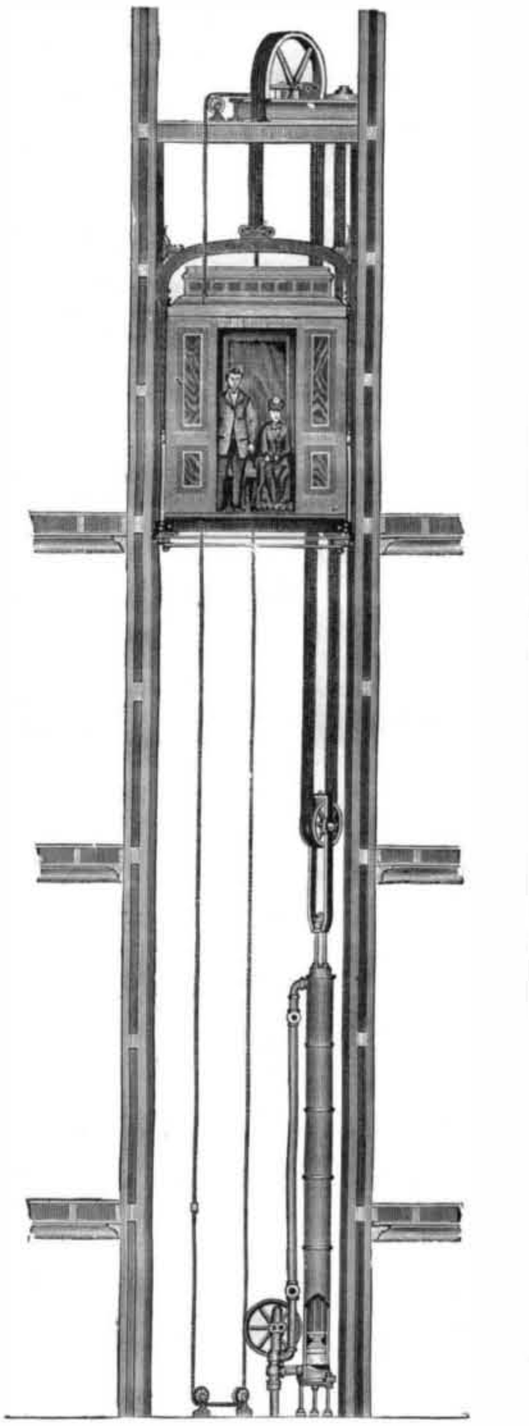
AMERICAN INDUSTRIES.—No. 71.

THE MANUFACTURE OF HYDRAULIC AND STEAM SAFETY HOISTING MACHINERY.

The most eligible building sites in our large cities now command almost fabulous prices. The figures paid for a small lot on which to erect a warehouse in some parts of this city are equal to a very respectable fortune. On this account owners are generally putting up taller buildings, or changing those already erected, so as to give additional stories above the roofs of old-time structures. Thus, in New York city and some of the other large business centers of the country, the available space for offices, etc., is being doubled in a manner which would have been deemed entirely useless twenty years ago; it being hardly a stretch of language to say, as we now sometimes hear, that the city is being repeated in miniature in the clouds. And this has been made possible as a consequence of the introduction of improved elevators. By this means quick and convenient access is afforded to the several floors of a building, without calling for the loss of time and severe labor required to mount long flights of stairs. The devices by which this end has been attained are now represented by a complete system of machinery, brought to its present state of absolute safety, ease of operation, and thorough efficiency, through a long



SECTION OF ELEVATOR.

course of close observation and careful experiments. Accidents entailing loss of life or making cripples were in former years of frequent occurrence from the use of the common factory elevators, or hoists, which have been employed for generations. When builders, therefore, in their efforts to meet the modern demands, began to introduce passenger elevators in high edifices, it is not strange that they should have met with strong opposition. It was at first common to hear people say that they "would not trust their lives" in them. But the urgent necessity for such facilities has called forth a corresponding activity on the part of inventors and manufacturers, and the result is that the old prejudices have been almost entirely eradicated, as their causes have been completely removed. The improvements made in response to this demand have also been widely beneficial to the entire class of factory operatives, as employés now have no excuse for using the frail and dangerous hoisting machinery which was formerly the occasion of so much peril to life and limb.

