may be used; and in this way, all the colors derived from tar may be manufactured into pigments. Thus the color is dissolved in any of the known solvents, and then mixed in water both with vegetable or animal soaps, dissolved in the hot or cold state, and the colors precipitated by alumina, previously precipitated from alum, or sulphate of barytes, or any kind of salt or metallic or earthy oxide. By these means, and especially by the assistance of an animal matter in a soapy state, the colors are rendered solid and durable, and are applicable for painting. A fine yellow cake or product is obtained by employing picric acid in combination with an earthy compound and the picrates in general, particularly the picrate of lead. These aniline colors are mixed with animal or vegetable soaps for making the colors soluble in water. When the blue and yellow products are combined, a fine green is obtained, and the mixture of red and yellow produces an orange color; and, by the mixture of the different colors, all varieties of tints can be procured. The richness of these colors is unequalled; and, as they maintain their tints when exposed to light, they are invaluable in the arts.

[A gramme is equal to 15 44 English grains; and a decigramme 5 65 dr. avoirdupois.

SCIENTIFIC INFORMATION--BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

In a recent issue we gave some condensed extracts from the opening address of the Chairman of this Association—Sir William Armstrong—and now present condensed abstracts of practical papers read by the members. We have done this every year, because many of the papers read are of a very useful character; there being a large number of mechanics and engineers members of the Association.

Gun Cotton.—Dr. Gladstone, member of a committee appointed to investigate this subject, read a paper relating to the chemistry of gun cotton. He stated that the Austrian gun cotton exhibited a marked degree of superiority over all other kinds. Among its advantages were, that it did not become ignited till it was raised to a temperature of 136° centigrade, that a gun was less injured by repeated discharges from it by gun cotton than by gunpowder, that gun cotton was not injured by damp like gunpowder, that no smoke arose from the explosion of the gun cotton, and that there was no residuum left in the gun to be got rid of before another charge could be introduced.

