MAGNETISM IN CITIES.

It has long been known that iron when subjected to repeated blows and shocks, while under the influence of a magnet, attains permanent magnetic qualities. Soft iron of pure quality is affected very little in this way, whereas impure wrought and cast irons are capable of being permanently magnetized to a considerable extent.

As early as the year 1600, Gilbert experimented in this direction by placing bars of iron in the magnetic meridian and striking them with a hammer. It would require very little imagination, therefore, to suppose that, in a busy city containing iron structures of all kinds, the latter should possess magnetic qualities, since they are constantly subjected to shocks and vibrations produced by traffic.

Such, indeed, is the case, and we propose to give here the results of a few experiments, made with the view of determining their character and extent. The results demonstrate anew the powerful magnetic inductive action of the earth, and show some curious facts. It may be well to remark that in what follows polarity is always designated with respect to the needle, the end pointing toward the north being called *north pole;* accordingly, therefore, the polarity of the northern hemisphere will be *south.*

The instrument used in these trials consisted of a surveyor's compass; the needle being about four inches long and delicately mounted, so that even very slight indications of magnetism were observed by it.

The first object investigated was the structure of the elevated railroads in New York city. For those not acquainted with them it might be well to explain that they consist essentially of wrought iron posts, or columns, which support trusses or open beams, upon which the tracks are laid.

Beginning with the posts, an examination of a large number of them showed that with very few exceptions they possessed magnetism, and that their *lower* extremities were *north* poles, without a single exception. The examination extended in various directions in the city, and posts distant seven miles from one another showed the same polarity. It was also observed. that while some gave very strong indications, others gave very little, but not one showed south polarity at the ground. So also did the cast iron foundation blocks show decided north polarity.

An examination of the superstructure showed that all vertical posts were more or less permanently magnetized, their *lower* extremities being *north* poles. Thus the cast iron columns which support the roofs of the stations showed this property to a remarkable degree, as did likewise a stove in the waiting room at the station. A screen of half inch iron rods showed the same property; here also the end of a gas pipe showed south polarity,

As regards the trusses which stretch from post to post, it was found that they were magnetized in such a manner, that their *lower* chords were *north* and their upper south poles. They constitute, therefore, long magnets with poles in the direction of their breadth instead of their length, as is generally the case. The same thing was observed on the trusses supporting the stations, which lie at right angles to the ones first mentioned.

This peculiarity of magnetization in the direction of the breadth of iron and steel bodies is a great deal more common than is generally supposed, and occurred in a case where it was least expected, as will be shown presently.

The writer's attention was next occupied by the Brooklyn Bridge; entering at the New York side, a few minutes' walk brought him to the cables on either side of the promenade. Selecting the most convenient parts of the cables, viz., the *tops*, or *upper sides*, and testing them, *south* polarity was shown in both of them. It was natural, therefore, to suppose that the Brooklyn ends would be north poles. Continuing our walk across the bridge and testing the cables at the center of the span, but also at the top, it was found that they still possessed the same polarity. At the Brooklyn end the cables showed the same indications. Struck by this apparent paradox, the idea immediately suggested itself that the cables were not magnetized in the direction of their lengths, but, on the contrary, in the direction of their diameters.

Testing, therefore, the bottom or under side of the cables it was found that in every instance *north polarity* was indicated; this was the case both on the New York and Brooklyn ends as well as in the middle, which leaves no doubt as to the correctness of the conclusion, that the cables are magnetized diametrically. Careful observation showed that the points of greatest intensity lay opposite each other in the line of the magnetic dip, about 76° in this locality. As regards the rest of the iron work on the bridge, it showed the same properties as that of the elevated railroads.

A further confirmation of this peculiarity was established by an examination of the rails in the yard at the Grand Central Depot, where they are subject to the frequent shocks of heavy locomotives. These rails are of steel, and show the greatest irregularities as regards their magnetic qualities, of which they are possessed more or less. Thus, for instance, some were found to be magnetized lengthwise; others, again, like the bridge cables, according to their breadth. In the latter case the top of the rail would invariably attract the north end of the needle, while the *bottom* attracted the *south* pole. The distance between these two positions being only four inches shows how marked the indications were, as the needle was completely swung around through an angle of 180°. This effect took place especially in the vicinity of switches, where connecting rods joined both rails. All rails free from contact, such as guard rails, were found to possess magnetism at their ends only.

