of the carriage is reversed, the saw blade is automatically drawn back about one-quarter of an inch from the freshly cut surface of the log, and retained in that position until the forward motion of the carriage begins, when the saw is instantly restored to its exact former position. The advantages of this are obvious. The saw does not scratch the surface of the log on its back motion, while at the same time the speed of the quick return movement can be greatly increased.

Before this attachment was made, the return motion of the carriage was twice as fast as the maximum forward feed; with the deflector attached the back motion has been easily increased to three times the forward feed. This may not appear at first sight so important, but the firm suggest the following calculation relative to this point: In a year of 300 working days, without the deflector, 200 will be spent in cutting and 100 in running back the carriage; while with the deflector in use 225 days will be spent in cutting and only 75 days in running carriage back, a clean gain of 25 days' sawing.

The carriage on which the log is carried, together with the head blocks and dogs for supporting and holding it, as well as the set works and rails on which the carriage runs, all merit attention. Four different kinds of carriages are made for these mills in order to meet the varying wants of customers, but the style shown in the illustration is the most complete.

The head blocks are each made of double wrought iron I-beams, planed true and carrying strong knees to which the dogs are attached. These knees are made to recede 44, 48, or 54 inches from the saw, as required. Motion is transmitted from the set works to the knees through a steel shaft, carrying cut steel pinions working in cut steel racks. The ratchet wheels in the set works have forged steel rims, the ratchet teeth being machine cut, thus insuring the greatest accuracy in every respect. This set works is graduated to set to sixteenths. After the log has been entirely sawed, the knees can be brought back by power while the carriage is running back, or a few turns of the hand wheel on the carriage will bring them back simultaneously.

The dogs used for holding the log are the celebrated Knight's patent upper and lower dog. These dogs are so well known that it is only necessary to say that the upper and lower dogs can be adjusted separately or together, and that they will hold a log or flitch when nearly cut up, so that it is impossible for the board to spring away from the knees, thus permitting a log to be cut up true to the last board.

The trucks under the carriage are strong and heavy, to stand the strain of loading and turning heavy logs, and the rails on which the carriage runs are made of railroad iron planed true. The rail nearest the saw is planed to a V-shape, while the other one is flat.

These mills are made also to be driven by belt instead of direct engine, and can then be driven from any suitable source of power.

Band saw mills as above described are suitable for cutting the finest lumber in the country—walnut, poplar, pine; saving a large amount of lumber which would otherwise be cut into sawdust by the wide kerf of the wasteful circular mill. Their capacity is rapidly approaching that of circular mills. Messrs. London, Berry, & Orton tell us that with good logs they can already average 20,000 feet of lumber per day, and expect soon to see the day when 30,000 feet will be cut on band mills. Those who are interested in the subject should write Messrs. London, Berry & Orton, Atlantic Works, 22d Street above Arch Street, Philadelphia, Pa. They make the entire plant for band saw mills, including all described above, as well as log turners, edgers, cut-off saws, and saw mill machinery generally.

The American Institute Fair.

The fifty-third industrial exhibition of the American Institute was opened in its great building on Third Avenue, New York, on Wednesday, September 24. There was an audience estimated at 5,000 to listen to the opening address of the President, Cyrus H. Loutrell, who was followed in a most interesting speech by Hon. Abram S. Hewitt. The latter declared that the wealth of the world had been multiplied a hundred fold within a hundred years, by the aid of intelligent invention and the work of skilled mechanics. Science, he said, and not legislation, was the great lever which produced happy men and women; science revolutionized society for the better.

The lists of exhibits and exhibitors at this year's fair outnumber those of any previous year. The central part of the building, which is an eighth of a mile in circumference, has a concrete floor. Conterno's Ninth Regiment band is to give a concert each afternoon and evening. The machinery will be in motion from 10 to 12 o'clock in the morning, 2 to 5 o'clock in the afternoon, and 7 to 10 in the evening. One of the most interesting exhibits is an incubator in which chickens will be hatched; the eggs have been placed in at such intervals that chickens are expected to be hatched hourly, when they will be placed under an artificial mother, so that on the last day of the fair, it is counted, there will be chickens hatched by artificial means on the premises from one hour to two months old.

