparison between the champagnes of the different countries, and as a result these wines were awarded a medal. At our Centennial in 1876 the "Gold Seal" and "Gold Seal Extra Dry" were awarded the highest honors, obtaining two medals and two diplomas.

The officers of the company are: D. M. Hildreth, President; Clark Bell, Vice-President; H. H. Cook, Treasurer; and A. Smedberg, Secretary. A. J. Switzer, Hammondsport, N. Y., is the General Superintendent.

Hints for Preserving Fruits.

A useful hint to cooks was given at a recent sanitary convention in Grand Rapids, Michigan. It was pointed out that by adding sugar to sour fruits, during the cooking process, the greater part of the cane sugar was converted by the aid of the acid into grape sugar, which does not possess half the sweetening power. By cooking the fruit first, and then adding the sugar to an agreeable sweetness, a very great deal of sugar might be saved.

Raspberry, strawberry, and cherry sirups of the German Pharmacopœia have to be made by bruising the fruit and letting the marc and juice ferment, after which the juice is strained off and filtered. A better and safer way is to add at once to the freshly bruised fruits five to six per cent of alcohol, to let the whole stand for some days, decant and filter. Lastly, boil up once to remove the greater part of the alcohol. Sirups made with juice prepared as above retain in a remarkable degree the odor and taste of the fresh fruits.

NOVEL FRUIT GATHERER.

The annexed engraving shows a convenient implement for gathering apples, pears, peaches, and other fruit without bruising it. The cup that receives the fruit is movable on the upper end of the rod, and is provided with a forked hook which grasps the stem of the fruit. A cover is hinged to the cup and connected with the rod, so that when the cup is pulled downward in the act of fruit picking, the cover closes and guides the fruit, so that it falls into a rubber tube connected with the lower part of the cup. After the fruit stem has been removed, the spring on the rod returns the parts to their former position.

Jarman's Fruit Gatherer.

This fruit gatherer was recently patented by Mr. J. N. Jarman, of Peacher's Mills, Tenn.

Sapphires in Siam.

Five years ago a native hunter in Siam found sapphires in a remote and secluded district. Some men who were let into the secret followed him to the mines and brought back to Rangoon and Calcutta a number of very valuable stones. A rush ensued from British Burmah, thousands of adventurers flocking to the mines, some to find sudden fortune, but more to lose their lives from privation and jungle fever.

The mines occur in the provinces of Battambong and Chantaboon. In his commercial report for 1879 the British consul at Bangkok says that the miners are very careful to conceal their gems while in Siam. Being anxious to show some of the gems to Admiral Coote, the consul called for specimens from some miners who had just returned from the diggings. One miner, a poorly clad and miserable looking fellow, produced a few small stones, and after a great deal of coaxing was induced, with many precautions, to give a private view of his great prize, which was a very large sapphire in the rough, valued at $10,000. He would probably not have shown this stone at all had he not been on the point of leaving in a steamer. Owing to the secrecy thus observed by the possessors of valuable gems, it is impossible to give any estimate of the total value of stones found, but that individuals have made very large profits is certain. One man dug out a stone which he offered for sale in Chantaboon at $500, but did not find a purchaser. He went with it to Rangoon, where he was offered $7,500; but, having awoke to the value of the stone, he declined to sell and took it to Calcutta, where he eventually obtained $15,000 for it. Now, however, there are many experienced gem merchants established in the neighborhood of the mines, and something like the real value of the stones can be obtained by the miners on the spot. The largest sapphire hitherto found, so far as the consul knows, weighed 370 carats in the rough, and when cut turned out 111 carats of the finest water. The ruby, onyx, and jade are also found in the district, but the quality of none of these is such as to make them very valuable.

Pyrethrum for Grain Weevils.

Adjacent to my office is a warehouse filled with wheat. This spring the grain weevils therein commenced to migrate, and infested my premises. We therefore sprinkled some buhach, or insect powder, over the grain, and swept the weevils up literally by the quart. Those which emigrated to my office were also treated with a sprinkling, and it cut short their earthly career. . . .

I am convinced that a judicious use of this powder on board each grain ship would save an immense amount of loss. I have seen it used in one of the largest mills in the State, and it brought cockroaches out in quantities which astonished even the miller, who little thought he had so many on his premises. A clergyman, a friend of mine, who cannot sleep if a mosquito is within a mile of him, tells me he has only to put a little powder on some burning paper in his room, and there is "perfect peace."—*A. T. Elliott, in American Entomologist.*

Bogus Sugar.