Among those who first appreciated the importance of this matter, and bent their efforts to obtain a practical success, were the members of the firm now constituting the pioneer house in the business in the United States, Messrs. Otis Brothers & Co., of New York. Their establishment at Yonkers, for the manufacture of all that pertains to the erection of standard hydraulic elevators, with safety hoisting machinery of every kind, furnishes the subject of our leading illustrations this week, in connection with which, also, we give views of three prominent structures, conspicu-

MORSE BUILDING.

ous even in New York for their architectural features, in which these elevators are employed—the Boreel and the Morse buildings (used mainly by banks, insurance companies, and for suites of offices) and the New York Post Office.

The factory at Yonkers, a good illustration of which is shown on the first page, occupies a ground space of 200 feet square. It is nearly thirty years since the Messrs. Otis Brothers commenced the manufacture of hoisting machinery, and they at an early day experienced the difficulties so commonly met with in making improvements or getting uniform work where one has to depend upon varying degrees of skill and thoroughness, or insufficient appliances, in several different shops. They have, therefore, combined in this one establishment all the facilities which their long experience has suggested as necessary in every department of the business. Their workmen have been especially drilled in this specialty, they use no low-priced, poor quality materials, and all their productions have that thorough adaptation of parts, careful adjustment, and uniform strength which have obtained for the Otis elevators so large a share of popular favor through so many years.

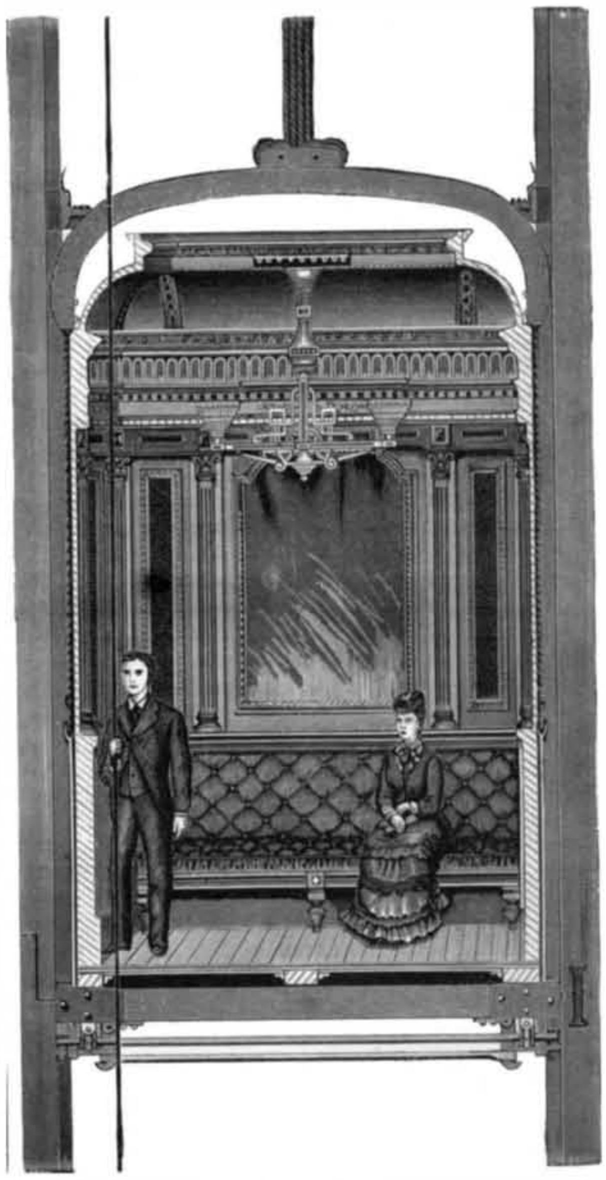
In the view given of the engine erecting room we have a

NEW YORK POST OFFICE.

