REPAIRING THE COOPER INSTITUTE.

So well known is the aim of Cooper Institute, and so widespread has been the good accomplished during the thirty-two years of its existence, that any statement regarding its work, except of the most general kind, would be superfluous. Founded by the philanthropist Peter Cooper, and amply endowed by him, it is devoted, with its entire income, to the instruction and elevation of the working people of New York city, irrespective of age, sex, or condition.

The building occupies a whole block, being 86 feet on Seventh Street, 155 feet on Third Avenue—the front shown in our frontispiece—143 feet on Eighth Street, and 195 feet on Fourth Avenue. Originally there were but five stories and a basement, the latter containing the large lecture room, which is 125 by 82 feet and 21 feet high; but a few years since, an additional story was placed over the entire building, two stories were raised over a part of the Third Avenue side, and the southern end (to the left in the engraving) was raised to a total of eight stories. This additional load, together with errors in the design, made necessary the extensive repairs which have been in progress for several months, and which are now nearing completion.

The piers supporting the walls facing the avenues were placed beneath the center lines of the window spaces of the third or reading room story, and also beneath the piers of the third story. The piers under the window spaces thus had but little or no load to carry beyond their own weight, and, as a natural consequence, the lintels and window sills were fractured by the strains produced by the bearing piers moving downward, thereby causing an upward reaction through the line of the intermediate ones, or those having no load. To remedy this defect, which is by no means an uncommon one, even in buildings of recent date, all the bearing piers were removed, and others were built having a larger section and an increased area of foundation, while the flat lintels of the second story were replaced by segmental stone arches. During this work the walls were supported upon shoring, as shown clearly in the engraving. Beneath the lower portion of each of the third story piers were placed two pairs of heavy iron I-beams 15 inches deep and two sets of heavy yellow pine timbers. The interior shores extended from floor to floor to the basement, where they rested upon a crib formed of timbers; the large foundation area thus obtained rendered easy the adjustment of the shores by the screws. Outside there were two shores to each needle, and where there were vaults under the sidewalk, the arches were centered, and held by shores. Struts were wedged across the lower part of each window space.

The ceiling of the lecture room was supported upon three rows—parallel with Fourth Avenue—of cast iron columns, 12 inches in diameter, spaced 18¾ feet apart; at right angles to the rows, the columns were 18 feet apart, and the outer rows were 20⅔ feet from the piers. Upon adjacent columns, and in a direction perpendicular to the avenue, were two brick arches (shown in Fig. 9), the space between which was filled in; the lower arch was designed to carry the ground floor, and the semicircular one served to distribute the weight of the dividing walls and the piers and columns which extended upward through the several stories of the building to the columns. The piers upon which the outer line of arches rested were so narrow that the line of thrust fell outside the base, and the pressure was not transmitted to the retaining wall, owing to the height at which the arch joining the wall and piers was placed. As repaired, the foundations of the piers are 10¾ feet square, and the arch is so curved, as shown in Fig. 8, which represents the lecture room finished, with the exception of the floor, that the line of thrust falls well within the base. In both the new and old constructions, Figs. 8 and 9, the thrust is indicated by the dotted lines. After this row of arches had been completed, the upper walls were found to be too weak to carry the load; the arches were then centered, and were supported by vertical and radial shores, while the adjoining ones were put in. All of these arches are of cut stone.

The columns were originally supported upon foundations consisting of an upper granite block 2 ft. square by from 11 to 12 in. thick, and by an under block, which in several instances was divided, 4½ by 4⅔ ft., and 16 in. thick. The upper block is now 4 ft. 8½ in. by 4 ft. 10½ in., and 1 ft. 10 in. thick; the lowest course of concrete is 8 by 9 ft. (The entire building rests upon sand, and in every case the foundations of the piers and columns have been increased in area and extended deeper.) The columns are of cast iron, 16 in. in diameter.

