THE COLUMBIA BICYCLE.

The bicycle furor which pervaded this country and Europe a few years ago has subsided into a solid interest in this means of locomotion, which is much more noticeable in England than in this country, although the bicycle is now very popular here, and is daily becoming more so. It has arrived at great perfection, and is constructed more scientifically than formerly It is of great practical utility as well as a rational means of amusement. It is, in fact, an ever saddled horse that eats nothing and requires no care.

Undoubtedly the most perfect bicycle now made is the "Columbia," manufactured by the Pope Manufacturing Company, of 87 Summer street, Boston, Mass. This machine, which is shown in our engraving, has a steering head which is one solid forging. The backbones, which are made of steel, are large, light, strong, and rigid. The spring is attached by a joint to a small plate sliding on the backbone. The wheels are of the spider pattern, with steel V shaped fellies, with forged steel hubs, hardened in bearing parts. The back wheel and pedals run on coned bearings, one being adjustable, and are made so as to prevent the admission of dust and dirt. The front wheel bearings are conical and well hardened, and fitted with coned fastenings of India rubber, 1 inch on the front and ¾ inch diameter on the back wheel.

In the modern bicycle the seat is placed almost directly over the center of the front wheel, by which means a much larger wheel can be ridden, thus gaining in speed and making the act of propelling it more like walking, instead of pushing with the feet as in the velocipede, which is tiresome and injurious to the rider. Although our bicyclists have had very little experience compared with English riders, yet some long distances worth mentioning have been made. On November 27, 1877, Mr. A. D. Chandler rode from Leominster to Boston, a distance of 40 miles, in 4 hours. May, 1878, Russell Sharp and John Storer, from Boston to Newport, R. I., 72 miles, in 13 hours, including stoppages. Actual riding time, 10½ hours. August, 1878, H. E. Parkhurst rode from Clinton to Boston, 44 miles, in 5½ hours, without a stop, making the distance from South Framingham to Boston, 20½ miles, in 2 hours. Has also ridden from Boston to Natick and return, without a dismount, 36 miles in 3½ hours. October, 15, 1878, E. W. Pope and F. S. Jaquith rode in the suburbs of Boston, 77 miles in 11 hours, including stops. After having ridden 60 miles they made the distance from Wellesley to Newton, over 7 miles, in 38 minutes. October 19, 1878, G. R. Agassiz, on the Chestnut Hill road, traveled one mile in 3 minutes 21¼ seconds, winning the Boston Bicycle Club Gold Medal. E. Costen and F. Smythe, September 2, 1876, on a turnpike road, made 205 miles in 22 hours.

We give a record of some professional and amateur bicycle runs made in England:

Quickest professional times—October 2, 1876, J. Keen, Molineaux Grounds, made 1 mile in 2 min. 56 1-5 secs. Same party, December 8, 1876, Lillie Bridge, made 10 miles in 33 minutes. Same rider, on same date and place, 20 miles in 1 hour 5 min. 34 sec. The same, October 9, 1876, Lillie Bridge, 50 miles in 3 hours 6 min. 45 sec. October 19, 1874, D. Stanton, Lillie Bridge, 106 miles in 7 hours 58 min. 54 sec. The same, March, 1878, Agricultural Hall, London, 1,000 miles in 6 days.

Quickest amateur times—T. T. East, Lillie Bridge, 1 mile in 2 min. 56 sec. September 11, 1875, W. Tylerson, Lillie Bridge, 10 miles in 34 min. 40¾ sec. May 15, 1876, Hon. I. K. Falconer, Cambridge University Grounds, 50 miles in 3 hours 20 min. 37 sec. June 10, 1878, F. E. Appleyard, turnpike road, Bath to London, 100 miles, in 7 hours 18 min. 55 sec. Stanley Thorpe, turnpike road from London to York, 105½ miles, in 22½ hours.

THE COLUMBIA BICYCLE.

EASILY MADE PHYSICAL APPARATUS.

BY GEO. M. HOPKINS.

But for the glass in the doors which imprison the physical apparatus in many of our institutions of learning, students would have little idea of the form or construction of the instruments, so many of which are now made for illustrating scientific principles, but which, alas! are doomed to eternal rest. Through fear of accident; through lack of confidence in their own ability to properly conduct experiments; or through indisposition to perform more than the absolutely necessary work, teachers too often ignore practical demonstration and permit students to rely on knowledge conveyed by text books, many of which are full of errors, while others lack that clearness, thoroughness, and conciseness which are necessary to a ready comprehension of the principles taught; in fact they are generally full of instruction on every point excepting the very one upon which instruction is most needed. There is scarcely a principle in physics that may not be easily demonstrated by experiment, and in the majority of cases the apparatus may be extemporized. To the young, one of the most interesting and instructive instruments is the air pump, as with it much that is daily seen and experienced may be explained.