Mr. J. Scott Russell read a report on gun cotton from the mechanical section. He stated that the committee found it difficult to believe that greater mechanical effect could be produced by gases generated from gunpowder. It seemed to the committee that gases once generated under a given pressure, expanded under the same law, must produce in the same chamber or shell effects nearly identical; and it was only after long and careful examination that they were able to understand and reconcile themselves to the fact that greater mechanical effects were produced by the gases of gun cotton than by the gases of gunpowder. One hundred pounds of gun cotton produced, when exploded, 955 cubic feet of gas, while the same weight of gunpowder produced 308 feet of gas when exploded. As regarded bulk, 22 pounds of gun cotton go into one cubic foot, while from 56 to 60 pounds of gunpowder go into one cubic foot. The great waste of force in gunpowder constituted an important difference between it and the gun cotton, in which there was no waste. Gunpowder consisted of about 68 per cent solid matter and 32 per cent useful gases. It might be said, therefore, that one-third of the gunpowder was not directly useful in producing gases; but the 68 per cent of solid matter in gunpowder was not only waste itself, but it used up a large portion of the mechanical force in the remaining 32 per cent of useful gases. Gun cotton can be exploded in any quantity instantaneously. This was once considered its great fault, but it was only a fault when we were ignorant of the means to make that velocity anything we pleased. General Lenk has discovered the means of giving gun cotton any velocity of explosion that is required, by merely the mechanical arrangements under which it is used. Gun cotton, in his hands, has any speed of explosion, from 1 foot per second to 40 feet per second, which is the velocity of gunpowder. The instantaneous explosion of a large quantity of gun cotton is made use of when it is required to produce destructive effects on the surrounding material. The slow combustion is made use of when it is required to produce manageable power, as in the case of gunnery. The temperature of ignition of gun cotton is between 277° and 338° Fah. One pound of gun cotton produces an effect exceeding three pounds of gunpowder, in artillery. It may be placed in store, and preserved with great safety. Danger from explosion does not arise until it is confined. It may become damp, and even perfectly wet, without injury, and may be dried by mere exposure to the air. This is of great value in ships of war and in case of fire the magazine may be submerged without injury. Gun cotton keeps the gun clean, and therefore performs much better in continuous firing. In gunpowder there is 68 per cent of refuse, while in gun cotton there is no residuum, and therefore no fouling. Experiments made by the Austrian Committee proved that 100 rounds could be fired with gun cotton against 30 rounds of gunpowder. Experiments showed that 100 rounds were fired with a 6-pounder in 34 minutes, and the temperature was raised by gun cotton to only 122° Fah; while 100 rounds with gunpowder took 100 minutes, and raised the temperature to such a degree that water was instantly evaporated. The firing with the gunpowder was therefore discontinued; but the rapid firing with the gun cotton was continued up to 100 rounds without any inconvenience. The absence of fouling allows all the mechanism of a gun to have much more exactness than where allowance is made for fouling. The comparative advantages of gun cotton and gunpowder for producing high velocities are shown in the following experiment with a Krupp's cast-steel gun, 6 pounder:—Ordinary charge, 30 ounces of powder, produced 1,338 feet per second; charge of 13½ ounces of gun cotton produced 1,563 feet. The fact of the recoil being less in the ratio of two to three enables a less weight of gun to be employed, as well as a shorter gun. The fact that the action of gun cotton is violent and rapid in exact proportion to the resistance it encounters tells us the secret of the far higher efficiency of gun cotton in mining than gunpowder. The stronger the rock the less gun cotton comparatively with gunpowder is found necessary for the effect—so much so that while gun cotton is stronger than gunpowder, weight for weight, as three to one in artillery, it is stronger in the proportion of 6·274 to 1 in strong and solid rock, weight for weight. It is the hollow rope form which is used for blasting. Its power in splitting up the material is regulated exactly as you wish. It is a well-known fact that a bag of gunpowder nailed on the gates of a city will blow them open. A bag of gun cotton exploded in the same way produces no effect. To blow up the gates of a city with gun cotton it must be confined before explosion. Against the palisade of a fortification a small square box containing 25 pounds simply flung down close to it will open a passage for troops. In actual experience on palisades a foot in diameter and 8 feet high, piled on the ground, backed by a second row of 8 inches diameter, a box of 25 pounds cut a clean opening 9 feet wide. To this three times the weight of gunpowder produced no effect whatever, except to blacken the piles. A strong bridge of 22-inch oak, 24 feet span, was shattered to atoms by a small box containing 25 pounds of gun cotton laid on its center. The bridge was not broken; it was shivered. Two tiers of piles were placed in water 13 feet deep, 10 inches wide, with stones between them, and a barrel of 100 pounds of gun cotton placed 3 feet from the face, and 8 feet under water, made a clean sweep through a radius of 15 feet, and raised the water 200 feet. In Venice a barrel of 400 pounds of gun cotton, placed near a slope, in 10 feet of water, at 18 feet distance, threw it in atoms to a hight of 400 feet.

Captain Galton, R E., said the subject reported upon was exceedingly important, but it must be borne in mind, in connection with the subject, that the Austrians had within a recent period discontinued the use of this material for guns. He begged to suggest that a proposal be submitted to the committee to the effect that it be requested to continue its labors in this inquiry.

Iron Ship Building.—A paper was read upon this subject by C. M. Palmer, of the "Jarrow Works," near Newcastle—a most extensive establishment, where iron steamships are built complete, with all their machinery produced from iron manufactured on the premises. He said:—

