of them from coming within range? We must go out to the enemy and destroy him, or drive him away. Such service may be performed:

1. By heavily-armored floating batteries, carrying the most powerful guns.
2. By swift and powerful rams.
3. By torpedo boats capable of being operated in rough water and at a great distance from the shore.
4. By small, swift vessels, armed with the heaviest guns.
5. By torpedo-missiles thrown through the air.

To meet great ironclads with great ironclads would seem to be an extremely expensive and hazardous proceeding, even if competent vessels of this sort were in possession and could pass in and out over the outer channel bars. The utility of rams is beyond question—provided they are swift and staunch and easily handled. Such rams are yet to be built. Small and swift gunboats, each carrying one gun of the highest attainable efficiency, might do the work. But this type of vessels, also, is yet to be developed. Great things are promised under the Lay torpedo combination; but as yet the torpedo for open sea use is practically unknown. The use of torpedo missiles to be launched through the air is as yet a mere suggestion. Shells charged with gunpowder are destructive only when they have buried themselves in the target. The more sudden and powerful explosives act differently and far more destructively. It is now possible to charge a torpedo with two non-explosive substances, a liquid and a solid, which become powerfully explosive when mixed. Would it be possible to charge projectiles with these substances? Until the two were combined the shell would be as safe to handle as a solid shot. In the act of firing or during the transit of the shell through the bore of the gun the gas pressure upon the base of the projectile might be made to crush the cell containing the liquid; the mixture of the ingredients would be effected during the flight of the projectile, and the originally inert charge converted into an explosive as powerful as dynamite, which, by well-known means, might be fired by the impact of the shell on striking. In this case the damage would not be measured by the penetrative power of the gun, but by the disruptive power of the torpedo-projectile. With such projectiles war ships might be kept from coming within miles of shore by simple and comparatively inexpensive land batteries.

Another line of development in torpedo warfare would seem to be possible in the direction of submerged or nearly submerged small torpedo craft, to be operated by one or two men, yet capable of planting against the side or bottom of an ironclad torpedoes of sufficient force to sink any vessel, however well armored. These small craft might win by sheer force of numbers, while the hazard of life would be reduced to the smallest.

In most of the discussions of this question it is tacitly assumed that defense must be sought by the conventional means of military and naval warfare; that we have little choice but to copy the processes and appliances upon which so much money has been spent in Europe. A wiser way would be to assume that the old means are substantially antiquated, except for use along the inner lines of defense, and to offer to inventors such inducements in the way of provisions for testing their novel devices as would encourage the boldest development of new ideas. The problem of coast defense is a serious one; and the hope of the country of safety in the emergency of war hangs upon invention, bold and radical invention, not in costly appliances in the way of ships, forts, and the like, whose day of possible usefulness usually passes before they can be made ready for actual service.

THE OLD SCIENTIFIC AMERICAN OFFICE, 37 PARK ROW, NEW YORK. DESTROYED BY FIRE, JANUARY 31, 1882.

BURNING OF THE OLD AND OPENING OF THE NEW SCIENTIFIC AMERICAN OFFICES, NEW YORK.

A business residence of some twenty-five years in the old quarters, No. 37 Park Row, New York, had rendered us almost oblivious to the fact that ours was not a fireproof dwelling with modern improvements. We were rudely aroused from a fancied security on the morning of January 31, at 10 o'clock, by a sudden alarm of fire. The cry was "Run for your lives!" and of the forty or fifty persons forming our corps of assistants, all, except half a dozen or so, rushed for the stairways, and, happily, gained the street in safety. The few who tarried, perhaps three seconds, were cut off from the stairs by the flames; these were Mr. Cyrus L. Topliff, of our financial department; Mr. B. G. Underwood, of our advertising department; Mr. Henry E. Mead and Mr. F. L. Seitz, of our art department; Mr. W. M. Avery and Mr. Harrold Avery, of our engraving department; Mr. C. N. Tillottson, of our subscription and mailing department, Mr. Charles Sedgwick, of our record department, and Mrs. Markey, janitress of our office. We are under obligations to them for their efforts to save property. They were taken from the third story windows by the gallant firemen who rapidly put up the ladders and rescued not only our people, but scores of others from the windows adjacent and above our premises. The splendid and effective services of the firemen on this occasion merit the highest praise, and show the excellence of their organization.

