

# SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. L.—No. 3.  
[NEW SERIES.]

NEW YORK, JANUARY 19, 1884.

\$3.20 per Annum.  
[POSTAGE PREPAID.]

## APPLICATION OF ELECTRICITY TO TUNNELING.

The progress that has been made in recent years permits now of executing the most varied works, thanks to the transport of motive power by means of dynamo-electric machines. For the piercing of subterranean galleries in mines, in tunnels, etc., the new process is called upon to render the most eminent services and suppress those cumbersome or too primitive apparatus that we have hitherto been obliged to employ.

As regards boring, certain rocks present great difficulties, and for this reason the systems adopted differ according as the galleries are to be opened through crystalline or non-crystalline or refractory rocks. The first include quartz, granite, and limestone; the second, clay, chalk, coal, etc.; and the third, porphyry and hard rocks.

In cases where the rocks are intractable and refractory it is necessary to have recourse to explosives, and to drill blast holes, which are then charged in different ways. The others may be attacked with iron or steel tools, such as the pick and *trivellaine*.

When it becomes necessary to use powder, holes have to be drilled two to four centimeters in diameter and from 0.3 m. to 1 m. in depth, into which are introduced cartridges that are afterwards ignited by a fuse. In order to form these holes recourse is had to a steel jumper and a hammer. In measure as the work goes on the hole is filled with sand moistened with water. Finally the contents are removed with a scraper, the cavity is dried with oakum, and the cartridge is introduced and rammed down with clay. Formerly the primer was pulled out by means of a string, but as this was capable of occasioning accidents, it has for a long time been customary to employ a slow match so as to give the workmen plenty of time to get out of the way after it has been lighted. For tamping, it was formerly the practice to use a hollow tamping bar, which permitted of the passage of the fuse through it without compression. At present, operations are much simplified by the use of compressed powder, which is to be found in the market in ready-made cartridges. The quantity of powder to be used is from six to seven kilogrammes per cubic meter of quartz to be blasted.

For refractory rocks dynamite is much better, but costs more. According to circumstances, we employ three numbers of this, which differ in their composition. The first contains 75 per cent of nitro-glycerine; the second, 55 per cent, and the third, 40 per cent. We may also use gummy dynamite; which contains as much as 95 per cent of nitro-glycerine. By these means we not only obtain a fracture, but the rocks are shivered to atoms and may therefore be more quickly removed.

When it is desired to drill sloping holes rotation is substituted for percussion, and then the tool used is a sort of pipe that carries at its extremity a ring provided with steel teeth. But this process is extremely slow, and the diamond drill answers much better. This consists of a steel tube whose terminal crown is armed with teeth made of black diamond. The debris removed pass through the central aperture, and the desired result is attained much more quickly.

In drilling slanting blast holes it is necessary to measure by eye the line of least resistance in order to determine the quantity of powder to be used in cases where granitic rock is being operated upon. For lines of least resistance of 0.6 m., 0.9 m., 1.2 m., and 1.5 m., the charge should be respectively 102, 378, 906, 1,750 grammes. In sum, the charge should be approximately equal to half the cube of the line of least resistance expressed in decimeters.

In horizontal galleries the work begins by an excavation, and above this the blast holes are drilled.

Numerous systems of rock drills have been employed, and up to the present time they have been run with compressed air. One of the principal is that of Dubois Francois, in which the rotation of the drill, instead of being continuous, is made alternating by means of a ratchet wheel and clicks. For excavating the shafts which permit of descending to the point where the subterranean galleries are to be opened, the same processes are employed, the rock being cut out in the center and blast holes being drilled all around.

