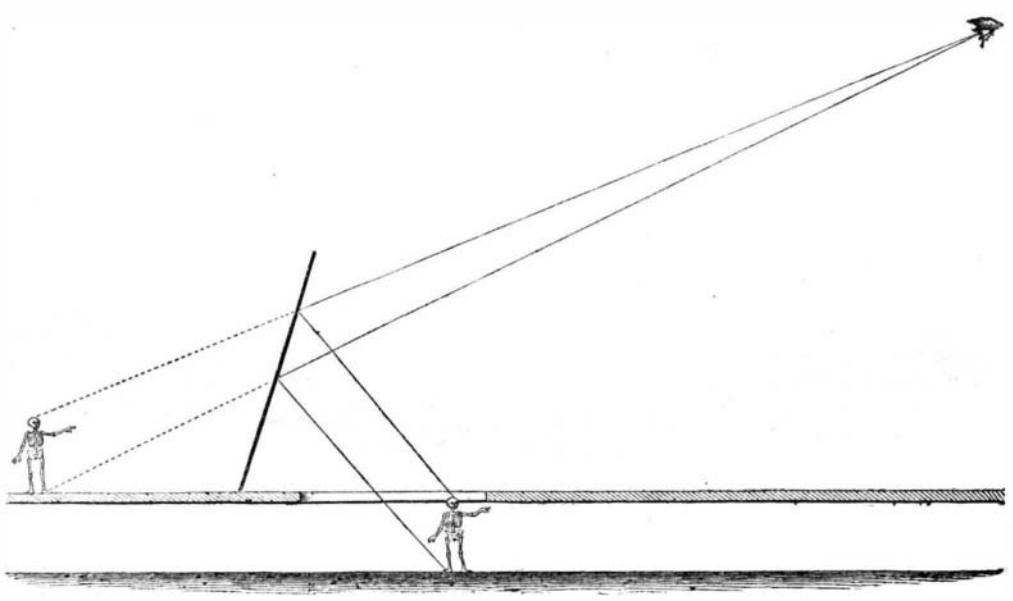
CORRECT EXPLANATION OF THE GHOST.

The great novelty in the theatrical world is the GHOST. Wallack's theater is crowded nightly by hundreds of our citizens to witness this truly wonderful and startling apparition.

An actor in the character of a murderer is seen asleep on a lounge in the rear of the stage, which is dimly lighted. Presently he rises in his sleep and begins to rave under the tortures of remorse for his crime. Instantly there appears at his side a bright image of a skeleton, so luminous that it sheds some light upon the obscurity around. Though startlingly distinct, it is seen to be only the image of a skeleton, as objects on the stage are visible directly through the bones. The murderer strikes his sword through the grizzly horror, but it is as impalpable as air. After a brief space the apparition vanishes as suddenly as it came. It makes no movement up or down or to either hand, but simply disappears.

Some of our cotemporaries have published explanations of the mode in which this wonderful optical illusion is produced; but, so far as we know, none of them, have given the correct explanation. This we are now enabled to give, on the authority of one of our learned professors.



The plan is exceedingly simple. A very large plate of transparent glass is set at an angle on the stage in front of the actors; an opening is made through the floor of the stage in front of the glass, and the skeleton is placed beneath the floor in front of the opening. As soon as a strong light is thrown upon the skeleton the light passes upward through the opening in the floor, and is reflected from the glass, producing an image in the rear. The glass is an invisible mirror, producing its image directly among the actors who are seen through it.

REPORT ON ARMSTRONG GUNS.

A select committee appointed by the House of Commons (England), "to inquire into the expenditure incurred since 1858, on various kinds of improved ordnance obtained by contract, and made at Government risks; also to inquire into the results obtained by such expenditure," has lately made a very full report. It is stated that Sir William Armstrong first brought his gun to the notice of the Government in 1854; and an order was then given for six trial guns, varying in size from 3 to 18-pounders. The reports of the officers employed to inspect them were favorable, and Lord Panmure declared, in reference to the 18-pounder, that "for all purposes of projection and accuracy of flight of the projectiles the experiments were conclusive." It was not, however, till 1858, that the idea of providing rifled ordnance for field service on a large scale was entertained by the War Office. In that year General Peel appointed a special committee to advise him on the whole subject, and this committee decided that, having regard to expense, the competition for the patronage of Government should be limited to the Whitworth and Armstrong guns. The latter was ultimately selected as the "field-gun of the service." In 1859 Sir William Armstrong was appointed engineer of rifled ordnance, and superintended the ordnance works at Elswick, erected by a company of which he was a partner.