THE prediction of M. Ch. Montigny, of Brussels, that the past summer would be a very dry one—a prediction founded on his observations of the change in the character of stellar scintillation—has been fulfilled to the letter.

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NEW YORK, SATURDAY, OCTOBER 4, 1884.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 457,

For the Week ending October 4, 1884.

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THE GREAT TELEPHONE SUIT.

After four years of preliminary work, the great telephone suit between the American Bell and the People's Telephone Co. has reached a hearing. In the interest of the inventions themselves, in the magnitude of the amount involved, and in the number of witnesses and size of record, the suit has no parallel. The four years' work and the accumulation of the vast amount of testimony is amply justified from the standpoint of the first two considerations.

The history of the litigation may be briefly stated. It is a suit brought by the American Bell Telephone Company upon letters patent issued to Alexander Graham Bell, dated March 7, 1876, and January 30, 1877, against the People's Telephone Company, of this city. The possession of these patents has given the Bell Company the control of the telephone market. They sue the People's Company as infringers. In their defense the People's Company allege priority of invention on the part of Daniel Drawbaugh, and the issue of infringement is waived, the defendants practically admitting that they do infringe upon the Bell patents. The defendants claim that the invention of these patents was made at a period long prior to their date of issue, by Daniel Drawbaugh, of Pennsylvania. Hence they say that the patent should not have been issued to Bell, as he was not the first inventor. In this way the Bell Company is put on the defensive to protect its own patents, and the nominal defendant is really the aggressor.

Daniel Drawbaugh was a native of Pennsylvania. He was born at Eberly's Mills, in Cumberland Co., where he always resided. He was a mechanical genius of the universal type, turning his hand to a variety of work in demand in such a country region as the one he inhabited. He repaired guns and clocks, made furniture and machinery, and painted the wagons, and the portraits of their owners, for the surrounding region. In this way he made his living, devoting his leisure time to electrical experiments. He was never well off, and had much of his small stock of money swept away by the war.

In the year 1860, it is claimed he first conceived the idea of conveying human speech by electricity. He describes almost pathetically one of his early troubles. He needed a co-operator, some one to talk back and to listen at the experimental telephones. This assistant he found in his daughter, a girl only six or seven years old, who has since died. Her voice, the Drawbaugh people say, was the first human intonation heard through a telephone. In her, Drawbaugh says, he found an obedient and docile assistant, and a companion in his work that would not laugh at his dreams.

Various sketches and primitive apparatus have been produced by the defense, showing what are claimed to have been the early inventions of Drawbaugh; among them are a telephone transmitter made out of a tea-cup, designed to work in connection with an equally primitive receiver, in whose construction a tin mustard-can plays a prominent part. As shown these are not "lover's telephones" by any means, but are genuine electrical ones. The early date of 1866 is assigned to this tea-cup and mustard-can combination. But the inventor kept on the road to perfection, and for the year 1867 or 1868 we are presented with a more highly developed production, a transmitter made out of a jelly tumbler. All the apparatus thus far described was designed for use with a battery. In 1870 it is claimed Drawbaugh found out that a battery was not needed, and substituted therefor a permanent magnet. A horseshoe magnet was used in contact with the cores of two parallel bobbins. Then for two years the inventor is said to have devoted his energies to reducing the size of the instrument. In 1873 or 1874 he is said to have produced a very compact and efficient transmitter, which is still in excellent working order. It is in the shape of a flat cylinder, and is about five inches in diameter. During the time of the trial it has frequently been used on telephone lines with good success. A still more compact instrument is shown, which is said to have been made in January, 1875. In this a spiral magnet is employed, and the instrument is only three inches in diameter by an inch and a half thick. A pair of these in perfect working order are still in existence. Finally a very perfect and compact carbon transmitter, attributed to the early part of 1876, is shown, along with a larger one dated in August of the same year. The latter has recently been tried, and found to transmit sound uttered twenty-three feet from its opening.

One very impressive feature of these claims is the statement that such perfection as above described was reached at so early a date by Drawbaugh. For the first Bell telephones, exhibited less than ten years ago, were quite indistinct, and hard to use. The early perfecting of the invention, under the disadvantages due to isolation and poverty, if proved, will render Daniel Drawbaugh's name forever most illustrious.