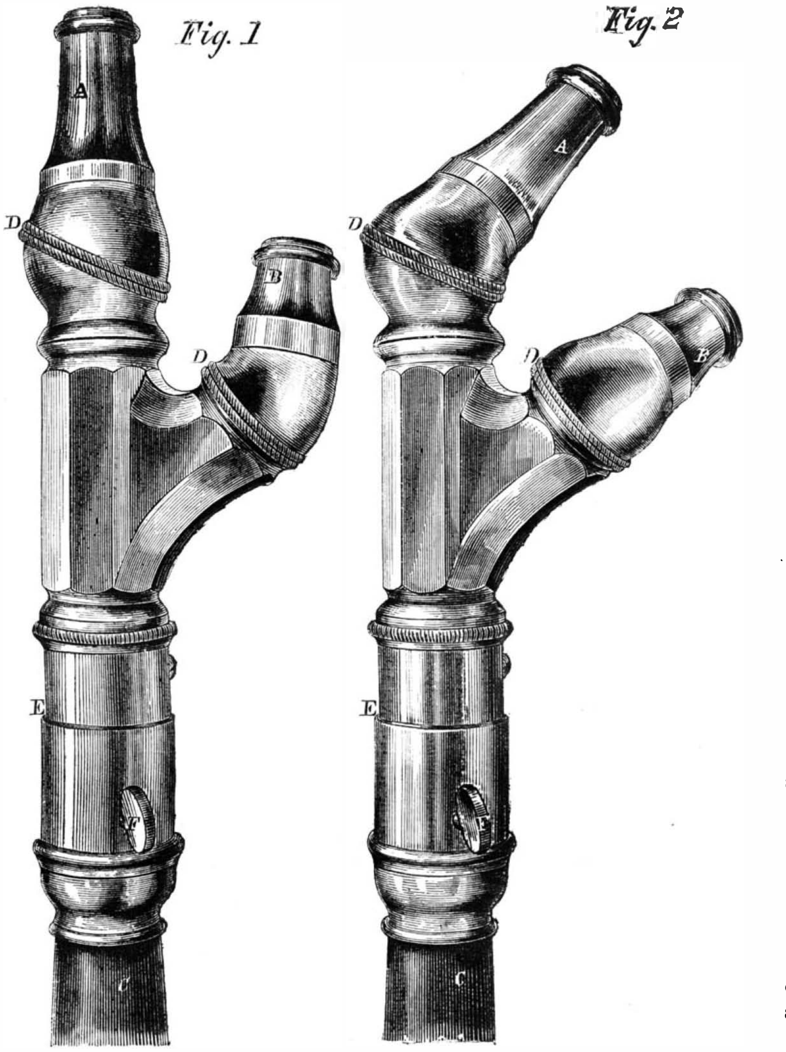
"The principal advantages claimed for ships of iron, as compared with vessels of timber, are briefly these:—In vessels of 1,000 tuns the iron ship will weigh 35 per cent less than the timber vessel, the displacement of water being the same. The iron ship will, therefore, carry more weight, and as the sides are only about one-half of the thickness, there will, consequently, be more space for cargo. The additional strength obtainable, too, allows iron ships to be built much longer and with finer lines; thus insuring higher sailing or steaming qualities, with greater carrying power. In wooden vessels repairs are frequently required, while the repairs in iron ships are generally of a lighter character, and are only needed at long intervals. An iron ship is not liable to strain in a heavy sea, whereas the straining of a timber vessel often damages a valuable cargo. Moreover, the use of iron masts, steelyards and wire rigging, effects a very large saving of weight, and affords the greatest facilities for the application of patent reefing sails, and other appliances by which economy of labor is attained. As to the form of building iron ships, and the manner of combining the iron, so as to obtain the requisite amount of strength with the least amount of material, much difference of opinion exists among practical men. The angle iron frame and plating of the iron vessel take respectively the places of the timbers and planking of the wooden ship: and it has been found by experience that plating one-eighth of an inch thick is equivalent in effect to planking of oak one inch thick, while plating $\frac{11}{16}$ths of an inch thick is equal to planking of oak five inches thick. As in the largest American wooden vessels the plank is seldom more than five inches thick, so it may be argued on the above data that the plating of the largest iron ship need not be more than $\frac{11}{16}$ths thick; and any strength required above that which such plating would give should be obtained by framework. Many practical men, however, advocate the system of light framework, and (in order to obtain the measure of strength necessary), the application of thicker plates. That the principle of strong framing and plating of moderate thickness is most advantageous may be shown by many facts. The strength of an iron ship, as in a girder, depends on its capability to resist the buckling and tensile strains that it is called on to bear. We have only to make a ship strong enough to resist the buckling strain. We have to make the parts of an iron ship, in principle, like a girder. A girder, however, is at rest, and the strains are always in some known direction; but in a ship, the position of which is ever varying, it requires to be so conducted as to resist the strains in such varied positions. If the side of a ship could remain as in a girder, constantly vertical, then the advocates for the thick plates and small frames might be able to show that their system was the most economical way to obtain the requisite strength; but, as such side, if laid over, as it is in a ship at sea, would, without support, bend or buckle of its own weight, it is evident that the framing is absolutely necessary to keep the plating firm in position, and consequently the strength of the ship depends in a very great degree on the strength of the framing. Another fact that shows the economy of strong frames is, that a plate with a piece of angle-iron attached to its edge, would bear much more before buckling than a similar plate increased in thickness so as to weigh the same as the plate and angle-iron.