The British Government has paid £1,067,794 (about $5,339,000), for guns, projectiles, &c., to this company; and the contract has been terminated. The sum of £1,471,753 has also been expended for guns, carriages, and ammunition, at the Woolwich Arsenal, making a total of no less than £2,539,547 (about $12,697,000), expended for Armstrong guns and their appendages, in about two and a half years. The choice of the Armstrong gun for military service is ratified by the committee. They admit that experiments with the Whitworth gun were "not of so extended a character" as those with its rival, but they give as a reason for this that at that time Mr. Whitworth had no system of his own for the construction of guns. "He had only rifled Government blocks of brass and cast-iron." Sir William Armstrong, on the contrary, had a complete method, capable of fulfilling the prescribed conditions, and the committee deny that, either then or now, any practical evidence was or is produced to show that any other method can be compared to it. The characteristic peculiarity of it they consider to consist in a "definite combination of construction, breech-loading, rifling, and coating the projectiles with soft metal;" and they are of opinion that its adoption in 1858 was "fully justified." With respect to the introduction of Armstrong 40-pounders and 100-pounders into the navy, the committee express a more qualified opinion. This was commenced in 1859, on the advice of Captain Hewlett, of the *Excellent*, a gunnery vessel. It is stated in the report that the old 68-pounder, at a distance of 200 yards, is superior, as a broadside gun, to a 100-pounder Armstrong, and the 60-pounder is considered the most effective gun in the service for piercing iron plates. About 3,000 Armstrong guns, altogether, have been constructed, of which number 570 of the 12-pounder class have been in service; and out of the entire number not one has yet exploded. Recently Sir William Armstrong has made some 600-pounders, but the results of trials with them are not given. Some statements had been published respecting the inefficiency of the breech-loader field pieces used in China. These assertions are contradicted. No difficulty was found in keeping them in perfect order under all circumstances, and their range and accuracy were unequalled. But for large guns, movable breeches are condemned and muzzle-loaders preferred.

One part of the report puzzles us. It is stated therein, that the old 68-pounder is the most effective gun against iron plates; and the London *Times* dwells upon this as a prominent fact. And yet not long ago it was reported in the English journals that the Whitworth, Armstrong, and Horsfall guns, penetrated and smashed targets, at Shoeburyness, that were perfectly invulnerable to the efforts of the old 68-pounders.

Yosemite Valley—California Scenery.

The scenery in some parts of California is grand and sublime, far surpassing that among the mountains on the Atlantic coast range. The following are extracts from a communication in the San Francisco *Bulletin*, by a lady who had visited the valley of Yosemite, to see its giant cliffs and wonderful waterfalls:—

"The descent into the valley is frightful—the pathway so steep in many places as to be absolutely precipitous. For miles we pursued this perilous way, unwilling to stop, and yet half afraid to go on. There are many places where a false step, a broken girth, a restive horse, or a dizzy brain, would have sent us into eternity. Fortunately for us we reached the valley in safety. Our party halted for a few moments on the bank of the Merced river, that our guide might adjust our saddles, our horses rest awhile, we regain our composure, and take breath after our rapid and exciting ride. It was a scene for an artist. The river flowing at our feet—a noble stream, clear, deep, and rapid; the tall pines rising majestically above us, their thick shadows turning aside the slanting sunbeams, or breaking them in checkers of golden light, the horses quietly cropping the rich grass. The grouping of the party was in itself artistic. While some were stretching themselves at full length under the trees, others were drinking from the stream, or, leaning idly upon their saddles, looking up at the towering cliffs which rose solemnly and sublimely all around, completely isolating us from the world and shutting us up within a wall of adamant 4,000 feet in hight! Down the valley the river came, winding its way like a huge serpent, its silver scales glistening in the sunlight. The light winds chased the shadows over the waving grass, which grew tall and even, like a field of grain. Opposite, down the giant wall, the delicate Pohono threw its bridal veil in misty wreaths, 900 feet into the valley; and from afar the sound of falling waters from half-a-dozen cataracts came to us on the breeze, like the breaking of the surf upon a rock-bound shore.

