

## PHENOMENON PRESENTED BY VORTEX RINGS.

Our readers are all familiar with the peculiar appearance of vortex-rings, as they frequently result from the discharge of cannon or from the sudden discharge of steam through an open top locomotive stack. Professor A. E. Dolbear, of Tuft's college, Mass., has been making a careful study of the peculiar phenomenon, connected with these rings, and to facilitate his study has improvised a very simple apparatus for their production, which may easily be constructed by any person who may be interested in this curious study. We copy from *Science*:

1. If one vortex-ring strikes another vortex-ring upon the edge the two rings will bound away from each other as though they were solid elastic bodies, each one vibrating as it recedes.

2. If one vortex-ring overtakes another ring, both moving in the same straight line, and both are of the same size, then the forward one will expand in diameter, and the latter will contract in diameter and will go through the forward one, when each will return to its original dimension. At the same time the forward one will have its velocity retarded while the other will have its velocity increased, and it may overtake the forward one and go through it.

3. If a vortex-ring passes near any light object, as, for instance, a silk thread suspended,



or better still a small cloud of smoke or ammonia chloride dust, the latter will be seen to be apparently repelled from the front of it, but attracted and drawn into the ring from the rear.

4. If a vortex-ring be projected parallel with any surface, and at not too great a distance from the surface, the ring will move in a curved path toward it and strike it.

5. If two vortex-rings are projected so as to start in parallel lines near to each other, they will approach each other until they touch, when they may be either broken or else bound away from each other as in the first case above.

6. If two vortex-rings having the same rate of rotation be started in lines parallel to each other, and at not too great a distance apart, they will not only approach each other, but they will combine to form one ring, which continues to move in the same direction.

7. The combination is effected by the breaking of each at the point of contact, and the welding of the opposite parts of each ring to form one ring with twice the diameter.

8. These rings may in like manner be combined into one.

9. The structure of the vortex-ring is concentric, that is, a cross section of a ring generally shows a series of several concentric circles, with a hollow center. The middle of the ring appears to be a cylindrical unoccupied space.

As experimental work with such rings is very entertaining, as well as suggestive of the behavior of the real atoms of matter, it may be well to give the simple instructions necessary to perfect success.

Provide a cubical box with dimensions about a foot each way, having a swinging back frame, over which is stretched a piece of stout cotton cloth. On the opposite side, two or more inches apart, may be bored two inches apart. Pour some strong hydrochloric acid into one saucer, and some strong ammonia water into another. Set the two into the box, and shut down the

door. The box will at once be filled with the white fumes, and a tsp with the finger upon the cloth back, will send out well formed rings.

The phenomena one to five, can best be seen by employing only one of the holes, so as to form but a single ring. By striking the cloth a little harder the second time than the first, the second ring may be made to overtake the first, and if it is desirable to exhibit the rings to a room full of people, there should be but a single hole in front, and that one about three inches in diameter; the rings can then be projected with force enough to make them go 10 or 15 ft. from the box.

The other phenomena can best be studied by using only small holes, and tapping gently. The rings will come together within a few inches of the box. It seems to be essential that the two rings that combine, should have the same rate of rotation, a matter easily secured by forming the two at once in the above described way, but well nigh impossible, if one is formed after the other.

It is sufficient now to remark that the new phenomena described above, stimulate in a very striking way, what we call gravitation and chemism.

## MALLEABLE CAST IRON.

In a paper read by M. Fourquignon before the French Academy of Sciences on malleable cast iron, he states that, as a bar softens, one observes throughout the mass an abundant deposit of amorphous graphite. Matters stand thus when the bar lies in an inert mass, as in anthracite coal; but when the pig iron comes in contact with a substance capable of burning or absorbing the carbon, a secondary reaction sets in. The liberated carbon having disappeared from the superficial zone, the equilibrium determined by the heat undergoes a slight change. A portion of the graphite from the lower strata returns to its combination, and ascending to the surface, disappears, and is replaced in its turn by another. The phenomenon continues until the average composition of the bar corresponds to a certain minimum of carburization of the iron, varied according to the circumstances of the annealing process.