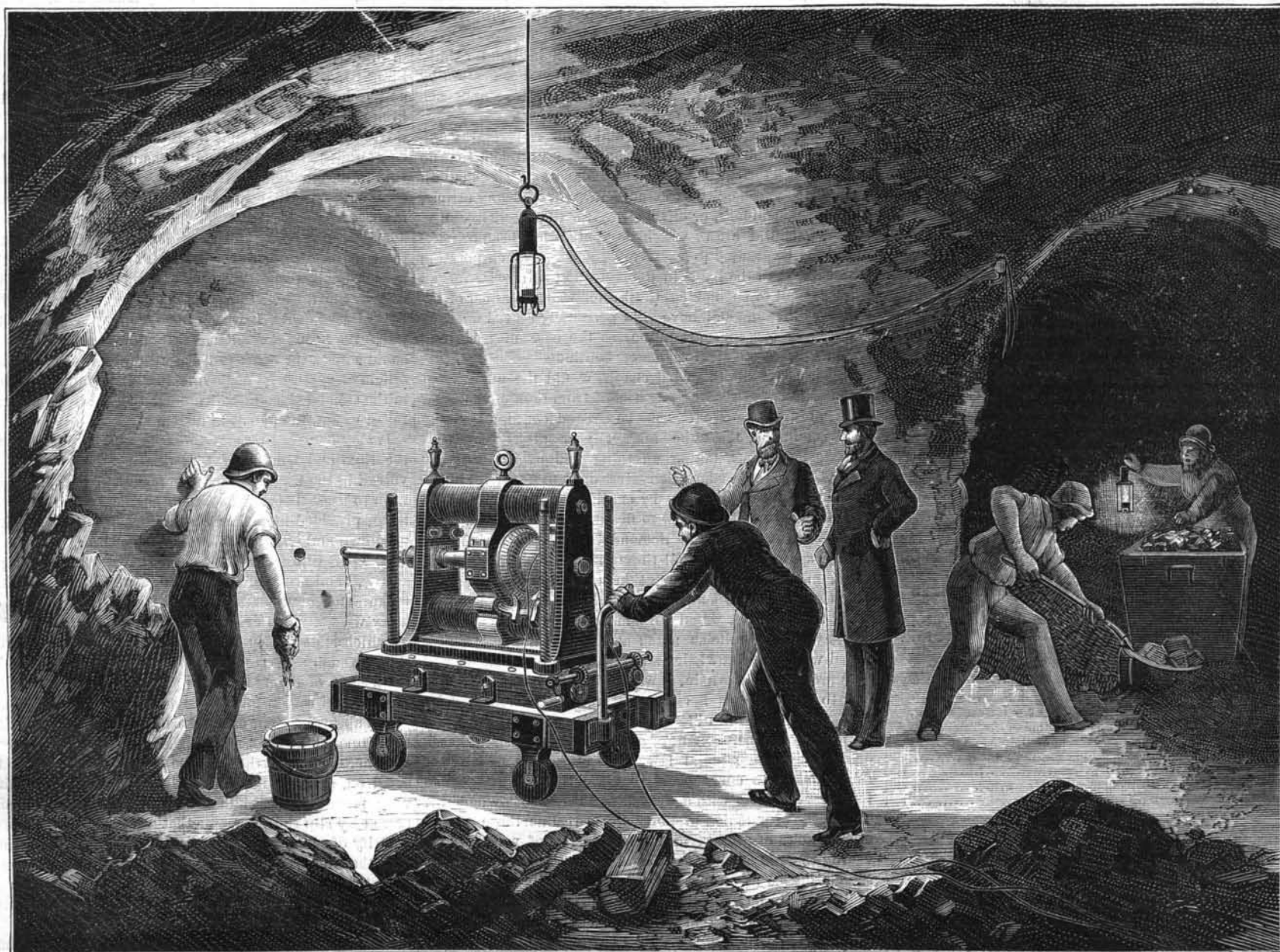
Rock cutting, which is employed only in large exploitations, is performed by rock drills—apparatus which move

on rails and which are provided with a revolving toothed wheel. Of these machines, which are capable of operating only in a gallery that has already been commenced, one of the principal is Winstanley's. These apparatus yield especially important results in cases where soft strata are operated upon; as for example, in such work as that of the Channel Tunnel, where the density of the material is scarcely greater than that of Stilton cheese. But machines of this kind are always cumbersome, and their starting gear quite complicated. By the use of electric processes the results obtained are more satisfactory from every point of view.

The accompanying engraving shows how a dynamo machine is employed for drilling blast holes. The apparatus is mounted upon a base provided with wheels, and, in a well conducted exploitation, these latter are placed upon rails which are laid in measure as the work progresses. The base carries four threaded uprights, which pass through the lower part of the frame, so that the machine may be firmly fixed by nuts and raised by wedges to variable heights. To the axis of the machine there may be fixed a steel drill or other boring tool, which is set in motion by the motive power from a generating machine outside of the gallery, and connected with the other by electric conductors. This is, as may be seen, a transportation of power to a short distance by means of electricity.