Deepest Coal Mine in the World.—The coal mine of Monkwearmouth was visited by a party of members of the British Association, among whom were four ladies. The depth of this mine from the surface is 1900 feet, and the workings of coal underneath extend to a distance of two miles from the shaft. About 300 persons are employed in it, and 600 tuns are mined daily. The heat at the bottom varies from 84° to 90° Fah., and the miners work in an almost nude state. Of all the pursuits by which men gain a living, there is none more toilsome, more dangerous, or more dreadful in all its circumstances and surroundings, than the life of him who wins coal from the mines.

Improved Hose Pipe.

In very many conflagrations the origin of the disaster is confined to a very small and sometimes inaccessible place, as under the eaves of houses, in the holds of ships, between party walls, &c. Were it possible, in all cases, to direct a stream to the precise spot, much valuable property would be saved that is now lost. In general this cannot be done without cutting away walls, floors, or other parts of the building. Herewith is illustrated a hose pipe on an entirely new plan; it admits of turning a stream of water in any direction, while the hole through which the pipe is inserted need be no larger in diameter than a hat or an ordinary pane of glass. Upon inspecting the engraving it will be seen that there are two nozzles, A and B, on the butt, C; these nozzles are furnished with water-tight joints, D, which stand obliquely with the body of the butt. When these nozzles are turned (they revolve easily on their seats at the joints, D) the water passage is, of course, changed, and the stream follows the direction to which the nozzle is moved; in Fig. 2 we have illustrated this peculiarity, and it will be fully understood by referring thereto.

Another feature is provided in this hose pipe whereby the nozzles are rotated by the action of the issuing jet, and the same made to cover a larger area of surface than when simply thrown straight ahead. This is done by making an easy working bearing at E, by which both the nozzles and the jets issuing from them revolve rapidly when they are turned, as shown in Fig. 2. This revolution is caused by the stream impinging or striking against the air, and by its sudden divergence from a straight line; which causes its force to be transferred to the side of the curved nozzle and the same turned on the axis, E. These passages and nozzles can be set at any required curve, by simply turning the branch on which both of them are set and tightening the thumb-screw, F; or they can be as rapidly changed to throw revolving jets by the same agency: viz., the slacking of the screw just named. All firemen and others interested will readily see how many changes it is possible to make: the revolutions of the nozzle can be instantly checked by grasping the axis or bearing, E, so that the water may be continued on any desired point; in short, the changes are endless and combine a wide range of usefulness. The main nozzle throws as straight a stream as any other pipe, unless turned on one side, as in Fig 2; and all the passages in whatever position are easy curves and not abrupt angles. This invention has been patented in this country and in England, France and Belgium, through the Scientific American Patent Agency; the American patents bearing date Oct. 14, 1862, and 1863. Those wishing to purchase State, city or village rights, or nozzles, can address the proprietor, C. H. Morrison, LeRoy, Genesee Co., N. Y., or his attorney, H. B. Morrison, traveling agent, LeRoy, N. Y.



MORRISON'S IMPROVED HOSE

HARBOR DEFENSES.

We have recently received quite a number of communications on the above subject, in which different plans are proposed and described. Some of these are very good, while others are entirely inapplicable under the circumstances. But one correspondent asserts that it makes no matter how good a plan may be devised for such a purpose, neither Government officials nor city committees appointed to look after harbor defenses, take the time or the trouble to give inventors a fair hearing. He asserts that the neglect and indifference of persons in authority to suggestions for the benefit of the country, coming from persons outside of the military and navy departments, are notorious, and the action of State and city commissioners forms no exception to this charge. The charge is undoubtedly founded on personal experience, and it is to be regretted that such a state of indifference to the suggestions and plans of many ingenious men should exist. The New York Chamber of Commerce, as a body, appears to have come to the conclusion that the harbor is nearly in a perfect state of defense, and that in a short period no hostile fleet will be able to enter it. At its regular meeting, held on the 1st inst., Captain Marshall stated that the work of fortifying the harbor was rapidly progressing, and even at the present moment the defense was ample. It was asserted that a hostile fleet coming up would have to encounter the fire of 800 guns of the heaviest caliber. No wooden vessel could sustain this, nor any iron-clad at a short range. Very soon all question as to the impregnability of the harbor will be set at rest by the completion of the defences.

