

Thomson, that Prof. Bell first showed the operation of his telephone, having the same Mr. Hubbard as his assistant, who is also believed to be the first person that ever heard speech through the then new instrument.

At the conclusion of the formalities those present were accorded the privilege of testing the line personally. Through the courtesy of Mr. A. S. Hubbard, the expert operator, and Mr. F. A. Pickerner, the chief engineer of construction, we were given an opportunity of trying the line, and conversed perfectly with Mr. Edward H. Lyon, the expert operator in Chicago, and with a representative of the western office of the *SCIENTIFIC AMERICAN*, Mr. G. M. Abbott. The most noticeable feature was the entire absence of all induction and perfect quiet of the line, also the sharpness or clear-cut quality of the words. The sound appeared to be fifty per cent less in volume than on short lines, but was otherwise as good.

On one side of the room was a long map showing the direction of the line from New York. It passes by cable under the North River, thence follows highways across the country through Newark, N. J., Easton, Harrisburg, Altoona, and Pittsburg, Pa., thence to New Castle, O., South Bend, Ind., and to Chicago. The line is built of two No. 8 hard-drawn copper wires carried along parallel with each other and transposed at certain intervals or crossed diagonally without touching, creating what is termed the electrical balance, which is proof against induction. There are forty-five poles to the mile, each 35 feet high, the total number being 42,750. The distance is 950 miles, and there are 435 pounds of wire to the mile, making a total weight in copper for the circuit of 826,500 pounds. An ordinary circuit for the same distance would weigh but 200,000 pounds. We were told the circumference area of the wire, if laid out to represent a flat surface, would cover 5 1-10 acres. The company have been but six months in building the extension of the line from Pittsburg westward, and will soon be able to connect Chicago with Milwaukee and other cities. Conversation has been carried on successfully between Chicago and Boston, a distance of about 1,200 miles.

It should be mentioned that an important element in the success of long distance telephony is the improved battery now used for energizing the transmitter, which has the merit of maintaining a nearly uniform electro-motive force of high tension for an extensive period of time. It is an improvement on the well known Fuller battery, and consists in using in the glass jar a solution of bichromate of soda and sulphuric acid, made as follows: Water, 10 gallons; commercial sulphuric acid, 25 pounds; and bichromate of sodium, 8½ pounds. In the bottom of the porous cup is placed mercury, an amalgamated zinc and a saturated solution of common salt. One large plate of carbon forms the other pole. A wood cover fits over the jar to prevent evaporation of the fluids. The outer solution, when fresh, has a light orange color. When exhausted, the solution changes to a dark olive green. It is called the "Standard" battery. Three cells are used to operate the transmitter, and were employed in making the test between New York and Chicago.

We were informed also that the long distance transmitter has been improved by using in it one uniform size of carbon granules, obtained by passing them through a sieve of a certain mesh.

The enterprise shown by the company in this great undertaking is worthy of all praise. It is a remarkable achievement, indicative of marvelous possibilities in the future, in an art still in its infancy.

The officers of the company are: John E. Hudson, president; E. J. Hall, vice-president; Melville Eggleston, secretary; W. R. Driver, treasurer.

Each invited guest was presented with a neat souvenir consisting of a spiral coil of the No. 8 copper wire flattened at each end, from which is suspended two miniature receivers. The words "New York" and "Chicago" are stamped on each end. Among those present at the Chicago office were George M. Pullman, Columbus R. Cummings, Professor John P. Barrett, and E. M. Barton. The rate for five minutes conversation between New York and Chicago is to be \$9.

#### A New Comet Discovered by Photography.

A faint comet was discovered by Professor E. E. Barnard at the Lick Observatory on Wednesday night, October 12, by photography. Later visual observations show the comet to be about one minute in diameter. It is of the thirteenth magnitude, and is moving south-east 1 degree 40 minutes daily. Prof. Barnard, it will be remembered, lately discovered the fifth satellite of Jupiter.

#### Difficulties of Exactness.

Professor W. A. Rogers has constructed a standard yard and meter (62 degrees Fah.) upon polished steel. On one edge of the standard is a meter subdivided by 20 millimeters, and 60 inches subdivided to tenths of inches. Of the 400 tenth-of-inch spaces, 280 have errors not exceeding one twenty-five-thousandth of an inch.