At the International Exhibition of Electricity, in 1881, an apparatus of this kind was shown by Mr. Taverdon. In sum, electricity now permits of doing away with apparatus run by steam or compressed air, and gives us machines that are much less cumbersome and that are consequently capable of being easily managed, a thing that is of great importance in mining operations. The use of electricity will prove very economical when the motive power can be furnished by any waterfall in the vicinity of the scene of operations, and a complete illumination of the works may be effected by means of an electric distribution furnished by the same generating machine that actuates the apparatus employed for drilling.

—*La Lumière Electrique.*



APPLICATION OF ELECTRICITY TO TUNNELING.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors. PUBLISHED WEEKLY AT No. 261 BROADWAY, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included. \$3 20 One copy, six months postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 261 Broadway, corner of Warren street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year postage free, on receipt of seven dollars. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 261 Broadway, corner of Warren street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, \$5.00 a year, sent prepaid to any part of the world. Single copies 50 cents.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 261 Broadway, corner of Warren street, New York.

NEW YORK, SATURDAY, JANUARY 19, 1884.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as 'Alaska volcano and tidal wave', 'Microbia, action of metals upon', 'Naturalist Club of Victoria', etc.

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 420,

For the Week ending January 19, 1884.

Price 10 cents. For sale by all newsdealers

Table listing contents of the supplement by section: I. CHEMISTRY, II. ENGINEERING AND MECHANICS, III. ARCHITECTURE, IV. PHYSICS, V. ELECTRICITY, etc.

THE NULLIFICATION OF THE PATENT LAWS.

It is a common averment of inventors that in the absence of a reasonable hope of substantial reward, made possible by the exclusive control of their inventions as guaranteed by the patent laws, they would rarely have the will or the ability to devote to the practical development of their ideas the time and labor and money usually necessary for their realization.

Accordingly, to lessen in any way the stimulus which the law gives by protecting patentees and manufacturers under patent rights, is to strike at the very heart of the system as a means of encouraging useful inventions. If inventors cannot enjoy the fruits of their labors in this direction, they will naturally turn their thoughts into other channels, and that would be equivalent to a suspension of all progress in American arts, and our speedy decadence as a manufacturing nation.

There would be little need of reciting undisputed truths like these, if the urgency of private interests did not continually threaten to override public interests, and the desire to gain favor with local powers induce legislators sometimes to act without due regard for the larger interests of the nation.

Under the guise of amendments looking to the correction of real or pretended evils in the working of the patent laws, Congress is annually beset with bills that would practically nullify the most beneficial features of the patent system. Not the least dangerous of these attempts to break down the legal safeguards of the rights of patented property are those which would make a very elastic and undeterminable "good faith" a pretext for invading the rights of patentees.

"A bill to provide for the protection of bona fide manufacturers, purchasers, venders and users of articles, machines, machinery, and other things for the exclusive use, manufacture, and sale of which a patent has been or hereafter may be granted."

Assuming that the existing laws are inadequate for the protection of the parties described, nothing would seem more fair and reasonable than the enacting of a law to that end. Unfortunately it is not that end, but the reverse which the bill in question would secure.

In all sincerity, the only man who can manufacture a patented article in good faith is he in whom is lawfully vested the right to manufacture it, as provided by the patent laws. Whoever has not properly acquired such right, or has not substantial reasons for believing that he has lawfully acquired it, cannot possibly proceed in good faith to manufacture an article presumedly the exclusive property of another.

In the face of this obvious truth the bill in hand calmly bases good faith on the absence of a written notification by the patentee of the existence of the patent.

"Be it enacted by the Senate and House of Representatives of the United States in Congress assembled, that no person, corporation, or joint stock association, who shall in good faith purchase, use, manufacture, or sell any article, machine, machinery, or other thing for the exclusive use, sale, or manufacture of which any patent has been or hereafter may be granted to any person, persons, or corporation whatever, shall be liable in damages and otherwise for an infringement of such patent until after written notice of the existence thereof shall have been personally served on such person, persons, or corporation, as the case may be, and such infringement shall thereafter continue."