The People's Company, alleging these facts in their defense, aver that Bell's patents are invalid and void from want of priority of invention, and aver that Drawbaugh was the prior inventor, and entitled to the broadest possible patent for the telephone and the telephonic art.

The Bell Company of course disputes all the proofs, and is fighting for the life of its own patents. This brief *resumé* of the Drawbaugh claims gives some clue to the line of rebuttal adopted by the complainants. Witnesses have been produced by them who testified that Drawbaugh could not have had the telephones in working order and in successful operation at the period mentioned without their knowledge.

The examination was conducted in various places, principally in Pennsylvania. Drawbaugh gave his testimony, in

answer to ex-Judge Lysander Hill's interrogatories, in a little attic room in Harrisburg. Mr. Chauncey Smith, of Boston, conducted his cross-examination, extending through upward of one thousand questions and answers. The direct examination of the alleged prior inventor occupied some three weeks, while five were devoted to this cross-examination.

The testimony was mostly taken before one examiner, Mr. Frederick M. Ott, of Pennsylvania. He received some hundred pages of manuscript of testimony taken in Boston, and since then has written out the enormous number of eight thousand pages of testimony. This represents over eight reams of law-cap paper, and certainly beats the record.

Now, after these four years of work, the case has come to be heard on its merits in the Circuit Court of this district, before his Honor Judge Wallace. An immense amount of matter is presented for his consideration. The testimony and record as printed fill a number of large octavo volumes. They contain much besides the examiner's record, as they include various matters stipulated into the case. Probably over ten thousand pages are filled by the two sides.

The interest of the suit is, as before stated, largely due to the subject matter. The telephone is so marvelous a conception, that expatiation on the greatness of the original invention is superfluous. If all of Mr. Drawbaugh's claims be proved, a veritable chapter of romance will be added to the already romantic annals of invention.

The magnitude of the moneyed interest is also impressive. One hundred millions of dollars is given as the amount in controversy. This is no fanciful amount; the Bell Company really control and monopolize the telephone supply. If their patents are broken down, they will lose the monopoly, and will have to enter the field against fierce competition.

The public is apt to consider itself benefited by the breaking down of any monopoly. They do not realize that the *quasi* monopoly of patents is instituted for their profit, and insures them most advantageous results. Hence public sentiment will probably be found to favor the Drawbaugh claims, in the hope of breaking down the Bell monopoly, and getting cheaper telephones. But this view, if taken, will be apt to prove a wrong one. The extensive development of the art is due to this protection, now menaced, and it is quite probable, if the Bell patents are declared invalid, that directly or indirectly the public will be the loser.

However, this is no place to argue the rights or wrongs of the case; the testimony is now before a United States Court, and a decision may be looked for at no very distant day.

The argument began on Monday, Sept. 22, 1884. It will last probably two or three weeks. The case for the complainants was opened by Mr. J. J. Storrow. At the present writing the defendant's side is being argued by ex-Judge Lysander Hill. The case was opened in the regular court room of the equity term of the Circuit Court, but the crowds that attended made a removal to a larger court room necessary. The noticeable feature of the attendance is the large assemblage of lawyers, as participants or spectators, within the bar. It is seldom, even on motion days, that the space is so crowded.

A note of the personnel of the trial is in place. The Bell Telephone Company is represented by the following array of counsel: Hon. Roscoe Conkling, Ed. N. Dickerson, Chauncey Smith, J. J. Storrow, and C. T. Howson. They produced as experts the following gentlemen: Prof. Charles R. Cross, of the Massachusetts Institute of Technology, F. L. Pope, Arthur W. Wright, and W. W. Jarnes. On the other side appear as counsel Hon. Geo. F. Edmunds, Hon. Lysander Hill, N. W. Jacobs, T. S. E. Dixon, and Melville Church. The expert was Mr. Park Benjamin. Both Prof. Bell and Mr. Drawbaugh have been present at times during the argument.

The total number of witnesses was over five hundred, of which nearly three hundred and fifty testified for the defense.

GRINDING MATERIALS.