#### POSITION OF THE PLANETS IN NOVEMBER.

##### JUPITER

is evening star. He retains his supremacy on star-lit November nights, while nothing in the line of a star exhibition is more brilliant than the celestial picture of which Jupiter is the central figure. The proof of this assertion will be apparent if we make a study of this superb planet on any evening when the moon is out of the way. If, for instance, we take the 18th, at a quarter past 8 o'clock. Jupiter on that evening makes his transit about 9 o'clock, and is nearly on the meridian at the time of observation. There are no bright stars in the immediate vicinity to detract from the splendor of the great magnate, but around him are grouped stars, constellations, and clusters that have called forth the admiration of observers ever since astronomy was young. Mars in lessening luster glows in the southwest, the brilliant Fomalhaut pays him homage from a point low in the south. The huge sea monster Cetus covers a wide range of sky well raised above the southeastern horizon, and presents to his notice Beta Ceti and Mira the Wonderful. Orion is rising in the east, the three stars in the belt being visible. Above them is Aldebaran, and still higher than the red star are the Pleiades. Cassiopeia is near the point overhead; below it is Perseus, with its demon star Algol. The lustrous Capella is on the left, while Castor and Pollux have arisen in the northeast. We omit the northern stars that are always visible, and note the brilliant Vega shining in the west, and Altair approaching the western horizon. Every observer may find the stars here mentioned, as well as enjoy the lovely picture of starry glory that the heavens reveal. The same picture may be seen on the 14th, at half past 8 o'clock, and on the 22d at 8 o'clock. Earlier in the month the same stars will rise later, and later in the month they will rise earlier, the stars rising four minutes earlier every evening on account of the movement of the earth in her orbit.

The moon makes two close conjunctions with Jupiter during the month. The first takes place two days before the full, on the second, at 6 h. 12 m. P. M., the moon being 21' south. The conjunction occurs an hour and a half after sunset, when moon and planet will be so near as almost to form an appulse. The second takes place three days after the first quarter, on the 30th, at 0 h. 49 m. A. M., the moon being 38' south. This conjunction is also visible, though the hour is less convenient for observation.

The right ascension of Jupiter on the 1st is 1 h. 7 m., his declination is 5° 23' north, his diameter is 46".9, and he is in the constellation Pisces.

Jupiter sets on the 1st at 4 h. 38 m. A. M. On the 30th he sets at 2 h. 32 m. A. M.

##### VENUS

is morning star. Her luster grows dim, her size decreases, and she rises at 3 o'clock on the 1st and at 4 o'clock on the 30th. These conditions are the palpable proofs that she is approaching the sun. The fairest of the stars has a planetary companion during November. Saturn is far enough from the sun to be easily visible. Venus, as she moves eastward toward the sun, encounters Saturn moving westward from the sun. The meeting or conjunction takes place on the 10th, at 2 h. 53 m. P. M., Venus being 31' south. The planets are invisible at the time, but will be near together on the morning of the 10th. Venus is in conjunction with Spica on the 20th at 0 h. 37 m. P. M., being 4° 18' north of the star.

The moon, four days before her change, makes a close conjunction with Venus, on the 15th, at 5 h. 7 m. P. M., being 14' north. The conjunction is invisible, but waning moon and morning star will be near companions on the morning of the 16th.

The right ascension of Venus on the 1st is 11 h. 55 m., her declination is 2° 5' north, her diameter is 16".6, and she is in the constellation Virgo.

Venus rises on the 1st at 2 h. 58 m. A. M. On the 30th she rises at 3 h. 58 m. A. M.

##### SATURN

is morning star. He has emerged from his eclipse in the sunbeams, and takes a position of growing importance on November records. His conjunction with Venus has been described. He is very near the third magnitude star Gamma Virginis on the 12th at 11 h. 41 m. P. M., being 39' south of the star.

The moon, four days before her change, is in conjunction with Saturn on the 15th, at 5 h. 16 m. P. M., being 23' north.

The right ascension of Saturn on the 1st is 12 h. 31 m., his declination is 1° 0' south, his diameter is 15".1, and he is in the constellation Virgo.

Saturn rises on the 1st at 3 h. 46 m. A. M. On the 30th he rises at 2 h. 6 m. A. M.

##### MERCURY

is evening star. He reaches his greatest eastern elongation on the 23d, at 4 h. A. M., when he is 21° 52' east of the sun. He is then visible to the naked eye, but his great southern declination will make him a difficult object to find, unless the observer has a practiced eye and excellent visual power.