Under a law like this what chance would the majority of patentees have of reaping any benefit from their inventions? A string of pirates from Maine to Oregon could, separately or in collusion, flood the market year after year with pirated inventions, taking anything and everything they chose, and yet never lay themselves open to a suit for damages or transgress the law by continuing to manufacture after being formally warned to desist.

What would be thought of a legislator who should seriously propose a general law exempting from penalty for robbery all who could plead that the rightful owner had never served them with a written notification of ownership? The rights of patented property are as real as those of any other species of property, and the injustice of wantonly invading them is as clear as in any other case.

Scarcely less fatal to all that is valuable in the patent laws are such measures as are proposed in House Bills numbered 311 and 419. The latter provides that "hereafter in any suit brought in any court having jurisdiction in patent cases for an alleged use or infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant in the suit purchased the same in good faith for his own personal use from the manufacturer thereof, or from a person or firm engaged in the open sale or practical application thereof, and applied the same for and to his own use, and not for sale, if the plaintiff shall recover a judgment for five dollars or less as damages, the court shall adjudge that he pay all costs of suit; and if the plaintiff shall not recover the sum of twenty dollars or over, the court shall adjudge him to pay all his own costs, unless it shall also appear that the defendant at the time of such purchase or practical application had knowledge or actual notice of the existence of such patent."

The first section of No. 311, introduced by Mr. Calkins, of Indiana, is substantially the same as the foregoing, but the second goes further and provides that at the commencement of the suit the plaintiff shall give bond to pay all costs and attorney's fees adjudged against him; and if the defendant shall finally prevail, the court shall allow costs and a sum not exceeding fifty dollars for counsel fees to the defendant.

Bearing in mind the fact that a very large proportion of all patented articles are sold for less than twenty dollars, it goes without saying that a law like either of those we have cited would deprive a very large class of patentees of any hope of profit from their inventions. With such marked and positive discrimination against them in the courts, not one patentee in ten could afford to defend his rights against infringement.

Let the reader run over in his mind the all but endless list of articles of utility, convenience, comfort, and adornment, not exceeding twenty dollars in price, that go, for example, to the furnishing of his home; add those used in the construction of the house or employed in making its furniture; add the multitude of patented implements, machines, and materials used in the production and marketing of the daily food supplies of the table, by the various manufacturers of textiles, clothing, and other necessities, conveniences, and luxuries, of less than twenty dollars cost, that help to make modern life what it is.

Review in short the entire range of the useful arts, and note how largely they produce or employ patented articles and processes that would be practically outlawed by the twenty dollar test, and then try to estimate the injury that would fall upon our productive industries in consequence of depriving such properties of the protection which the law now properly affords.

And what excuse can be given for the proposed invasion of property rights and disturbance of legitimate enterprises? Simply that misinformed, careless, or designing purchasers and users of patented articles improperly obtained have been subjected to inconvenience and loss through suits for infringement at the hands of the rightful owners. In some cases unquestioning good faith has no doubt brought hardship to unintentional infringers; but their loss is as nothing compared with that which would certainly accrue to equally innocent patentees through the operation of the proposed amendments; and the wronged patentees would not have the easy means of protecting themselves that the infringers now have by exercising due caution with regard to what they buy and use.

It may be urged that the innocent purchaser cannot afford the time and trouble of investigating the legal rights involved in the thousand and one patented inventions he may wish to use. It is not necessary that he should investigate them, provided he makes it a rule not to buy such things of unknown and irresponsible sellers. Such reasonable caution on the part of buyers would soon spoil the trade of "patent sharps," and prove of immense advantage to all legitimate manufacturers under patent rights, while practically doing away with any real evils in this connection, the correction of which is popularly demanded.

Yet absurdly, even outrageously, unjust and impolitic as the proposed measures may be, they are before Congress; and there is danger that, in the multiplicity of bills to be acted on, and through the skill with which their mischievous measures are hidden under a plausible phraseology, there may slip through some that shall grievously affect the security of patents and manufacturers' rights under them.

In the emergency it would seem highly desirable that our inventors and manufacturers should impress upon their senators and representatives in Congress the importance of the issues at stake and the need of watchfulness.

A sufficient number of well put and well directed communications and remonstrances now may prevent much mischief by and by.