California Champagne.

The success of the experiment of manufacturing champagne in California is now an established fact, and the production of that generous beverage in our State hereafter will undoubtedly be so great as to enable us to drive the poisonous European simulated brands from the American market, lay "Jersey lightning" on the shelf, and compete successfully with the manufacturers of the most celebrated European brands for the trade of the world. About 15,000 bottles have already been put up at the Harazthy Vineyard at Sonoma, this season, and about 600 bottles per diem are now being turned out. This wine will commence ripening fit for market in October. One thousand dozen of this wine has already been ordered by a French house in New York, to be shipped next month via. Cape Horn. Thirty thousand gallons of still wines of the same growth will be shipped by the same vessel. The vintage in both the northern and southern grape-producing districts of California will be larger than ever before, more vines coming into bearing, and the crop in all the vineyards, so far as we can learn, being more than an average one. The drouth which so injuriously affected all the other crops in Los Angelos and San Bernardino counties, appears to have had little or no deleterious effect on the grapes.

[The *Californian* has omitted to state one important point—whether it is "sold at a price within the reach of all."—Eds.

Artificial Marble.

Sir James Hall upon one occasion produced crystalline marble by subjecting chalk to a high heat in a close vessel. Professor Rose of Berlin, Prussia, tried the experiment, and failing to produce such a result denied the correctness of Sir James Hall's statements. Being assured that crystalline marble had thus been produced, and that the specimens could be seen in London, he entered upon a second experiment, and in a recent communication to the Berlin Academy of Sciences, Professor Rose states that marble can be produced by exposing massive carbonate of lime to a high temperature under great pressure. His experiments were made with aragonite from Bilin in Bohemia, and with lithographic limestone. In one case the mineral was heated in a wrought-iron cylinder, and in the other in a porcelain bottle, the vessels being air-tight. They were exposed to a white heat for half an hour, and on cooling, both the aragonite and the lithographic limestone were found converted into crystalline limestone; the former resembling Carrara marble, and the latter a grey granular limestone. The change was effected without any material decomposition; the resulting marble containing a trifle less carbonic acid than lithographic limestone, from which it was produced.

The Armstrong Gun Useless.

The London *Army and Navy Gazette* of Sept. 12, regrets to state that in the late experiments with the Armstrong guns at Newhaven the defects of the lead-coated shot and fine grooving were very apparent, as happened in the previous practice. With the full charge of twelve pounds, several of the shells burst at the muzzle, and one in the gun, cutting up the grooving; while others of the shells were stripped of their lead coating and fell short. Last Thursday's experiments, which were conducted partly to try the fuses, showed that the one hundred and ten-pounder could not be depended upon in the hour of greatest need in a close hand-to-hand combat, and established also the fact that the peculiar nature of the Armstrong rifling rendered it very difficult, if not impossible, to obtain a safe fuse for the gun.

Sewing Machines.—A few weeks ago in noticing the articles of most interest in the Fair of the American Institute, it was stated that Messrs. Grover & Baker's sewing machines were on exhibition. We have since been informed that none of the machines of this company, but specimens of the work executed by them, were exhibited on that occasion. The Grover & Baker machines and their work have been exhibited in competition with other machines at the State Fair's of Vermont, New York, Iowa, Michigan, Kentucky, Indiana and Illinois, during the past month, at each of which they have taken the highest premiums, both for the machines and work.

The Michigan Central Railroad Company is about to erect a very extensive grain elevator at Detroit. Its dimensions will be one hundred and ninety-three feet four inches in length, by seventy-seven feet six inches in width. The hight to the summit of the cupola will be one hundred and twenty-eight feet. The bins will be eighty in number, with a depth of fifty-five feet each.