"In a little while we were safely landed on the opposite bank and cantering gaily up the valley. As we advanced, cliff after cliff loomed grandly before us, each one looking larger than the last, until the white walls of Tutochanoola rose sternly and solemnly before us. Words cannot paint the sublimity of this giant crag; no artist can do it justice. We rode under its shadow for miles, and it seemed no nearer and no further off. Turn which way we would, there it stood frowning down upon us threateningly, grim and white, like destiny itself. It is an event in one's life to have looked upon a sight like this. The Sentinel Rock is a sharp gray peak towering up above its fellows, like a watch-tower, on this giant wall. The Three Brothers are stupendous, and their great domes seem to prop the very sky. But wonderful as they are, and past all description, they do not impress one like El Capitan. After a ride of forty miles we at last arrived at the Yosemite Hotel—a house very pleasantly situated within a few yards of the river, in the midst of a magnificent forest, directly opposite the falls of the Yosemite. Tired as we were, we could not resist the temptation of lingering at the door to look at this beautiful fall, or rather succession of falls, for there are three in number, making in all 2,500 feet of descent. It looks like myriads of water rockets (if one can imagine such a thing) bursting into foam, waving and fluttering in the wind. It looks like anything but water; it is more like some long, white, flowing garment—some snowy descended drapery, as if an angel had dropped its mantle in its upward flight. There was a fascination about it which charmed us to look at and listen to its solemn anthem, as it rose high and clear above all other sounds, like the voice of some mighty organ. It is unfortunate for the dusty, weary pilgrim, that the waters of the Merced are too cold for bathing, for after such a journey there is no luxury which could be so acceptable as a bath. The water is so beautifully clear, and the soft white sand at the bottom of the river gleams so temptingly, that it is difficult to resist the impulse to plunge in.

"We spent our first day in the valley, sight-seeing in a small way. We visited the falls of the Yosemite, and afterward rode several miles up the valley to visit two little lakes, picturesquely situated in a

little nook surrounded by giant cliffs. Fine trees and overhanging shrubbery grow upon their banks. The deep, clear waters look darkly blue, and an indescribable serenity rests upon the scene—a sort of Sabbath silence, as if Nature was at her devotions, and not to be disturbed by worldly cares. These lakelets are full of speckled trout, some of them of great size. They are often taken of the weight of three pounds. We also visited the Vernal and Nevada falls in the valley. After riding a couple of miles, we dismounted and followed our guide along a blind pathway, over rocks, through thickets, and across streams for two miles further, until we entered the deep ravine into which the Vernal fall precipitates itself. There the trail ascends a narrow ledge, which seams the face of the mountain, at a frightful distance above the mad whirling river below. The pathway is very steep, very narrow, and not without danger. We stood upon the very verge of the cataract in perfect safety. The table-land through which the river rushes after its first great leap—the Nevada falls—until it takes its final plunge over the Vernal fall, is the wildest and most desolate region one can imagine. It looks as if a hurricane had swept over it at no remote period. The mountain sides are verdureless and bare, and not a living thing, bird or beast, or sound, but of the cataract, greets the eye or ear of the adventurous tourist. All is silence and desolation. A few dwarfed manzanitas have found root among the rocks, and we saw occasional clusters of the Alpine rose and a few fine portulaccas, covered with fragrant yellow blossoms. The river is something fearful, as it dashes furiously along its rocky channel, whirling and eddying, and leaping in fierce fury. Around and below, on every side of us were giant cliffs, huge domes, and great rugged rocks lifting their bare and weather-beaten heads into the very sky. There was no sound of human life—no sign of human habitation anywhere. We seemed to be all alone in the world.

"We spent three entire days in the valley. One can spend a week there without weariness; but for all purposes of mere sight-seeing, three days are sufficient. The Pohono or Bridal Veil, is perhaps the most regularly beautiful of all the falls, leaping, in one unbroken bound, 940 feet. It is seen to the greatest advantage between the hours of four and six in the afternoon, when the light falls upon it in such a manner as to produce most marvelous effects in the way of rainbows."

DISCOVERIES AND INVENTIONS ABROAD.