The examination extended also to iron buildings and miscellaneous iron work in the city. Several buildings with cast iron fronts were examined, and showed that at the *ground* they were *north* poles and contrary at the top. Again, a beam in one of the warehouses now building under the arches of the Brooklyn Bridge was magnetized in the direction of its breadth. The Grand Central Depot consists of iron arches whose extremities at the ground are north poles.

The lamp posts about town showed marked magnetic properties, as did also the hydrants. All their upper extremities are south poles. In the case of the former, the neutral line was found to be on an average at about 12" from the ground, while in the latter it was close to it, and sometimes below. In buildings heated by steam, the radiators were found to be magnetized, with *north* polarity at the *bottom.* Instances could be multiplied indefinitely, but those mentioned will suffice to show that it would be well nigh impossible to procure a piece of iron entirely free of magnetism.

The explanation of all these phenomena is very simple when we consider that the earth is a great magnet, the south pole of which is in our hemisphere. Every piece of iron and steel held vertically will therefore have north polarity induced in its lower end, which will become permanent under suitable conditions. By referring back it will be seen that this law has been uniformly followed, since all the examples given showed north polarity at their lower ends. As regards the Brooklyn Bridge cables, the explanation for their case and similar ones is to be found in the fact that they lie nearly east and west, in other words, at right angles to the magnetic meridian, consequently the direction in which they would tend to magnetize is that of their diameter.

All these investigations are what might be called qualitative, in so far as they only show the disposition of magnetism existing in the bodies mentioned. We reserve for a future article, therefore, an account of the extent of this magnetization and the exact effects upon the needle due to these and some other causes which exist in New York city.

A BLOW AT THE INDUSTRIES OF INDIANA.

Mr. Calkins, representative from Indiana, has introduced a bill into the House of Representatives which, if it become a law, may work the most serious results upon the industries of the whole country. This bill (H. R. No. 311) provides that in cases where parties are sued for infringement of patents, the plaintiff or patentee shall pay the costs of the suit, if the damages awarded are less than twenty dollars.

The effect of such a law would be to almost completely counteract the object for which patents are issued. It must be evident that by far the larger number of patents issued are upon articles whose entire value is less than twenty dollars. In every case of a suit, therefore, the burden of costs would rest upon the patentee. He would thus find it cheaper to allow the infringement rather than prevent it; or in other words, his patent is less than worthless.

Let us see the effects of this upon Indiana alone. Her population is at present 2,000,000, and while in 1860 the number of her manufacturing establishments was estimated at 5,500, it is at present estimated at 12,000. Now by referring to the Patent Office reports of inventions it would be almost impossible to mention a single industry which is not in one way or another protected by a patent, and there have been issued to citizens of Indiana alone between 6,000 and 7,000 patents. which are still in force. The injury which Mr. Calkins would work on his own constituents might amount to large sums.

What is true in the case of Indiana holds good for the rest of the States. It is due, largely, to the influence of our patent system that our industries have attained to their present growth, and anything interfering with the former will certainly militate against the latter. "It is almost self-evident," says an able American author, "or at any rate susceptible of proof, that the magnificent material prosperity of the United States of America is directly traceable to wise patent laws and their kindly construction by the courts."

Mr. Calkins lately asked unanimous consent for immediate consideration of his bill, but objections having been raised, his motion was tabled.

In the mean time it would be well for the holders of patents in Indiana to send in written protests to their representatives in Congress, while manufacturers and inventors generally ought to use every effort to defeat such manifestly unjust and destructive enactments as H. R. number 311.

WORKING COLD WROUGHT IRON.