To the exertions of Mr. Topliff, of our financial department, whose coolness and presence of mind were conspicuous, we are much indebted. For him and Mr. Tillottson the alarm meant the instant gathering and placing of our records, subscription books, drawings, and correspondence, in the large fireproof safes provided for that purpose, and the locking of the safe doors.

The fire spread with such amazing rapidity that in fifteen minutes the great building was in flames from top to bottom. It had three fronts: Park Row, Beekman Street, and Nassau Street. Our establishment occupied most of the entire third floor, nearly two hundred feet long and fifty wide. We give an engraving showing our establishment as it appeared before the fire. The reader will be able to picture for himself, better than we can describe, the thrilling spectacle that was presented when the building was wrapped in flames.

THE NEW SCIENTIFIC AMERICAN OFFICE, 261 BROADWAY, CORNER WARREN STREET, NEW YORK.

There was a leaden sky; a snowstorm was in progress; great volumes of smoke and fire belched from the windows; groups of helpless men were seen clinging here and there to the window sills, calling for help; the streets below were filled with hurrying firemen and horses, hissing steamers, ladder and hose carts, stand pipes and fire paraphernalia of all kinds. In the background of the City Hall Park were fifty thousand spectators, whose cheers of joy made the welkin ring when the ladders went up and the rescue was complete.

Several hundred persons were in the building, but all escaped, it is thought, except seven, who, sad to relate, lost their lives, two by jumping, through fright, from the windows before the ladders arrived. The others, it is believed, were overwhelmed by the gas and smoke. Three of the lost were employed in the office of the New York *Observer*, which adjoined our own office. From the fourth story window above us a young woman of 17 years, Miss Green, leaped to the pavement, and was caught and saved in a tarpaulin, held by Mr. O. F. Gunz, Theo. Hoster, and H. L. Goodwin, of the SCIENTIFIC AMERICAN office, and others. She says she was told to jump, and did so, became instantly unconscious, and knew nothing of the result until she recovered her senses in a neighboring store.

The fire was caused, it is supposed, by the overheating of a chimney, which set fire to woodwork of the lowest floor, and, once started, it ran up the elevator shaft with almost lightning velocity. It was an old-fashioned building, floors, beams, and mazes of partitions, all pine, of quarter of a century dryness. No wonder that it burned quickly. In half an hour the walls fell in and the old SCIENTIFIC AMERICAN office was in ruins.

Two hours later we had leased the elegant series of offices in the large building of the United States Life Insurance Company, 261 Broadway, corner of Warren, across the Park, opposite our former quarters; and before nightfall loads of desks, chairs, drawing tables, books, and instruments had been delivered, our helpers were at work, and the hum of the SCIENTIFIC AMERICAN beehive had again begun.

The late fire makes no interruption in our business. Our printing and mailing was all done in another building; all our plates were preserved, and the regular issues of the SCIENTIFIC AMERICAN and SUPPLEMENT proceed as usual. Nearly all of our books, records, correspondence, and patent drawings were preserved. The principal loss was in furniture and back numbers of our publications. The latter are being rapidly reprinted from the plates. Some hundreds of old models, and a few new ones, are in ashes. But this is of little account, as the Patent Office does not now require models except in special cases.