Manufacture of Copper and Brass Tubes.—A patent has been taken out by J. J. Laveissiere, Paris, for an improvement in manufacturing tubes from hollow ingots of copper or brass. In order to obtain a sound hollow ingot or cylinder of the metal or alloy, the patentee runs into a mold of the shape required for the exterior of the ingot the requisite quantity of the melted metal or alloy, it being either poured in at the top or run in at the side, and as soon as the metal or alloy has nearly, but not completely set, a mandrel is forced down into the metal. This is effected by means of a screw or otherwise; the mandrel is not, however, forced quite to the bottom of the mold, so that one end of the ingot will be closed; or it may be made with an internal flange only at its end. The metal is thus compressed and the volume displaced by the mandrel is caused to rise up around the core, and to fill the mold. As soon as the metal or alloy has sufficiently set to retain its shape, the mandrel is raised from the mold. In order to draw out the hollow ingots into tubes, he employs a system which allows of the metal being worked hot or cold. This system consists in employing grooved rollers, between the grooves of which the ingot is either pushed or drawn by a mandrel forced forward in any suitable manner, and in order to be enabled more quickly and regularly to draw down the tube, he employs two sets of rollers placed close together, one after the other, the axes of one set being vertical, and the other horizontal. The grooves in the second set are also made smaller than the grooves in the first set. The tube will thus nearly simultaneously be nipped by the rollers in the two directions. After the thickpess of the tube has by this means been considerably diminished, the tube is completed by being drawn through dies in the ordinary manner.

Medico-galvano-electric Apparatus.—E. T. Hughes, of London, has obtained a patent for improvements in apparatus for applying electricity in cases of disease—a practice now becoming quite common. The invention consists of various arrangements of galvanic apparatus, adapted to every part of the human body. When adapted to the head the patentee employs a wig spring, and solders to one end a silvered copper plate, of any required size and shape, having a shallow cavity formed in it for containing a conductor, consisting of several folds of flannel sewed together. On the rim outside the cavity he places a ribbon of silk, and fastens it to the conductor, over which and the silk he places a zinc plate, and clasps its edge by the rim of the silvered copper plate, the said zinc plate fitting the part of the head against which it is to be placed. The two plates are insulated by the silk between them, and the double folded rim is pressed air and water-tight; the same construction is applied to the other end of the spring, but the plates are changed—that is, the plate having the cavity is formed of zinc, and the plate which fits the head and covers the conductor and insulator, of silvered copper plate. At the top of each cavity there are two openings, one larger than the other; the larger for the passage of the fluid for molstening the conductor, and the smaller for allowing the air to escape: which openings are to be perfectly closed when the cavity is filled. The fluid employed is vinegar or dilute sulphuric acid, either of which may contain a small quantity of weak alcohol, to enable the fluid to be quickly imbibed by the conductor. When both conductors are moistened, the development of electricity is immediately perceived by the cracking noise; and when the inner plates are fitted in opposite positions against the head the galvanic current passes through it. When the apparatus is to be used for passing a galvanic current through the body from the foot to the wrist, or other parts, he uses a similar arrangement of plates, conductors, and openings to those before described; but makes them of such size and shape as the requirements demand.

Treatment of Gas with Acid.—A patent has been taken out by John Leigh, of Manchester, England, for obtaining nitro-benzole from gas. The invention consists in subjecting gas made from cannel coal used for illumination, to the action of nitric acid, by which nitro-benzole is obtained. The method of proceeding is as follows:—"Into a series of earthenware vessels, in the form and arranged in the manner of Woulfe's bottles, is introduced a quantity of fuming nitric acid, and through this is passed a current of gas, the operation being continued so long as any action is exerted by the acid upon the gas." When the operation is completed, nitro-benzole is found condensed in the bottles; which may be separated with a faucet, and employed for the manufacture of aniline colors. The gas thus treated, however, is liable to carry over some acid in the pipe. To prevent this, it is passed through an alkaline solution or moist lime, to neutralize the acid.