representation of only one of ten different rooms in which the work of this department of their business is carried on. The variety of the machine work called for is very great, as, beside the numerous different constructions of hydraulic and steam elevators for hotels, offices, mercantile buildings, and residences, they furnish elevators and hoists for warehouses and factories, furnaces and mines, winding engines for inclined planes, screw and gear combination lifting powers, with many special modifications of engines and appliances to meet the demands for all kinds of service. In this work they endeavor to make each piece of every machine a duplicate of the corresponding piece in all similar machines, so that when a particular part may need replacing from wear or injury no delay or trouble need occur. So thorough, however, is the workmanship, so well adapted the strength of the different parts to do the work required of them, and with so little friction, that the instances are comparatively few where an elevator needs any repairs in the first five years, while many of them run for a much longer period in as good condition as when first started.

The testing room, shown at the bottom of the page, gives a view of the operations in a department of the utmost importance as affects both the safety and durability of all kinds of hydraulic hoisting machinery. All the pipes and cylinders are here subjected to a hydraulic pressure of much greater severity than they will ever be called upon to bear in actual use, and the gates and valves are carefully tried to see that they fit accurately and work smoothly and with precision. None of the machinery furnished by the firm is ever allowed to leave the establishment until it has passed this ordeal.

The principle on which the hydraulic elevator is operated will be readily understood from the section plan herewith.



HOTEL ELEVATOR.

The carriage is suspended by wire ropes, four or six in number, which pass over a fixed pulley above the highest point of the lift, and thence under a pulley connected with the piston rod of an upright cylinder, with which is a weighted block; the ends of the wire ropes are permanently attached at as high a point as the fixed pulley, but he weight of the car is about evenly balanced by the weighted block and the piston. The power required to make the lift, and the ease with which the speed of the elevator is regulated, both ascending and descending, may be readily understood with a knowledge of the simplest principles of hydraulics. The piston being at the top of the upright cylinder, and the car at the bottom of the shaft, the pressure of the water on the top of the piston, either from a street main or a tank on the roof, forces the piston down and causes the car to rise, the water in the cylinder under the piston being allowed to flow out at the bottom at the exact rate which it enters at the top. In this way the air pressure, as well as the weight of a column of water of the diameter of the large cylinder, and as high as the tank on the roof, or its equivalent in the head from which it is supplied, is exerted in lifting the load. The cylinder, however, is always full of water, the escape valve at the bottom being open only when the piston is falling and the water coming in at the top; when the car is going down and the piston rising the escape valve at the bottom is closed, and the water is simply forced thereby through a circulating pipe from the top of the cylinder into an opening at the bottom, thus only being transferred from above to below the piston, and the car and piston cannot move any faster than the gates and valves will allow this flow to take place. These valves can be fixed so that the speed at which the car is to move can be exactly regulated, independent of the will of the operator in the car, who, by opening and closing them with the hand rope, governs the running. As a further provision, however, against too rapid movement, either ascending or descending, a governor is run by the passage of the elevator which can be set so as to regulate the speed as desired, and the maximum speed desired by the proprietor can in no case be exceeded.

What this rate shall be is to some extent a matter of choice with users of the Otis hydraulic elevator, for while many other machines are so made that they must be run slow, the Otis elevators may be readily run as fast as 250 feet a minute, and everything work smoothly, without jar or friction, and with no excessive wear on any of the parts.

Of course, the size of the cylinder and the head under which the water is supplied to it must determine the maximum load. The usual arrangement for passenger elevators is to have the motion of the car only twice, or at most three times that of the piston. This reduces the friction and the wear to a very small item as compared with what it is when the car is made to move from eight to twelve times as fast as the piston, as is the case in some of the elevators used. The cylinders are of cast iron, three-fourths of an inch thick, bored out true and smooth, and, from their upright position, they experience but slight wear, and no lodging place is afforded for sand or gritty matter in the water to make trouble with the packing.