Hardly had we taken possession of our new quarters when we began to receive letters and telegrams from hundreds of friends. The *American Machinist* most promptly and generously offered us the use of all their types and engravings. We have gladly availed ourselves of this kindness in making use of the excellent portrait of the late Mr. Holley, engraved specially for the *Machinist*, together with the excellent biographical sketch written by our contemporary. To the proprietors of the *American Machinist*, the *Mechanical News*, the *Mechanical Engineer*, *Science*, the New York *Times*, the *World*, the *Independent*, *Engineering News*, and other papers, we return our sincere thanks for their kind offers of printing and other facilities. We also gratefully acknowledge the kind invitation of Mr. Thomas D. Stetson and Mr. David L. Haight, of the Vanderbilt Building, to occupy their offices temporarily; and the proffers of aid from Messrs. Brown & Brown, from Elihu Root, Esq., and many others.

Our good fortune in so quickly finding suitable shelter from the snow storm rendered it unnecessary for us to take advantage of these kind offers; but we appreciate all the same the generous spirit that prompted our friends, and we shall remember them with gratitude.

We are asked, in view of this calamity, what we consider to be the best protection against fire. We say a good fireproof building. The New York *Times* edifice, which adjoined the burned structure, is built with iron beams and brick arches, and suffered no damage except some water.

We are also asked as to the best fire escape. We say a stout chain, long enough to reach the ground, and attached ready for use within every separate apartment of the building.

We are also asked as to the best fireproof safes. We say Marvin's, 266 Broadway. In them were saved the SCIENTIFIC AMERICAN drawings, books, and records, from this great fire. On the morning of the second day our books were in use. But more of safes hereafter.

Our new offices at 261 Broadway are unequaled for excellence and convenience of location. We give herewith an engraving of the new building. It is located near the general Post Office, opposite the City Hall Park, and in front of the entrance to the great suspension bridge between New York and Brook.

THE BRANCH OFFICE OF THE SCIENTIFIC AMERICAN, CORNER F AND 7TH STREETS, WASHINGTON, D. C.

lyn. If any of our readers wish to gaze upon a scene of active city life we advise them to come and stand for a few minutes upon the steps of the new SCIENTIFIC AMERICAN office. The throng of passengers and vehicles constantly moving before our doors is remarkable.

We cannot very well close this little episode relating to the SCIENTIFIC AMERICAN offices without giving our readers a picture of our branch office at Washington. It is located at the corner of F and Seventh streets, directly opposite the Patent Office, a location which, by its convenience, greatly facilitates us in the dispatch of our affairs. In this and our New York establishment, aided by many able assistants, we are carrying on probably the largest and most successful business relating to patents that was ever undertaken by a single firm. We aim to do the work promptly, properly, and on moderate terms. That our labors, which now extend over a continuous period of more than thirty-five years, are highly satisfactory to the public, is seen in the wide patronage that we enjoy, and which steadily increases with each passing year.

IT is gratifying to know that Commissioner E. M. Marble has been prevailed upon to reconsider his proffered resignation of the Commissionership of Patents.

Manufacture of Oxygen Gas.

The industrial manufacture of oxygen has engaged much thought, while the uses, on a large scale, of that agent have not been very exactly determined. At Passy, says *Nature*, there are now works for producing the gas according to an improved method of MM. Brin frères, who attach the highest value to oxygen as an industrial agent, and indicate various applications of it. The process is the well known one in which caustic baryta absorbs oxygen from the air, and gives it up under heat. By a special way of preparing the baryta, however (described in *Annales Industrielles*), they render it highly retentive of its absorbent power, obviating the necessity of frequent renewal. After 400 operations there was (on microscopical examination) no appreciable change. The baryta is placed, at Passy, in metallic retorts connected, in groups of fifteen, in two furnaces heated with gaseous fuel. A locomotive engine drives Root blowers, which force air into the retorts; after peroxidation the oxygen is liberated by heat, and pumped into the gasometer through an apparatus which removes traces of carbonic acid. As it is found that the peroxidation takes place better with moist than with dry air, the air is passed through a saturator on its way to the retorts. For production of 5,000 cubic meters of oxygen a day in Paris, it is estimated (from the data at Passy) that the cost per cubic meter would be from 0·12 to 0·15 franc, according as coal or coke was used for fuel. The price of 100 kilogrammes of baryta prepared by the new method is about 250 francs.