Unless the iron is of small diameter, as wire, and makes a considerable circle in bending, it is usually believed that it should be heated to be worked. But if the wire is of tough iron it may be worked as closely when cold, if not as easily, as though heated. Familiar instances are the small articles known as "bright wire goods." These are staples, hooks, rings, screw eyes for picture frames, angle hooks, and many similar articles. Some of these undergo as square bending as would be possible if they were worked when red hot, as the angle hooks, which are either pointed to be driven or threaded to be screwed; the angle being perfectly square without the suggestion of a curve. These hooks are made in machine dies, and to form the elbow with a perfectly square turn the wire is actually upset cold at the bend. Other instances of the malleability of cold wrought iron are given in the heading of cut nails and iron rivets, but usually this sort of work is kept within narrow limits as to size of material. Yet a large tool making establishment in New England has built a number of heading machines on foreign orders that made conical and flat heads on bars of iron three-quarters of an inch in diameter. These heads were as clean and as free from cracks or fraying as if formed from the red hot bar, and the projection of the head on each side was slightly less than one-quarter of an inch, making a head one and a quarter inches diameter. The heading machine forsuch work as this must, of course, be of enormous strength to resist the blow and pressure that would upset a three-quarter inch bar to such an extent.

Wrought iron has another quality when cold—that of being welded—a quality that in some instances makes trouble, but in others is utilized. Where iron washers have been put in the step of an upright shaft carrying a heavy wheel with a view of dividing the friction, they have sometimes become welded solidly, so thoroughly united that not even heating them would separate them. Harness rings of iron wire and others for hand bags are solidly welded when cold by placing the formed ring in a die a trifle smaller in diameter than the ring, and bringing a corresponding die with great pressure on the ring, forcing the ends of the wire together.

RESTORATION OF AMERICAN SHIPBUILDING.

An interesting and able essay on this subject, written by Mr. George B. Butler, has been issued by the Union League Club of New York.

The points which it seeks to bring forward are that this country ought to provide means and establish laws by which our ocean trade should be done in American ships. After giving an outline of the decline of our shipping, it suggests the means by which the supremacy of the United States could be re-established on the sea, as regards both merchant marine and navy. The arguments are essentially the following:

1. We should not buy foreign ships, but depend upon ourselves for whatever is necessary for support, defense, or war.

2. Foreign vessels should not be encouraged to transport our postal matter and home production.

3. That, following the example of other countries, we should resort to subsidies.

4. We must modify our navigation laws in favor of our own flag, whether subsidies are granted or not.

In addition it declares that the Naval Academy at Annapolis should be enlarged so as to include shipbuilding, both practically and theoretically, in order that not only the government, but private establishments, shall be provided with skilled minds.

A Substitute for Transfusion of Blood.

William T. Bull, M.D., Surgeon of the Chambers Street and New York Hospitals, says the use of saline injections in Asiatic cholera in the early part of this century demonstrated the safety of such a procedure, and likewise its inefficiency in checking the career of that disease. Within a few years, however, this method has risen to the level of a life-saving measure, as a substitute for the transfusion of blood in conditions of acute anæmia and collapse. Of nineteen patients who have been subjected to the operation, when at the point of death, thirteen have entirely recovered; in three death was averted, but occurred later; and in the remainder only a temporary improvement was effected.

I have employed the solution as used by Szumann and also recommended by Schwarz, consisting of water, ʒ xxxij.; common salt, ʒ jss.; carbonate of soda, grs. xv., and in place of the irrigator a tubulated bottle with rubber tubing and canula attached, and have had distilled water at my disposal in but one case, when a two per cent salt solution was injected. The average duration of the injection has been fifteen minutes.

COLUMBIA COLLEGE has been presented, by Mr. Lewis M. Rutherfurd, one of the trustees, with a set of astronomical instruments valued at $12,000, and a further sum to cover cost of moving and setting them up. They include a 13-inch equatorial refracting telescope, with mountings and clockwork complete; a photographic correcting lens and accessories, which when in their proper place make the equatorial a photographic telescope for moon and star work; two micrometers for double-star work, and one very fine micrometer, measuring star plates, now being used by Dr. B. A. Gould, at Washington; an excellent transit, made by Stackpole Brothers; and a fine sidereal clock. Mr. Rutherfurd is an enthusiastic amateur astronomer, and has an observatory adjoining his residence in this city, which is well provided with astronomical apparatus.

TO RENDER LEATHER, PAPER, ETC., IMPERMEABLE.—M.M. Huleux and Dreyfus advise the employment of the following mixture, which operates according to the quantity and proportion of the materials added:

	Grammes.
White or yellow wax, first quality	1000
Burgundy pitch	60
Oil of arachide	80
Sulphate of iron	50
Essence of thyme	20