No higher commendation, indeed, could be given for any system of elevators than was awarded this machinery by a board of United States officers which reported in favor of their adoption in the Government buildings at Chicago. In their report they say:

"One source of accidents, which we are told are the most frequent in elevators with the usual steam-hoisting drums, and are very dangerous, is the holding up of the car while descending, caused by obstructions which may be accidentally placed so as to project beyond the floors at the doors of exit, perhaps temporarily holding the car up while the engine continues to run, thereby unwinding the ropes until they become slack, leaving the car entirely without their support; then, of course, when the temporary obstruction yields, the car must fall. Such an accident cannot possibly occur with the Otis machine, as the piston in the hydraulic cylinder is in such cases held in position by the solid column of water above and below it; consequently the ropes are kept perfectly tight under strain, and no motion of the car can take place until the car is released from the obstruction. No water can escape when the valve is set to now the car to descend, so the car must be held; and, when allowed to move, can only descend as fast as the water can pass through the pipes and valves. If the 'shipper' or starting rope breaks or becomes detached so that the valves cannot be closed by the operator in the car, the piston can only descend to the lower part of the cylinder, raising the car to the top of the lift, where it will be held safely until the rope can be readjusted or the valve be opened by hand. For the same reason the car cannot by any means be raised too high."

The factor of safety in these elevators, and this is the first condition in all devices of this class, seems to be so large that no accident can possibly happen for which the machinery will be at fault. One of the most approved forms of safety catches is provided, and the number of cables is many times greater than are actually needed. There are no cogs, racks, belts, or shafts liable to fracture, and the power is exerted in a direct up and down motion. The economy of the system is also well shown by the operation of the four elevators used in the Boreel Building, where the constant flow of business in its 150 offices makes the crowds in its halls and corridors often equal to those on the Broadway sidewalks. A pump in the basement keeps a 4,000 gallon tank on the roof supplied with the water necessary to run all these elevators, and a similar tank at the bottom receives the discharge, the same water being used over and over again, with scarcely a perceptible loss from evaporation. It is believed that from 80 to 90 per cent of the power of the water is actually utilized in these machines, and their smooth and noiseless working certainly goes to show that the amount of friction has been reduced to a minimum.

Beside their hydraulic elevators the Messrs. Otis Brothers have been for many years prominent in the manufacture of steam hoisting machinery, in which they have introduced many improvements, covered by a wide range of patents. These machines, as they now offer them, represent the results of over twenty years' investigation and experience, and their universal or factory elevator is to be found in nearly every manufacturing town in the country. They are provided with governor attachment, cut gear and pinion, safety drum grooved for wire rope, self-oiling loose pulleys and boxes, safety ratchets, wire lifting and operating ropes, with all necessary chains and connections. They do not recommend these machines as passenger elevators, giving the preference to the hydraulic system for this purpose, but in factories where a large amount of power is in constant use they are in great favor, and are employed for both freight and passengers. Where the only power needed in a building, however, is that which is required in running the elevator the hydraulic system is much cheaper, as a comparatively small pump, working all the time, will keep the tank supplied, and the elevator can at any time by called upon to lift its maximum load. Their self-oiling loose pulley, patented in 1865, has proved a most important adjunct in this branch of their business, and it has now been in use for a sufficiently long period to thoroughly demonstrate its practical usefulness. These pulleys are now used on all the hoisting machines of the firm.

These elevators are now in daily use in most of the large cities of the United States and Canada. They are at present being put in three of the most notable structures just approaching completion in New York city—the United Bank building, corner of Wall street and Broadway, the London, Liverpool, and Globe edifice in William street near Wall, and the "Post" building in Beaver street, of which George B. Post is the architect. They are to be found in most of the recently erected prominent buildings devoted to public use, or for business offices, hotels, apartments, or private residences, as well as in factories and warehouses, and their simplicity, economy, and efficiency, united with the growing public conviction of their entire safety, render it extremely probable that the field of their future use will be rapidly and greatly enlarged.

The New York office of Messrs. Otis Brothers & Co. is at No. 348 Broadway.

Danger of Lightning from Telephone Connections.