The engraving shows in perspective in Fig. 1, and in section in Fig. 2, an air pump which may be readily made. The base, A, is a perfectly plain board, 8 inches wide, 15 inches long, and 1 inch thick. A 3-8 inch hole is bored longitudinally through the center, and near one end, two 1-16 inch holes are bored into the longitudinal hole at *a*, 3-4 inch apart. Another 1-16 inch hole is made at *b*, and another one at *c*. The board may be of any well seasoned wood that is not liable to warp. After boring it should receive several coats of good alcoholic shellac varnish on all sides and in the holes. When the last coat is applied a 6 inch disk, J, of elastic packing rubber, having a small central aperture, and which has previously received a coat of the same kind of varnish, is placed varnish side down upon the board with its central aperture coincident with the hole, *c*, in the board, and it is kept in position under slight pressure until the varnish dries, which will take a considerable time (a day or so), being confined between the two surfaces. To the base, A, two wooden standards, B, are secured, each 6 1-2 inches high and about 2 inches wide at the narrower end and 1-2 inch thick. They are two inches apart and are connected at the top by a cross piece, C. The base, A, standards, B, and cross piece, C, should be fastened together with long screws. The pump barrel, D, is a piece of glass tubing 1 1 2 inches internal diameter, and 6 inches long. A piece which is as nearly true and straight as possible should be selected. It may be cut from a long piece by turning it in a heated loop of heavy iron wire, which half encircles the tube. The tube should be turned back and forth at first until it begins to crack, when it should be turned slowly in one direction until it cracks entirely around. If the ends need to be squared up they may be readily ground upon an ordinary grindstone, or by moving it with a gyratory motion upon a slab of glass having on its surface some coarse emery and water. A piece of mandrel drawn brass tube will answer as a barrel equally as well as the glass tube.

The lower end of the pump barrel rests upon a soft rubber disk, E, and a ring of the same material is placed between the cross piece, C, and the upper end of the barrel. The rubber disk, E, has an oblong aperture, also a small circular one, as seen in Fig. 5. The oblong aperture is placed over the right hand hole at *a;* the small aperture over the left hand hole.

A disk, F, Fig. 4, of hard rubber, brass, or other suitable material, having its edge grooved, and having two small apertures (1-16 inch) which coincide with the holes at *a*, is covered on its under side with oiled silk, which is drawn over its edges and fastened by a stout thread wound in the groove. Two slits are cut in the oiled silk, one upon each side of the right hand hole, making a valve which works in the little chamber formed by the oblong hole in the packing disk, E; the oiled silk is removed around the left hand hole. The upper valve, which is shown in Fig. 3, consists of a strip of oiled silk, which covers the left hand hole and is fastened by a thread around the edges of the disk, as in the other case.

The disk, F, is placed upon the packing disk, E, and secured by four small screws that pass through both into the base.

The piston, H, consists of two disks of wood, which have been soaked in melted paraffin to prevent them from absorbing moisture. The lower one nearly fills the barrel; the upper one is small enough to receive between it and the barrel a leather packing, which is turned upward in the same manner as the packing of an ordinary cistern pump. The piston is fastened to the end of the wooden piston rod, I, by means of a long wood screw. The piston rod passes upward through a hole in the cross piece, C, and is provided with a suitable handle.

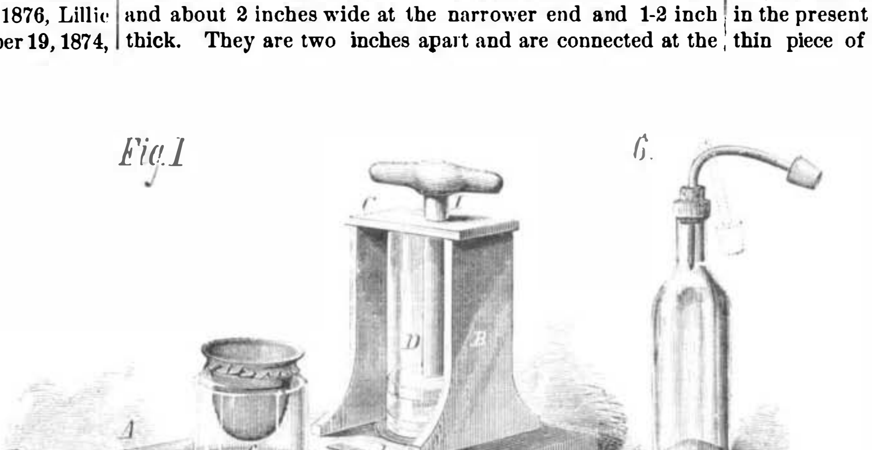
A rubber stopper is forced into the longitudinal hole in the bed to a point between the two holes at *a*, and another rubber stopper closes the opposite end of the hole. An oiled silk or flexible rubber flap or valve covers the hole, *b*. The piston should be greased with lard. By adding to the piston a second packing turned downward the pump may be used for the compression of air.

Any of the experiments performed with other air pumps may be repeated with this. A bottomless glass jar is shown in the present case upon the soft rubber disk, J. It has a thin piece of elastic rubber stretched over its mouth, and tied when the air is exhausted. External air pressure forces the elastic rubber downward. By substituting a piece of bladder for the rubber, it will burst with a loud report. By placing the hand over the mouth of the jar and exhausting the air, the fact that the air has weight will at once be realized.

A strong common fruit jar may be used as a receiver, and to insure a perfect joint with the rubber disk, a packing ring of very soft rubber may be interposed between the mouth of the jar and the rubber disk, J, and in any case the rubber disk and whatever is placed on it should be greased with lard to make a joint.

The fountain in vacuo requires no expensive apparatus. All that is needed is a small tube or jet, which may be either of metal or glass, a piece of stiff rubber tubing, and two good corks or rubber stoppers. One of the corks is inserted in the bottle and the jet is inserted in the cork, the rubber tube is slipped over the outer end of the jet tube and is fitted to a hole in the second cork, as seen in Fig. 6.

To exhaust the air from the bottle stop the hole, *c*, insert the cork that is on the end of the rubber tube in place of the stopper in the end of the bed. Work the pump, and when the air is exhausted bind the rubber tube, as indicated by the dotted lines, so as to close it; raise the valve from the hole, *b*, to admit air to the passage in the bed, and remove the cork on the rubber tube from the hole in the bed, and dip it in a vessel of water, at the same time allowing the rubber tube to straighten out.



A SIMPLE AIR PUMP.