The manufacture and great profits which the makers of glucose are now realizing are described in the following testimony lately given by one of the original producers, in a law suit at Buffalo, N. Y. It would appear from the evidence that the public rather prefers to be cheated, and will pay more for sugar that is not sweet than for the genuine article.

Mr. Horace Williams testified as follows:

"The manufacture of grape sugar from corn was commenced originally by witness and his partner. He invented some of the machinery by which the process was brought to perfection. He obtained patents in order to keep his process a secret. Their firm name was then A. W. Fox & Co. They commenced with two or three hundred bushels a day, and increased this amount gradually to two thousand. This was the amount in 1874. The Buffalo Grape Sugar Company was then organized. There were 200 shares, of which Fox owned 102; witness owned 60 shares, and the balance was held by William Hamlin. Improvements have since been made in the machinery, by which a better article of sugar is made and with greater facility. They first produced crude sugar—used in the manufacture of ale and lager beer, principally ale. The sugar was used in place of malt. At a later date they refined the sugar. Grape sugar also was used, in 1874, by tobacconists. As its quality was improved it was used in other branches of business. A large quantity is now used in making sirups for table use. Witness knew there was very little pure cane sirup sold now. The grape-sugar sirup is more wholesome and delicious. Glucose and grape sugar are one and the same thing—glucose being the sugar in a liquid form. When it is called grape sugar it is in a solid form. This is being used considerably in New York in making sugar, making what is called improved sugar. Witness understood that the Buffalo Grape Sugar Company was interested in this mixing of sugars in New York. At the present time the demand for grape sugar exceeds the supply, and the price of it has increased. In 1874 thirty pounds of sugar were made from one bushel or fifty-six pounds of corn. The price was then from 3½ to 4, and sometimes 4½ cents a pound. The refuse is sold for feed, and the price of it was from seven to eight cents a bushel. In mixing sugar the grape sugar is pulverized, and about twenty-five per cent. added to cane sugar. It improves the color of the sugar, and enables dealers to sell it for a better price.

During 1874 and 1875 the earnings were about $15,000 a month, and in 1876 they averaged from $19,000 to $20,000. In 1877 the earnings for one month were $35,000. Witness did not see many of the statements during 1878. A starch factory was run in connection with the sugar works, about 500 bushels of corn being used in a day. Witness did not know much about the earnings of the starch factory. He was aware that the business was profitable. He understood all of the processes of the establishment, and had charge of the manufacturing of the sugar, glucose, etc. He made estimates from time to time of the cost of turning a bushel of corn into sugar, and in doing so took into consideration the outlays, cost of machinery, building, etc. He estimated it to be about 25 cents a bushel, and the net profit of a bushel of corn, at 45 cents a bushel, when turned into sugar, to be 70 cents. A number of small manufactories have sprung up in this country, but there are only four or five of any account. The amount of corn consumed in 1879 was from 4,000 to 6,000 bushels a day. In some respects it costs less per bushel to run a large amount of corn than it would to consume a small quantity. The net profit per bushel from 1874 to 1879 was from 40 to 50 cents.

Composite Diamonds.

A diamond expert of Chicago asserts that many of the so-called solitaires, sold as single stones, are made up of small stones cleverly put together. Under the blowpipe they separate. He adds the surprising statement that not one diamond in ten sold in this country is other than the refuse of the London market. Nearly all are off-colored, specked, or feathered, and are sold at a fictitious value.

Mr. Whymper among the Andes.