The Cantonal Government of Zürich, having been applied to by a telephone company for permission to fix the supports of insulators on the tops of certain public buildings, applied to Prof. Kleiner for an opinion. The following is a summary of the chief points in his report:

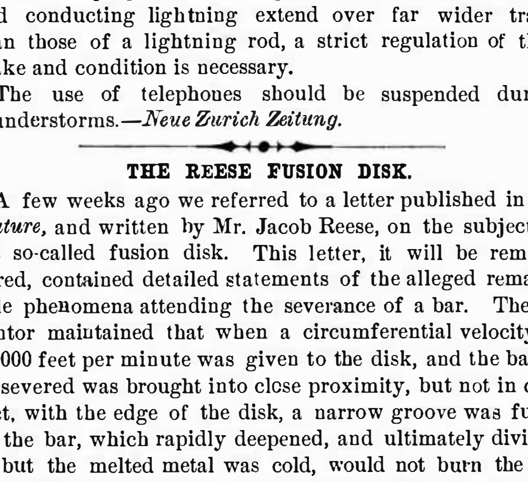
1. The danger of lighthing in houses over which telephone wires are stretched is not increased, but lessened, if the total conductivity of a wire is approximately equal to that of a lightning conductor. This condition is not always fulfilled under existing arrangements. It may be insured by very simple arrangements, such as the introduction of a special wire for the conduction of lightning wherever the number of wires of two millimeters in thickness running in the same direction is less than sixty. This should be insisted upon in all cases. Single connections running along the houses should be stronger than at present—as least as strong as telegraph wires.

2. As the properties of a telephonic plexus for attracting and conducting lightning extend over far wider tracts than those of a lightning rod, a strict regulation of their make and condition is necessary.

The use of telephones should be suspended during thunderstorms.—*Neue Zurich Zeitung.*

THE REESE FUSION DISK.

A few weeks ago we referred to a letter published in *La Nature*, and written by Mr. Jacob Reese, on the subject of his so-called fusion disk. This letter, it will be remembered, contained detailed statements of the alleged remarkable phenomena attending the severance of a bar. The inventor maintained that when a circumferential velocity of 25,000 feet per minute was given to the disk, and the bar to be severed was brought into close proximity, but not in contact, with the edge of the disk, a narrow groove was fused in the bar, which rapidly deepened, and ultimately divided it, but the melted metal was cold, would not burn the fingers, discolor paper, etc. The theory set forth was that the particles of air in proximity to the disk were propelled with a "melting velocity," and that in this way the bar was severed. We suggested that—giving all credit for sincerity—Mr. Reese was mistaken as to the action of the disk, and that it was nothing more or less than an ordinary cold saw,



except that the bar to be cut was rotated. Since writing this note we have received a piece of steel cut with the machine, and we annex an illustration of the work done, which we think—unless Mr. Reese can offer some satisfactory explanation—will prove conclusively the fallacy of all that he has advanced in this respect, as well as the very wild statement that hundreds of thousands of revolver chambers are finished off by it. The bar illustrated was cut in the manner prescribed by Mr. Reese, and with one of the machines he had supplied and received royalty for. It was found that until contact was established between the surfaces no effect of any kind was produced, but that when the disk was kept in contact with the bar, the latter was cut through in the rough manner shown in the drawing. None of the phenomena so minutely described by Mr. Reese were present, and the purchaser of the machine has been always unable to detect any indication of their existence. It will be noticed that the characteristics of the severance are: a burr around the circumference of the bar, radial lines upon the cut face produced by the hard contact of the disk, and a broken tongue of metal with sharp edges drawn out from the center. We shall be very glad to receive from Mr. Reese any explanation he may have to offer on the subject, and to give publicity to any well authenticated experiments which will serve to refute the conclusion to which the illustrations we have given incontestably point.—*Engineering.*

The Reese letter above mentioned was published in the Scientific American of April 2, 1881, and an engraving of the Reese machine was given in our Supplement, No. 260.

Correspondence.

The Reese Circular Saw.