The plates and wedges used with the columns are shown detached and separated in Fig. 5 and in position in Fig. 6. Wedging similar in principle to this, but in form corresponding with the situation, was used at the front walls for the removal of the shores and elsewhere in the building. The facing surfaces of each plate are recessed to receive the wedges, which are sharp and planed true; a slight tap with a small hammer upon each wedge successively brings each to a bearing, and insures an even distribution of weight. The plates were bedded in pure Portland cement. The columns in the reading room in the third story were directly over the outer rows in the basement, and that portion of the room between these columns—37 ft. wide and 90 ft. long—passed through the third and fourth stories. The ceiling over this space, Fig. 2, was held by girders supported at the end upon columns and at the center by rods from the roof. These girders at the ends of the reading room, as shown in the cross sectional view, Fig. 4, and at *b* in Fig. 2, were made up of two deck beams each 7 in. deep, put bulb to bulb and held by bolts through the flanges. A permanent deflection averaging about 2 in. had taken place. These are reenforced by the placing of two heavy I-beams, one at each side, as shown in the section, Fig. 3, and at *a*, Fig. 2. To relieve the roof a center row of columns has been erected. While the repairs in the reading room and the strengthening of the walls in the lower stories were going forward, the central portions of the floors were cut away. The columns in the reading room were carried by shores extending to the basement floor. About the upper part of the column were firmly bolted the carefully fitted sections of an iron jacket shaped as shown in the upper part of Fig. 7; the shores bore against the extended under side of this jacket, and held the column during the building of the new wall.

In the foregoing we have attempted to describe only the main features of the principal changes, and to briefly mention the causes making them necessary. This building was the first one in which iron was used extensively; and owing to the experimental condition in which the use of this material then was, there crept into the design errors in form and proportioning which the experience of later years enables the builder to steer clear of. All such parts have been either entirely removed and rebuilt, or have been strengthened. During the repairs, the load in every case has been carried to the basement by shoring always placed vertically in line, thereby obviating the risk of having an unusual weight brought upon the floors. All the division walls and the columns have been carried up vertically in line with the basement columns, and have been made of such size as to insure ample strength.

It is estimated that these repairs will cost in the neighborhood of $250,000, the building costing originally $650,000; this expense thus far has been borne by a few gentlemen whose names we are not at liberty to give, but to whom all praise is due for their generous and unostentatious support of so good a work. The architect under whose direction the work has been most successfully prosecuted is Mr. Leopold Eidlitz. Mr. J. H. Smith is the builder, and Mr. Isaac Whitenack, the foreman of masons.

PHOTOGRAPHIC NOTES.

Increasing the Sensitiveness of Orthochromatic Plates.—From recent experiments described in the *Photographische Wochenblatt* by V. Schumann, and translated by the *Photographic News*, it appears plates prepared with a bromo-argentic emulsion containing also an ammoniacal solution of eosine are not as sensitive to yellow and red colors as those coated with the ordinary Eder silver, oxide, ammonia emulsion, and then dipped for two or three minutes in an aqueous solution of eosine to which a little ammonia is added. After immersion, the plates are dried and then exposed in the camera.

The pyro and potash developer is preferred, and very brilliant results are obtained when the emulsion contains bromide and iodide of silver formed simultaneously.

It is also advised not to use an emulsion of high speed, as the dipping bath then tends to fog the plate. It is probable, in photographing colored objects, the bath plates will prove to be superior, as they will render more accurately the different shadings of colors in consequence of being more sensitive to yellow.

Removing Silver Stains.—Dr. H. W. Vogel recommends the same compound used as a reducer for removing stains of silver from the hands or clothes. A few crystals of ferricyanide of potassium are dissolved in a solution of hypo, or instead a 10 or 20 per cent solution of the ferricyanide is added to the hypo, and then applied to the stains. The advantage of this solution is that it is not poisonous, and does not destroy the color of articles of clothing.

Antwerp Prizes for America.

The juries at the Antwerp Exhibition made the following awards to American exhibitors:

Diploma of Honor.—Davis Sewing Machine Co.

Gold Medals.—Westinghouse Co., general machinery; New Home Sewing Machine; Geo. Bruce, Son & Co., paper ware.

Silver Medals.—Meriden Britannia Co., metal ware; Rochester Lamp Company; Santa Maria & Co., food products; Washington Packing Co.; San Jose Fruit Packing Co.; Arpad, Haraszthy & Co., liquors.

Bronze Medal.—Seabury & Johnson, chemicals.

