

a small canyon, whose right wall was rugged lava, while the left was Aubrey limestone. On emerging and climbing an eminence, we saw that this lava wall was the margin of a terrace, several of which were visible, being successive overflows from the volcano around whose base they had been formed. Our journey for the last twelve miles of it was over a road which, however fine it may be from May to November, was for us but an alternation of stony ridges and miry bogs, with occasionally a lingering snow drift. It was after dark when we rattled at full speed down the long limestone hill leading to the welcome cabin of honest John Hance. Under a sheltering hill, beside a living stream, nestled amid gigantic pines, some of which have been so felled as to fence in the spacious door yard, is the home of this mountaineer. He has probably done more actual exploring of the canyons of the Colorado than any other Arizonian; and it is his boast that, in the period of two years, with his own unaided hands, he made the famous Hance Trail, from the highest rim down to the river—certainly one of the greatest engineering feats ever accomplished by one man. William Mulvern, sheriff of Yavapai County, and John Francis, sheriff of Coconino County, assisted by John McGowan and R. A. Ferguson, recently surveyed the Grand Canyon from the head of the Hance Trail, and determined its depth to be 6,675 feet vertically from the rim to the river. The trail covers 4,000 feet of this in 7,050 feet, and the remainder at a much easier grade.

After our tired horses had been cared for, and our own hearty supper duly disposed of—matters demanding our first attention—I was determined to have a look at the canyon, although it was after nine o'clock. In solitude I climbed the hill. The distance from the cabin to the rim is less than 300 yards. But even when within a hundred feet of the mysterious rim, not a sign of the glorious vision awaiting me appeared. For a moment I paused with a natural shrinking from what I knew must lie beyond that calm, untrodden snow bank. The full moon was riding in a cloudless sky. The wind soured through the tall pines and fragrant junipers. Huge rocks cast their shadows across my way, and seemed to be watching like grim sentinels. At length, resolutely, I advanced through the snow, and stood alone on the dizzy verge. Bending over it in a kind of sacred horror, I beheld, at last, what for many years I had longed to see, the fathomless, boundless abyss, with its myriads of chasms and cliffs, fretted ruins, slender spires and massive towers, all under the beaming stars and flooded by the silvery moonlight. And this sublime chaos, such as cannot be found elsewhere in the whole world, and amid whose depths we were to venture on the morrow, was the Grand Canyon of the Colorado.

#### The Doctor and Good Roads.

The sentiment in favor of improving country roads is growing every year. It has reached our legislative assemblies, and bills are being introduced in order to secure State aid in the matter. Good roads are things which no class of persons would appreciate more than physicians, and to none would they bring more direct personal comfort, and even practical financial help. On a good road the country doctor can travel ten miles an hour, on a bad one barely five. The time required in doing his work is doubled, the physical weariness is increased, the amount of visiting rendered possible is curtailed. Besides this, the patient suffers, for the doctor's visits are delayed and less numerous. He cannot watch the patient so closely, and he brings to his work a wearied body.

Perhaps the horse would argue most eloquently of all, if he could speak in favor of good roads. His working life would be lengthened and his working days made easier.

With good roads the bicycle could be utilized, and through its invigorating influence, perhaps, the country doctor would cease, as years rolled on, to become obese from too much sitting in a wagon, his wits would be sharper, his professional work better.

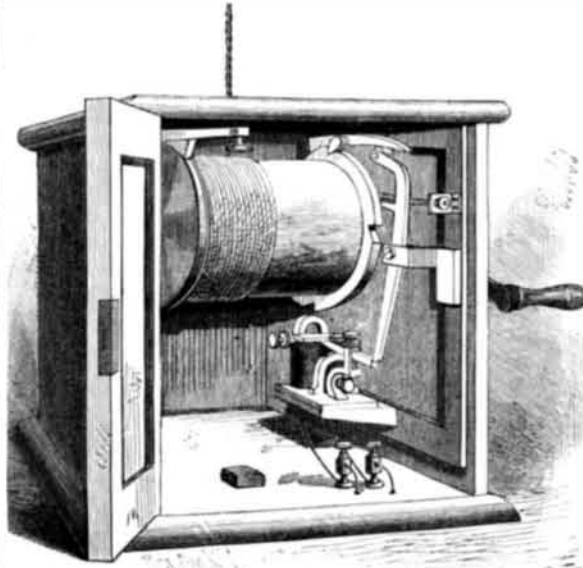
By all means, then, let the doctors take up the gospel of good roads and urge forward their construction. They make intercourse more easy, work less burdensome, life more enjoyable; and they are, in fine, an index of the progressiveness and civilization of a community.—*Med. Record.*