Refining Petroleum.—The following is the substance of a patent granted to E. V. Gardner, Professor of Chemistry, London. This improvement relates to the use of both high and low pressures, and superheated steam in connection therewith, by which means all risk of fire and explosion is obviated, and the various distinct compounds which are contained in ordinary mineral oils are separated, if necessary, in one continuous operation. The apparatus consists of a shallow and wide vessel, or still, which is kept supplied with mineral oils from a service-pipe. This vessel, or still, is provided with several conducting-tubes, each one leading to a separate condenser, and terminating in a distinct receiver, which, for convenience and safety, should be buried. The oil, previously treated with chlorides, perchlorides, or hyperchlorides of iron, zinc, tin, lime, soda, or manganese, or any such compounds, or a mixture of two or more of them, is run from the agitator, in which it has been thoroughly treated with the above named substances, into the still, or the oil and chlorides are introduced without agitation. Steam of low temperature is allowed to enter by a pipe, and traverses a perforated coil in the bottom of the vessel, escaping with the light oils, and passing off to its condenser. High-pressure steam is now introduced into the same coil by means of convenient pipes from the same or another boiler, and the product of this second process passes off to its distinct condenser and receiver-pipes, the others being closed. Superheated steam is next passed from a third source, through the same coil, the former pipes being closed, and passes by a third condenser-pipe to its receiver. These condenser pipes are fitted with taps for use as required. The remaining dead oil is run from the vessel through a tube or pipes to a general receiver while hot, and submitted to further distillation.

If the oils be not previously agitated and treated with chloride or chlorides, but introduced with them into the vessel, then, after being submitted to steam at 212° Fah., and at high pressure before the introduction of the super-heated steam, the mixture must be allowed to subside, and the solution of chloride run off. The remaining oil is then treated as if chloride had not been present. In these processes neither acids nor alkalis must be allowed to come in contact with the oils previous to the above treatment, as by the action of the acid the oil is considerably carbonized and the production in pure oil lessened.

Breech-loading Ordnance.—A. F. Blakely, London, the inventor of the Blakely gun, has taken out a patent for an arrangement of breech piece, which is opened by the recoil of the gun, when the shot leaves the muzzle, so as to permit the gun to receive a fresh charge without further trouble. The breech piece enters the barrel to an extent sufficient to insure its not leaving the breech end until the shot passes out of the muzzle.

NEW BOOKS AND PUBLICATIONS.

SYSTEMS OF MILITARY BRIDGES; by Brigadier-General George W. Cullum, Lieut-Colonel Corps Engineers, U. S. A. Published by D. Van Nostrand, at 192 Broadway, New York.

This is a handsome scientific and practical work, illustrated by a large number of wood cuts and lithographic plates. The author is an accomplished military engineer, and is Chief of Staff of the General-in-Chief of the armies of the United States. The different systems of military bridges adopted for the armies of the European Powers, as well as those in use in America, are very clearly described. The passage of rivers is considered the most difficult and hazardous of all military operations; and no army should take the field without means to overcome all obstacles. The importance of military bridges, during our present war, affords good reason for the production of this work at the present time. The experience of our army on the Chickahominy and Rappahannock has shown how the fortune of war may be borne upon a few frail pontoons. Military bridges should be light and strong, easily put up, taken down, and transported. The American india-rubber pontoon bridge is fully described, and appears to surpass all other portable bridges. The first india-rubber pontoon bridge experimented with was in 1836, by Captain John F. Lane, U. S. Army; it is 350 feet in length, and was thrown over the Tallapoosa river, in Alabama. Such bridges were afterwards practically used in the Mexican war, under the charge of General Cullum. The pontoons consist of vulcanized india-rubber cylinders, divided into compartments, and when used for a bridge, they are inflated and anchored at intervals of about 18 feet apart, parallel with the current of the river. They thus form floating piers, upon which the plank roadway and superstructure are laid. When the bridge has to be lifted, the superstructure is taken apart, the pontoons are taken out, and the air expelled from them; when they may be packed closely in suitable wagons and easily transported to their next destined position. The French have borrowed the construction of such military bridges from American engineers. General Cullum describes a remarkable instance of American engineering originality and energy in the erection of a temporary railroad bridge across the Potomac Creek, by Brigadier-General Herman Haupt, C. E. It was put up to replace one burned by the rebels; was 400 feet long, 80 feet in hight, and the labor was done by the soldiers. It was constructed of trees cut from the forest in the vicinity, in May 1862; and only nine working days were occupied in its erection.

General McDowell, in his defense before the Court of Inquiry, said respecting it:—"It is a structure which ignores all the rules of military science, as laid down in books. It is constructed chiefly of round