Wild Beasts and Snakes in India.

It is with somewhat more than ordinary interest that we have for some years past awaited the annual records setting forth the fearful ravages wrought by tigers and other wild animals, and by snakes, throughout our Indian empire. From a brief notice which appears in the columns of a contemporary, we now learn that there has been a steady *decrease*, from 1876 to 1880, in the total number of wild animals destroyed throughout Hindostan, coupled, however, with a proportionate *increase* in the number of persons killed by wild animals and snakes. Thus, whereas in the year first named there were destroyed in Hindostan no fewer than 23,459 wild beasts, in 1880 the figures diminished to 14,886; but, during this same period, the number of human beings who have lost their lives has mounted up from 19,272 to 21,990! One satisfactory feature observable in the present annual returns is that relating to the great increase in the number of snakes destroyed in the Bombay Presidency alone. Of course, it must be a matter of impossibility to suggest an antidote for the mortal injuries inflicted by a wild beast such as the tiger; but there would seem to be a good field now presented for the further prosecution of the experiments already made by Dr. De Lacerda in connection with a specific for snake bite.

Consolidation of Torpedo Interests.

The various patentees of electrical devices for torpedoes have lately combined in one corporation, to be known as the Lay Torpedo Company. By combining all the recent improvements in devices for reducing the size, increasing the speed, and controlling the discharge of movable torpedoes, it is believed that torpedo boats can be built at once smaller, lighter, and faster than any before seen; boats that can be run on or below the surface, as may be desired; steered in any direction, and stopped at will; exploded by the operator or automatically, as may be desired, the charge being 100 pounds of explosive equal to dynamite in power. One wire will carry the current for stopping, starting, steering, or firing.

Electricity from Crystals.

Jacques and Curie have shown that by the mere compression of an inclined hemihedral crystal, electricity is developed. They experimented by placing a crystal or a suitable section of it between two sheets of tin foil insulated on the exterior by plates of caoutchouc, the tin foil being connected to a galvanometer. By now compressing the crystal in a vise or otherwise, electricity is developed and may be measured by the galvanometer. The electricity developed is the opposite of that produced by heating a crystal—that is to say, the extremity of the crystal which becomes positive on heating, becomes negative on compression. On releasing the pressure, electricity of an opposite kind is produced. The authors find that the production of electricity by pressure can only be obtained with hemihedral crystals having inclined faces. By combining a number of such crystals in a pile, they have invented a new apparatus for producing electricity. The amount of electricity developed varies for different minerals. They find, for example, that a section of quartz, cut perpendicular to the main axis, evolves more electricity than a similar section of tourmaline.

IMPROVED PULVERIZER.

A very simple and effective pulverizing machine has lately been perfected by Messrs. Thomas B. Jordan & Son,