The moon is in conjunction with Mercury two days after her change, on the 21st, at 8 h. 7 m. A. M., being 1° 6' south.

The right ascension of Mercury on the 1st is 15 h. 27 m., his declination is 20° 26' south, his diameter is 5".0, and he is in the constellation Libra.

Mercury rises on the 1st at 5 h. 22 m. P. M. On the 30th he sets at 5 h. 34 m. P. M.

##### MARS

is evening star. He has finished his course through Capricornus, and entered Aquarius, and at the end of the month occupies nearly the same position in the heavens that Jupiter occupied on January 1. As Mars is moving eastward or in direct motion, and Jupiter is moving westward or retrograding, the planets will seem to approach each other during the month. Jupiter on the 1st is 48° northeast of Mars and 30° northeast of him on the 30th. Mars also is moving north, which brings him into better position for observation.

The moon on the day of the first quarter is in conjunction with Mars on the 27th at 0 h. 10 m. P. M., being 3° 34' south.

The right ascension of Mars on the 1st is 21 h. 54 m., his declination is 15° 10' south, his diameter is 13".6, and he is in the constellation Aquarius.

Mars sets on the 1st at 0 h. 12 m. A. M. On the 30th he sets at 11 h. 46 m. P. M.

##### URANUS

is morning star.

The moon is in conjunction with Uranus, two days before her change, on the 17th, at 4 h. 3 m. P. M., being 0° 27' south.

The right ascension of Uranus on the 1st is 14 h. 18 m., his declination is 13° 17' south, his diameter is 3".4, and he is in the constellation Virgo.

Uranus rises on the 1st at 6 h. 15 m. A. M. On the 30th he rises at 4 h. 26 m. A. M.

##### NEPTUNE

is morning star.

His right ascension on the 1st is 4 h. 37 m., his declination is 20° 29' north, his diameter is 2".7, and he is in the constellation Taurus.

Neptune rises on the 1st at 6 h. 30 m. P. M. On the 30th he rises at 4 h. 33 m. P. M.

#### THE OCCULTATION OF SATURN.

The moon occults Saturn on the 15th, the phenomenon being visible in this portion of the earth's territory. The immersion takes place on the 15th, at 3 h. 19 m. A. M., Washington mean time, and the emersion at 4 h. 8 m. A. M., the occultation continuing 49 m. There are six occultations of planets by the moon during the month, showing how nearly the moon's path coincides with that of the planets. Jupiter is occulted twice. Saturn, Venus, Uranus, and Mercury are each occulted once. Saturn and Venus are occulted on the same day. Our neighbor, the moon, therefore, contributes largely to the interesting incidents of the month.

Mercury, Mars and Jupiter are evening stars at the close of the month. Venus, Saturn, Uranus and Neptune are morning stars.

#### Lime Juice.

In a recent report the United States consul at Kingston gives the following description of the manufacture of lime juice in Jamaica:

The juice in its crude state is obtained either by running the limes through an ordinary cone mill, when the same is convenient and the fruit to be had in sufficient quantities, or by placing them in a squeezer especially adapted to the purpose, which seems to be the simpler and more usual plan.

To clarify the same requires straining and filtration, when some foreign substance is added to prevent decomposition of the vegetable matter, in which shape most of the juice is shipped from the island.

In order to concentrate, it is strained from the seed and pulp and placed in a copper battery and boiled on the same principle as sugar, care being taken not to scorch or burn it, as that destroys the acid. The more densely the juice is concentrated, the more valuable it is; but it is not advisable to go too far, as it burns easily without forming a crust on the copper. No iron vessel must be used, as the iron turns the acid black.

From the latest data (the year ended 31st March, 1891) the amount exported, which was doubtless about all that was made, was 53,884 gallons, of which 44,492 gallons went to the United Kingdom, 110 to Canada, and 9,282 to the United States.

The average valuation in the export list is 20 cents per gallon, but the price for the raw juice ranges from 18 to 30 cents, according to the supply and the demand, while the concentrated juice sells according to the percentage of citric acid it contains.

Substantially the same process is adopted in the manufacture of sour orange juice, which, when concentrated, I notice to be invoiced at from 45 to 50 cents per gallon; and 1,102 gallons, the entire amount manufactured during the period above stated, was exported to the United States.