Honorable Mention.—Leonard & Ellis, chemicals; Mr. Cooleman, chemicals; Lloyd & Suppler, tools.

Correspondence.

A "Gateway of Knowledge."

(FROM AN OLD SUBSCRIBER.)

To the Editor of the Scientific American:

My attention has been called to the fact that this is the fortieth year of the publication of the SCIENTIFIC AMERICAN. The first paper was published the year of my birth, in 1845; and I can say that I have been one of its readers for twenty years, or since I was twenty years old. I hesitate not to say that the SCIENTIFIC AMERICAN is one of the gateways to knowledge, and the SUPPLEMENT, its near relative, I have taken from its first edition. As journals of science, they have no equals. CHAS. MCCUNE.

Decatur, Macon County, Ill.,
November 16, 1885.

An Improved Thermometer Required.

To the Editor of the Scientific American:

One of the greatest aids in medicine is the clinical thermometer. As generally used, it consists of a glass tube having a bulb for the mercury, a construction in the bore between the bulb and main tube for maintaining the index, and a bar divided into degrees and tenths, the graduation running from 90° to 110°. The index is the important point. It is usually obtained by causing a portion of the mercury column to separate from the main column or from the mass of mercury in the bulb, so that it shall remain *in situ*, and register the degree of heat of the body after it is removed from contact with the body. Great trouble is experienced in maintaining this index, and many ingenious methods have been devised to overcome the annoyance of "losing the index" by constructing, turning, or twisting the bore of the tube. The bulb may be of various shapes, as an elongated cylinder, or even disk-shaped. The glass tube may be round, oval, hemispherical, or even triangular in section. The bore of the tube may be backed with white or black enamel, and the tube over the bore may be so made that it shall magnify the mercury.

With all its improvements, however, the material of which the thermometer is made remains the same, namely, glass—the great objection to which is its liability to breakage. In spite of hard rubber cases with shoulders, metal cases with chains, and other safeguards, thermometers will break. To enumerate the ways in which they may break would be useless; it is sufficient to say that they do break, and it becomes an item of no small expense to keep one's self in thermometers.

The one who can invent and put upon the market unbreakable thermometers will not only confer a great benefit upon the medical profession, but will enrich himself greatly. Such a thermometer must be accurate in measuring temperature and in recording it, and it must be permanent, that is, always record a given temperature correctly. It need not cover a scale of more than 20°, viz., 90° to 110°, but this scale must be divided into fifths at least, and tenths, if possible. The dial or scale must be of a size that can be easily read, or, if very small, must be magnified by a lens covering it. The whole thermometer must be of convenient size and shape. It may be a moderately long cylinder, 3 inches to 6 inches by ¼ inch to ½ inch, or a disk of moderate thickness and diameter, or an ovoid not larger than a robin's egg. The mechanism, including the dial, must be inclosed in a covering impermeable to moisture, and one that can be easily cleaned, preferably hard rubber. The different expansibilities of different metals would suggest one or more compound metallic bars, tubes, or plates, straight, curved, twisted, or coiled upon themselves or corrugated, one end being permanently fixed, the other being attached to an index in such a way that there shall be no loose motion, the sweep of the index being increased, if necessary, by suitable mechanism. Hard rubber may be used in connection with metal. The steam gauge and aneroid barometer are suggestive of a form.

These remarks are presented with the hope that some person may experiment in this direction.

CHAS. EVERETE WARREN, M.D.

No. 5 Union Park, Boston, Mass.

[The above is a good suggestion, which deserves the attention of our inventors. Some of the very volatile liquids, such as ether and gasolene, might be available in the construction of a thermometer of this kind. Such a liquid might be hermetically sealed in an elastic vessel, and the expansive force generated by the heat of the body acting on the liquid could be made to operate indicating or recording mechanism.]

Buckman's Car Coupler.

In our notice of the car coupler invented by Mr. Thomas E. Buckman, of Jacksonville, Fla., in the SCIENTIFIC AMERICAN of Nov. 21, it was stated that when the cars are drawn apart—having been uncoupled—the coupler always assumes "at the instant its position for *uncoupling* automatically." It is apparent that the word *recoupling* should have been used.