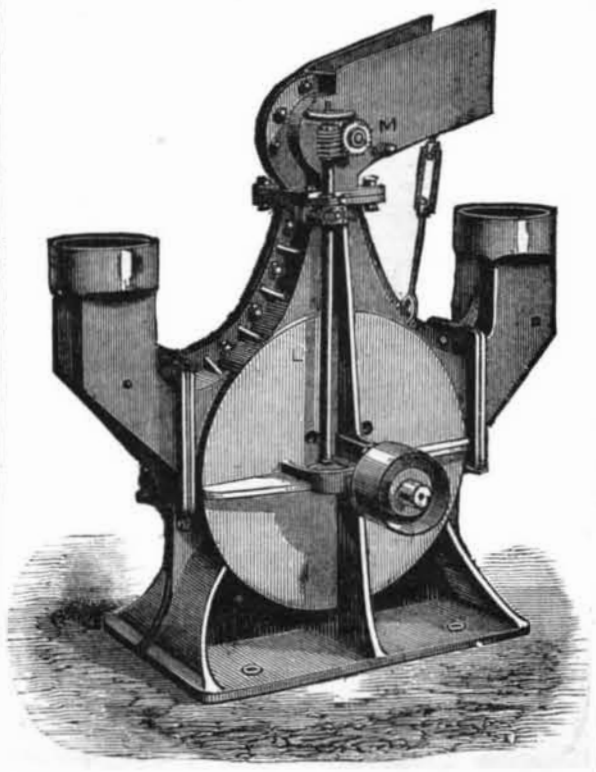

FIG. 1.
IMPROVED PULVERIZER.

London, and which is represented in the two engravings. Requiring a machine of this class for their own use, and not finding one in the market sufficiently simple or effective for their purpose, Messrs. Jordan, after long and careful experiments, perfected this machine, which constitutes an important advance in crushing apparatus. In our engravings, Fig. 1 is a general perspective view of the machine; while Fig. 2 is a vertical section showing its internal arrangement. In this machine, two circular dished castings, A A, each having a long bearing, B, projecting from its center, are bolted together by their flanges, C C, and form the crushing chamber, D D, which has an inlet opening on the top, E, and two outlet openings, one on each side, F F. The two bearings carry short wrought iron spindles at B, which meet end to end at the center of the crushing chamber. On the inner

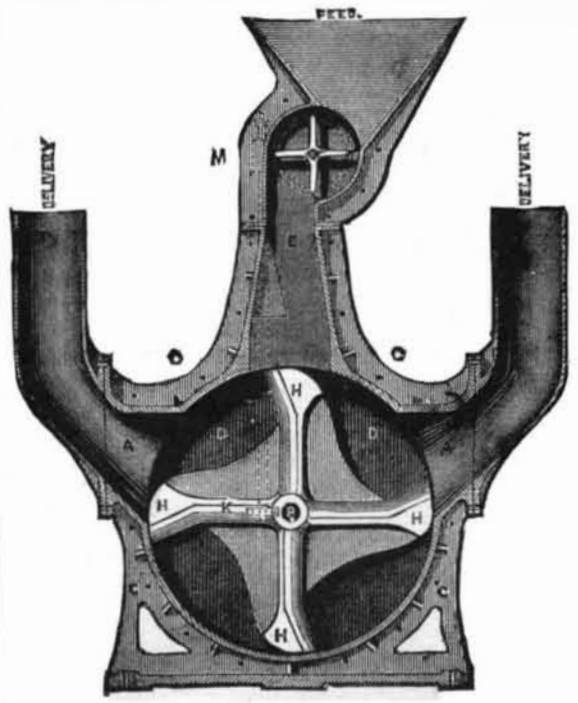

FIG. 2.
IMPROVED PULVERIZER.

side of each spindle is keyed a set of four arms, H H H H, of the diameter of the chamber, the surfaces of the one set of arms being so angled at 45 degrees with the horizontal center line that they are parallel to and face those of the other set. These arms revolve in opposite directions, passing close to each other and to the sides of the chamber, and their backs are so formed as to create a blowing or fan action in the chamber, drawing air through openings placed in the sides and near the center of the chamber. On the outer end of the spindles, at B, are keyed pulleys for driving by belts, the spindles and their arms and pulleys being quite free and independent of each other to turn in reverse directions. One of the spindles at K, has a worm engaging a wheel, and working the vertical shaft, L, which drives at a given speed the automatic feeder, M. By means of driving belts on the pulleys the spindles and their arms are revolved in reverse directions at any suitable speed for the material to be crushed. The material falling into the chamber from the automatic feeder is struck by one of the arms (owing to the angle of its face) into the path of those revolving in the reverse direction, and is by them, for the same reason, immediately returned; thus it is with great force struck to and fro from arm to arm until reduced as fine as required. There is, therefore, no grinding action, the crushing being done entirely by percussion or impact, but without centrifugal force. This is the whole process of crushing. The fineness of the material leaving the machine is regulated not by sieves in the ordinary way, but by the current of air, which immediately carries off all particles light enough for its force to suspend, and the force of this current can be accurately adjusted by closing or opening the apertures in the casing. The current in the machine is sufficient to carry the crushed material up 10 or 20 feet of pipe to another chamber, the height of which column of pipes also regulating the size of the particles delivered, different sizes being delivered at various levels if required. It will thus be seen that the machine is extremely simple; complete in itself and self-contained; there is very slight wear and tear; and great saving of power, there being no grinding action or friction between the parts of the machine, and the crushed material leaving the machine immediately in the state required, giving place to fresh crude stuff. Although very recently introduced, several of these machines are already in use in a cement factory, where they are doing good work. Being applicable to the reduction of any kind of material to the finest possible powder without sieving, this pulverizer undoubtedly has a large future before it.