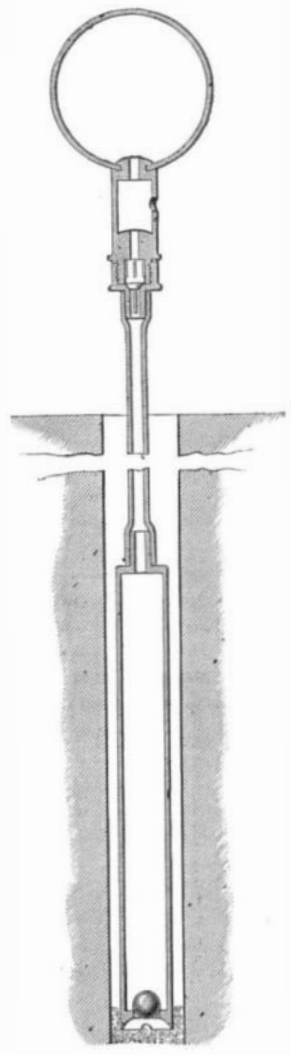
Mr. Whymper, the English mountain climber and artist, writes to a friend in London that, during a forty-one days' excursion north of Quito, the most of the time was spent in tents at altitudes varying from 10,000 to 14,500 feet. Seven days were passed without any shelter whatever. The objects of the trip were the exploration and ascents of Cayambe, Saraurcu, and Cotocachi, and the collection of Inca antiquities. He was accompanied by the two Carrels, the well known Swiss guides. They were entirely successful, though at a somewhat severe cost, being drenched every day and much reduced by exposure and diarrhea. On Saraurcu it rained on one occasion for seventy hours without ceasing for a minute, and for more than six days and a half out of seven consecutive ones. He found Cayambe to have a height of 19,200 feet, Saraurcu 15,600, and Cotocachi 16,200 feet. The ascent of the highest mountain gave least trouble, and the lowest one gave most. He waited for fourteen days before he could see it, as it is almost perpetually enveloped in mist.

The Best Vehicle.

An anecdote is told of a physician who was called to a foreign family to prescribe for a case of incipient consumption. He gave them a prescription for pills, and wrote the direction: "One pill to be taken three times a day, in any convenient vehicle." The family looked in the dictionary to get at the meaning of the prescription. They got on well until they got to the word vehicle. They found "cart, wagon, carriage, buggy, wheelbarrow." After grave consideration they came to the conclusion that the doctor meant the patient should ride out, and while in the vehicle he should take the pill. He followed the advice to the letter, and in a few weeks the fresh air and exercise secured the advantage which otherwise might not have come.

PNEUMATIC DRILL-HOLE CLEANER.

A simple device for removing drillings from drill holes is shown in the accompanying engraving. A tube having a ball valve at its lower end is connected at its upper end by a flexible tube with a hollow rubber ball, having a metallic neck containing a check valve, and having a small air hole in one side to be closed by the finger. The tube is inserted in the hole to be cleared of drillings; the rubber ball is compressed, and the air hole is closed by the finger. The ball being released, a partial vacuum is formed, and the external air pressure forces the drillings into the tube. The operation may be repeated several times before removing the tube, if necessary. The tube is emptied of drillings by pushing up the ball valve. This invention has been patented by Mr. J. L. Prentiss, of Cañon City, Col.



Drill Hole Cleaner.

Operations at Flood Rock.

In the government operations for the removal of Flood Rock, Hell Gate, East River, about one hundred and thirty men, in three sets, who relieve each other every eight hours, night and day, six days a week, and the work of making the East River practicable to ships of the largest class, is progressing rapidly. The area of rock to be undermined and blown away is between five and six acres, in addition to about three acres that have already been mined and made ready for the great explosion that is to give New York from twenty-six to thirty-two feet of water at low tide from Blackwell's Island into the Sound. The width of the channel at Flood Rock now is 600 feet; after the rock has been blown away it will be 1,200. It is believed that the velocity of the tide at Hell Gate will be decreased by the destruction of Flood Rock.

A Clever Trick.

The *Japan Mail* describes a clever trick which was being exhibited by a native juggler at Joshida-bashi. The performance takes place in a small room about twenty-six feet long by twelve feet wide, half being allotted to the spectators, who are admitted on payment of the moderate fee of two cents. The "properties" consist of a deal table and a sword, etc. After the usual soul-stirring flourish on a drum and samisen, a man and woman appear from behind a screen, the man binds the woman's head in a cloth, and she then kneels down close to the table, and sideways to the spectators. The man then draws the sword, makes a violent blow at the woman's head, she falls forward, arms extended and limbs twitching. He then, having first wiped the sword on a gory-looking piece of rag, takes up (apparently) the woman's head, wrapped in the cloth, and places it on the table. To all appearance it is a human head, the eyelids and features have a convulsive motion; presently the eyes open in a dreamy sort of way, and, to the accompaniment of the everlasting samisen, the head sings a mournful song. A curtain is interposed between the audience and the performers, and when again drawn back the woman is disclosed quietly seated alongside the man. When it is recollected that this all takes place within about three feet from the spectator, and that the "properties" are of the simplest description, some idea may be formed of the wonderful excellence of a performance which has excited attention.