To the Editor of the Scientific American:

Gentlemen, in your issue of April 2, I notice a very interesting communication from the pen of Jacob Reese, Esq., on the phenomena of his metal cutting disk, and after stating that a person may put his "hand in the stream of white and apparently molten sparks without being burned, and even white paper without discoloration," etc., while at the same time the sparks thrown into the atmosphere "more than five feet burn like a hot poker," he calls upon French and German scientists to explain "so wonderful a phenomenon." It appears to me that it may be thus explained. The periphery of the disk traveling through space of 25,250 feet per minute coming in close contact with a metal bar traveling in an opposite direction creates heat by friction sufficient to ignite the oxygen of the atmosphere, which is the supporter of heat, while nitrogen is the exact opposite. The intense heat produced creates at once a vacuum, and the air rushes in (or is forced in by atmospheric pressure) to fill up the vacuum produced, thus supplying a rapid and constant flow of oxygen, which is as rapidly consumed, so that the space below the point of fusion is largely nitrogen, which is heat extinguishing, so that the molten sparks are caught in a heat-extinguishing atmosphere and cool instantaneously.

The sparks, however, that happen to fly off instantly into the natural atmosphere come in contact with oxygen in its flight, which supports their heat until their velocity is so diminished that oxygen ceases to be its supporter.

For example, electricity is not heat, nor the supporter of heat, but in its rapid flight through the atmosphere, compressed at about fourteen pounds to the square inch, the friction produced ignites the oxygen, before which the most obdurate metals yield. Again, heat the end of a bar of iron at a forge or furnace to a white welding heat, and while at this high heat at once place it in a cold blast from a blower or bellows, which gives a large flow of oxygen, intensifying the heat, and the iron is not only fused but runs down into a pile, appearing like slag, the principle being substantially the same as the forcing a blast of air through molten iron metal and so intensifying the heat as to burn out the carbon as well as base metals and minerals, this being the first step in the Bessemer process; and it matters not whether the heated metal is forced through the atmosphere or the atmosphere through the metal, the result is the same. Whether you swing the firebrand in the air or blow it with the bellows the result is the same; either intensifies the heat.

Mr. Reese claims that the metals do not touch each other in the fusing process. Well, if he makes this statement on the principle that no atomic particles touch each other, I have no argument to offer. But if he claims that the cutting or rotating disk is not affected by the cutting, *i. e.*, worn, I must decidedly take exceptions. If Mr. Reese will turn or dress the face of his disk flat, so as to present cutting or sharp corners, and then put it into use, he will find that the corners are soon worn rounding, and that in a short time the face will become rounding also, and the disk burr on its edges, so that it will make a kerf a full one-sixteenth of an inch wider than the thickness of the disk.

He may claim that this is caused by the heat fusing the edge of the disk, but this theory is very questionable, because if the disk fuses a particle it must of necessity melt away very rapidly on account of its great velocity.

But such is not the case, for the disk wears very slowly, for the simple reason that nearly its entire periphery is traveling in the air without heat enough to create combustion with the oxygen. Another evidence that it comes in direct contact with the metal to be cut is proven in the fact that while running in open air but little power is consumed in comparison with the power required while in the act of severing a bar of metal, and the larger the bar to be severed the more power is required. I have had experience in severing metal with rotary disks, and think that I know something about the principle. In 1870 I suggested the adoption of toothless disks to the manager of Messrs. Jones & Laughlin, at the American Iron Works, which was successfully adopted in cutting large bars of iron, and I think this was the first ever used in Pittsburg. At that time I recommended 23,000 feet per minute for the rim of the disk to run. Since that time they have come into general use.

J. E. Emerson.

Professor Bell's Reception.

To the Editor of the Scientific American:

In a recent issue of your paper you notice a "reception given to Professor Bell by the Mayor and Corporation of Brantford, England." For the credit of our little city, permit me to correct you. It was Brantford, Ontario, that tendered Professor Bell the reception. It was here also, I understand, that Professor Bell's first experiments were made, and Brantford claims the parentage of the telephone.