#### Microscopic Drawing.

Place the body of the microscope horizontal; remove the mirror; put the slide on the stage; condense the light upon it by means of the bull's eye, taking care to center the light; attach the concave mirror to the front of the eyepiece by means of a spring or a piece of thin wood. Have its surface at an angle of 45° with the plane of the anterior glass of the ocular. This will project an image of the object on the paper beneath. If the outer ring of light is circular, there will be no distortion. With a black cloth exclude all outer light, covering both your head and the instrument. Mr. Hopewell Smith draws any section easily in this manner, including magnifications of 600 diameters.

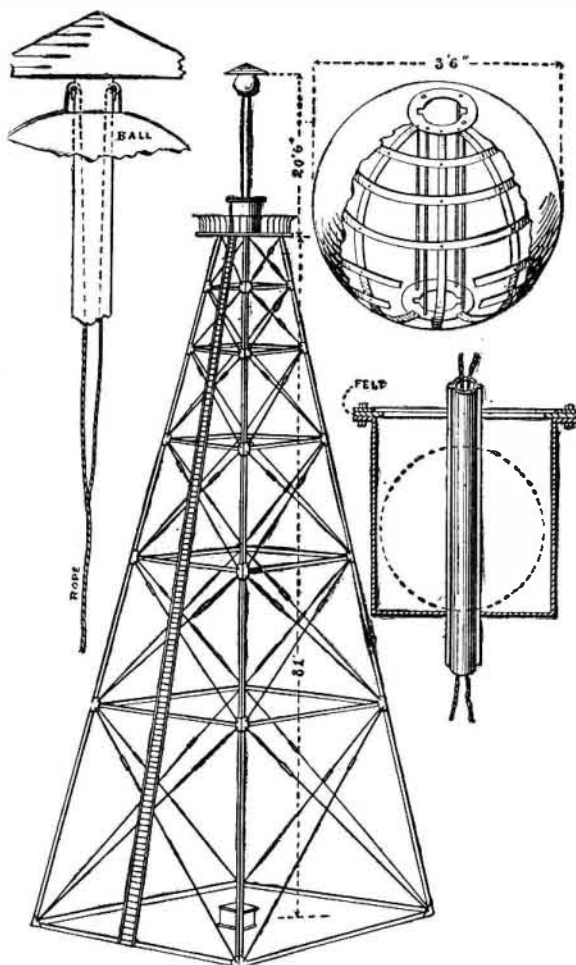
#### THE WESTERN UNION TIME BALL SERVICE.

Since the fire which destroyed the upper stories of the Western Union Telegraph building, the time ball service has been suspended. The old staff and ball were mounted on the tower in the front of the building. As the new building has been completed another tower has been built for special service of the time ball system. This tower is built of open iron work, and through its center a ladder runs up to the top. From the top a staff of hollow iron piping with two feathers running down opposite sides of it rises, and is surmounted by a cap. As regards dimensions, the tower rests on the roof of the main building, 163 feet above



WINDLASS AND ELECTRIC TRIPPING MECHANISM.

the surface of the street. The base of the tower is 24 feet, 6 3/4 inches by 25 feet, 4 inches; the top of the tower is 4 feet, 3 inches by 5 feet, 5/8 inches; and the height of the tower is 81 feet. A platform 7 feet, 5 inches square surmounts it, and from the center of this the flagstaff rises 20 feet and 6 inches, giving as the total height from the street 264 feet, 6 inches. The time ball is of very light construction; notched rings that fit the staff loosely form the top and bottom elements and are connected by four 1/2 inch iron rods. The contour is secured by hoop iron running in directions corresponding to the latitude and longitude of a globe, and over the whole canvas is fastened. The ball is 3 feet, 6 inches in diameter, and weighs only 35 pounds. The staff passes through its center. To raise it a double lead of rope runs up through the center of the staff; the two ends of the rope pass over two pulleys on opposite sides of the staff near the top and, descending thence, are attached to the ball at the top.