A proportion of manganese, even below 5-1,000 gradually arrests the softening process until it ceases altogether. The pig, of course, continues to lose carbon by oxidation, almost as much in fact as when it is pure, but the manganese resists the production of graphite and retains it in combination in the metallic mass. The silicon may, to a certain extent, saturate the manganese and drive out the graphite. He finds these explanations based on the following facts, as elicited in the course of his experiments: (1.) Pig iron which is truly malleable always contains graphite; (2.) pig may lose carbon, and yet remain brittle if graphite be not formed, or if the quantity existing before the annealing process be not augmented; (3.) pig may become malleable without losing a sensible portion of its total carbon, the annealing being effected by the medium of coal, the co-operation of an oxidizing agent not being indispensable to the softening process; (4.) if silicon be added to a manganiferous pig the metal is improved by annealing.

**AN ELECTRIC SOLDERING IRON.**—Mr. Ball, of Philadelphia, has patented a soldering iron capable of melting the hardest solders, as those of gold and silver, by electricity. The electrodes pass through and project beyond the handle, and are connected with a ball of platinum; this, when battery connection is complete, becomes heated to any required degree, and the desired soldering is readily effected.

**A NEW STEAM BOILER.**—A new form of steam boiler, invented by Mons. Bernard, has been tested on a French vessel with such satisfactory results that the naval authorities in France have directed a careful examination of it, with a view to its adoption for war steamers. It is shaped like a gasometer receiver, and its chief advantage over other boilers is said to be superior economy in the consumption of fuel.

## HOLLOW STEEL SHAFTING.

Hollow steel shafting is quite a new idea, and seems to be coming into quite extensive use in England. Specimens shown at the recent Manchester (Eng.) Exchange are said to have created quite a sensation among the iron and steel men. A large iron firm in Pittsburg, Penn., have experimented some in this direction, and are now prepared to make this a specialty. In a recent communication to the *American Manufacturer*, they say:

"Casting hollow steel ingots for shafting and pipes will be one of our specialties in our new Bessemer plant, and we claim, and think we can prove, that we were the first to cast hollow steel shafts and pipes which could be rolled as other steel or iron is rolled.

"We will, within a few days, cast a steel pipe 16 ft. long, 14 inches diameter outside, and 10 inches inside, weighing 4,500 lbs., which could easily be rolled to 40 ft. in length.

"Nearly two years ago we tried to interest two of our largest pipe manufacturing firms in rolling steel pipes, but without success.

"We will run our new plant on heavy castings, and shaped steel ingots for channels, beams, angles, hollow shafts, and any work which cannot easily be shaped with rolls.

"We intend to pay particular attention to making these special steel ingots of low or high carbon, of ordinary Bessemer or of refined Bessemer, made under our own patents."

**THE REESE FUSING DISK**, to which quite full allusion has been made in these columns, seems to have attracted considerable attention in England, and one party, at least, has undertaken some experiments to determine its practical utility. The results of those experiments, with illustrations, were furnished to *London Engineering*, from which journal they were copied into the *Scientific American*. The conclusions were anything but favorable to the practical value of the invention. In a subsequent number of the *Scientific American*, the inventor, Mr. Reese, appears with a communication, in which he says: "I have written *Engineering* that the statements made in the article are so astonishing, and the work exhibited is so radically different from any that I have ever seen produced by the fusing disk, that I think the gentlemen who furnished the article and cuts and made the statements contained in the article have made a mistake, and I asked for their address that I might give them attention first." Mr. Reese further reiterates what he has heretofore said and claimed in regard to his invention, and expresses his willingness to explain and maintain his theory, and cheerfully accept the result of the discussion, whatever that may be.

**THE RELATION OF THE ATOMS OF CHEMICAL ELEMENTS TO ELECTRICITY.**—Prof. Helmholtz, in his recent Faraday lecture, affirms that the atom of every chemical element is always united with a definite unvarying quantity of electricity. This quantity stands in close connection with the combining power of the atom, or its quantivalence. If the amount of electricity of the monad atom be taken as the unit, that of the dyad is two, that of the triad three, etc. Prof. Helmholtz says: "If we conclude from the facts that every unit of affinity of every atom is charged always with one equivalent either of positive or negative electricity, they can form compounds, being electrically neutral, only if every unit charged positively unite under the influence of a mighty electric attraction with another unit charged negatively. This ought to produce compounds in which every unit of affinity of every atom is connected with one—and only with one—other unit of another atom. This is, indeed, the modern chemical theory of quantivalence, comprising all the saturated compounds.

When you hear a mother calling to her son to "come here and shut the shutter," and hear him respond: "It is shut, mother, and I can't shut it any shutter," do you ever pause to analyze the delicate beauties of our language?