The Cola Nut.

Sir Joseph Hooker's recently issued report on Kew Gardens contains an interesting note on the subject of the cola nut. They are the seeds of a tree, *Cola acuminata*, belonging to the natural order Sterculiaceæ. From six to twelve are contained in woody pods, from three inches to six inches in length, of which five or less are produced by each flower. Like olives, they are said to enhance the flavor of whatever is eaten after them. But their most important property is that they are said to have the power of staying, even for a prolonged period, the cravings of hunger, and of enabling those who eat them to endure prolonged labor without fatigue. In a report by Consul Berkeley, from the Gambia, some interesting facts relating to the large trade done in them in West Africa are given. The import of these nuts was, in 1879, no less than 108,000 pounds more than in 1878; while, on the other hand, the exports were also 58,000 pounds in excess. The trade in cola nuts is an attractive feature in the commerce of the Gambia. They are the product of the Sierra Leone district, and the trade in them, both at Sierra Leone and the Gambia, is almost exclusively in the hands of women, to a large number of whom it affords the means of livelihood, and in many instances the acquisition of considerable wealth. They are largely consumed by the natives of the Gambia, and are of bitter taste and produce no exhilarating effect, but are said to possess the power of satisfying for a considerable time the cravings of hunger. For this purpose, however, the nut is much less used than it is as a luxury. The trade in the article is rapidly increasing. In the year 1860 the import was about 150,000 pounds; in 1870 it had increased to about 416,000 pounds; while in 1879 it had increased to over 743,000 pounds. During the past ten years, also, the trade has spread to Central African, and even to the African shores of the Mediterranean. It is pointed out by Sir Joseph Hooker that the *Cola acuminata*, in fact, plays the same part in tropical Africa that Erythroxylon coca does in South America. The plant has been introduced into the West Indies, and it having been suggested that the nuts would be valued in the Indian Ocean, the plant has been successfully propagated at Kew, and thence has been distributed to the Botanic Gardens at Calcutta, Cambridge (United States of America), Ceylon, Demerara, Dominica, Mauritius, Sydney, and Zanzibar.—*London Times.*

The Waukegan Artesian Well.

Waukegan, Illinois, is in latitude 42° 30′ N., longitude 88° W., on a bluff 80 feet above and overlooking Lake Michigan. Settled in 1834, it was incorporated as a city in 1859. A water supply is procured from an artesian well, completed in 1875 to a depth of 1,134 feet. Rock is encountered 180 feet from the surface, to which depth the boring is cased with a four-inch iron pipe. The first pipe put in corroded and was replaced in 1881.

The water will rise to 65 feet above the surface. The well discharges into a brick tank 20 feet square and 20 feet high, built half above and half below the surface of the ground, on the highest land in the city. The supply is copious and constant.

From the tank it is distributed by cast iron pipe, of which three miles, mostly of six inch diameter, are laid, with fifteen fire hydrants.

The population in 1880 was 4,031. The daily consumption is not stated. The yield of the well is in excess of the present demand. The cost of the well was $3,350.