THE WESTERN UNION TIME BALL TOWER.

The two leads join each other a little distance down, and a single rope runs thence to a windlass, which is contained in a box at the base of the tower.

By tripping mechanism the ball is released at noon-time and falls down the staff. To receive it an air box is provided at the bottom which cushions its fall. This is a circular box 4 feet high and 3 feet, 6 inches in

diameter, and therefore of just such size as to receive the ball. A sort of flange or washer of felt is carried around the mouth of the box, so that the ball cannot by any possibility strike any hard material in its descent. As it falls, the air in the box can only escape slowly, so that it forms a true cushioning device.

The tripping mechanism is contained in the box with the windlass. On a flange projecting from one end of the windlass four notches are cut with which a pawl engages as the windlass is wound up, preventing it from unwinding or turning the wrong way. The pawl is carried by an arm pivoted at one end. If the arm were raised, it is evident that the pawl would be withdrawn from the notch and the windlass would be free to unwind. The tripping mechanism effects the raising of this arm. A lever nearly vertical is pivoted at its center, and a roller at its upper end touches the rear end of the pawl lever, which at this point is bent downward. A spring tends to draw the upper end of this lever backward. If it were so drawn, the end of the latter would be raised and the pawl released, owing to the downwardly curved shape of the pawl lever. To prevent the spring from doing this, the lower end of the lever is caught by a projecting bar attached to the armature of an electro-magnet. The whole is so arranged that by connecting the magnet with an active circuit its armature is attracted, which draws the bar out of engagement with the vertical lever. The spring on the latter then draws its upper end back, thereby raising the pawl lever and releasing the pawl. The windlass and tripping devices occupy but little space, the whole being contained in a cubical box only 18 inches each way.

A special clock at Washington is connected to the circuit of the electro-magnet, the whole being on open circuit. When the clock in its motion closes the circuit, which it does precisely at noon, the electro-magnet is excited, its armature is attracted, releasing the vertical lever whose upper end is drawn back and trips or releases the drum of the windlass, and the ball at once begins its descent. From the above it will be seen that it is the beginning of the fall of the ball which marks the time of noon. The system formerly in use was different in several respects from the present one. The one we illustrate is based largely on the results attained at Washington, and its operations will undoubtedly be very perfect. By the time this paper reaches our readers the new service will have been inaugurated.

#### Hints for Boys.

A gentleman advertised for a boy to assist him in his office, and nearly fifty applicants presented themselves before him. Out of the whole number he selected one, and dismissed the rest. "I should like to know," said a friend, "on what ground you selected that boy without a single recommendation?" "You are mistaken," said the gentleman, "he has a great many. He wiped his feet when he came in, and closed the door after him, showing that he was careful; gave up his seat to that lame old man, showing that he was kind and thoughtful; he took off his cap when he came in, answered my questions promptly and respectfully, showing that he was polite and gentlemanly; he picked up a book, which I had purposely laid upon the floor, and replaced it on the table, while all the rest stepped over it or shoved it aside; and he waited quietly for his turn, instead of pushing or crowding, showing that he was honest and orderly. When I talked with him I noticed that his clothes were carefully brushed, his hair in nice order, and his teeth as white as milk; and when he wrote his name I noticed that his finger nails were clean, instead of being tipped with jet like that handsome little fellow's in the blue jacket. Don't you call these things letters of recommendation? I do, and I would give more for what I can tell about a boy by using my eyes ten minutes than all the letters of recommendation he can give me."

#### The Telephone in New York.

We are indebted to the *Western Electrician* for the interesting report under the above heading we recently gave, describing a visit of the members of the New York Electrical Society to the premises of the Metropolitan Telegraph and Telephone Company. Due credit should have been given at the time. The *Western Electrician* is one of the most enterprising and successful electrical publications in the world.

A PROSPEROUS German residing in America writes of a recent visit to his native country, thus: "One day I saw a review of cavalry in Berlin. There were thousands of men cantering gayly along for the entertainment of the young Emperor—the War Lord as he calls himself. The next day I went into the country, and not very far from the capital I saw a sight that was pitiful enough. One woman was holding a plow, and this was being dragged through the earth by two other women and a dog harnessed together. Here, then, were two pictures—the idle horses and the idle men capering about Berlin, the women and dogs doing the work of men and horses in the country!"