W. T. Mair.

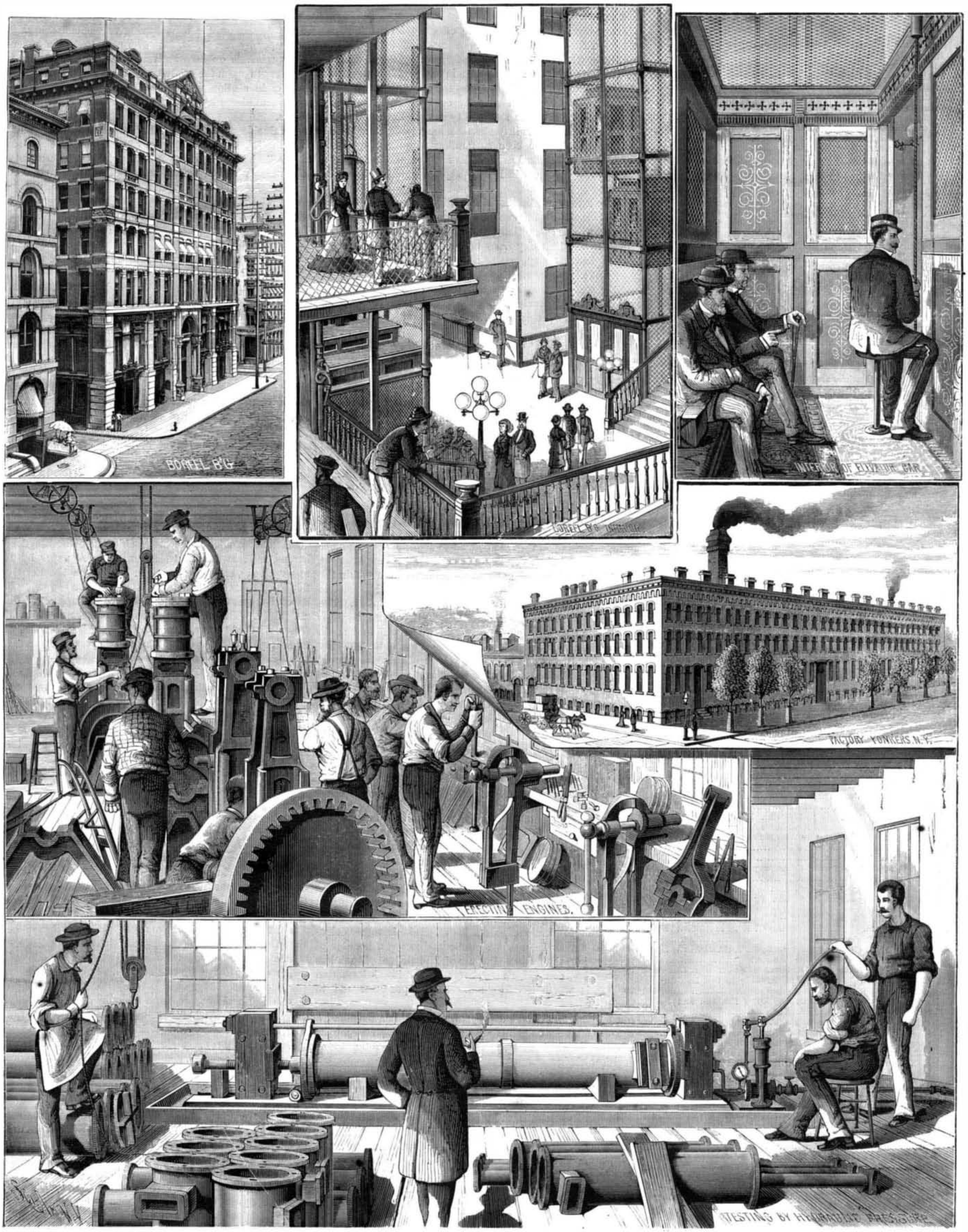
Brantford, Ontario, March, 1881.

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. XLIV.—No. 16. [NEW SERIES.] NEW YORK, APRIL 16, 1881. [$3.20 per Annum. [POSTAGE PREPAID.



MANUFACTURE OF HYDRAULIC AND STEAM SAFETY HOISTING MACHINERY.—OTIS BROTHERS & CO. N. Y.—(See Page 243.)