The finest of emery cuts and leaves minute scores in the metal, particularly if the metal be soft; it is impossible to produce a good, polishable surface on silver with flour of emery; burnishing would be necessary to make a surface, and even then it would present a striated appearance under reflected light. Other grinding substances are required for some fine surfacing work. Moulding sand, that has been used in the foundry for some time, makes an excellent material for surfacing light brass—brass that contains a large proportion of zinc. Some excellent results are gained by the levigation of the sand—rubbing it under a muller on a stone (marble) slab, as paints are ground for the artist. By this means the foundry sand may be reduced to an impalpable powder, which, however, retains much of its abrading quality.

There is a manufacturer of fine tools in an Eastern city who uses coal ashes to give the last surface, before polishing, to his hardened steel tools. He takes the ashes of Lehigh coal, pours them into a tub of water, stirs them up violently, and, when the water is turbid with the fine ashes held in suspension, he draws it off into a shallow tank and allows it to settle. The sediment is his polishing powder. If a higher degree of fineness is required, the operation of stirring, and washing, and settling is repeated. The material thus obtained makes an excellent surfacing material.

In the manufacture of silverware (solid silver) the surfacing before burnishing is done by a blue clay, technically called "grit." It is found in several localities, particularly in the Connecticut River valley up to fifty miles from its mouth, in the vicinity of Middletown and Hartford. This clay appears to be the substance of which blue slate is formed, but is usually obtained in a semi-liquid form, and is dried for use. It is not surface clay, being found below the alluvium and sometimes below gravel, its depth or thickness of bed having been discovered, by boring for artesian wells, to be in some places more than sixty feet. Its identity with slate substance appears to be suggested by its behavior under heat, it assuming a stratified, porous form. It does not scratch pure silver, nor copper, nor mar coin gold, but it will not give a polish. It grinds without leaving a shining surface; this is produced by burnishing, by rubbing with whiting, chalk, or even with the bare hand.

ASPECTS OF THE PLANETS FOR OCTOBER.

JUPITER

is morning star, and by far the most brilliant of the shining throng that adorns the eastern sky, outmeasuring and outshining his fair rival Venus. The paths of the two planets lie near each other during the whole month, and their proximity affords the opportunity for some of the most charming exhibitions that these celestial wanderers are capable of producing.

Jupiter now rises about a quarter of an hour later than Venus. As he is apparently moving westward, and she is moving eastward, it is plain that with each successive rising the space between them will lessen until they meet. This event occurs on the 6th, at 11 o'clock in the morning, when Jupiter is 1° 15′ north of Venus. The planets are invisible at their nearest point of approach, but they will be near enough to each other on the morning of the 6th to make a lovely picture on the celestial canvas. They will rise together soon after 2 o'clock, and continue side by side on their shining course till the glowing dawn conceals them in the ethereal depths.

On the morning of the 7th they will present a new phase. Their relative position will be changed, Jupiter being west of Venus. The distance between them will go on increasing as each planet pursues its appointed course in a seemingly opposite direction. For Jupiter is approaching the earth in his progress toward opposition, growing all the while larger and brighter, and Venus is approaching the sun while receding from the earth, growing all the while smaller and less brilliant as she draws nearer to superior conjunction. Astronomers will have to lay aside Venus for the present as a subject for telescopic observation. Her white spots will shine no longer, for the rapidly waning crescent—the form she now takes on—will effectually hide her delicate markings from terrestrial observers.

There is, however, a compensation for those who take pleasure in the study of the queen of the sciences. When one planet retires from the field, another comes into prominence. Jupiter is now in favorable condition for the telescopist to wrest mighty secrets from his giant grasp. Has the great red spot vanished entirely beneath the all-encompassing clouds that swell his limits to such huge dimensions; or will another rift open a new path of exploration to his glowing neucleus; or what new discoveries will be noted in the process of world-making that is there taking place? We are sure to learn all the tidings that the best instruments in the hands of practiced observers can reveal.

When we speak of the conjunctions of two heavenly bodies, we mean that they are in the same right ascension or longitude, but not in the same declination or latitude. They will then rise together, but one may be north or south of the other. Thus, in the present conjunction of Jupiter and Venus, the planets are in the same right ascension, and will rise at the same time; but Jupiter is 1° 15′ north of Venus. If right ascension and declination are the same, in the case of planets, stars, and the moon, an occultation takes place instead of a conjunction. In the case of the sun and moon, the hiding of one luminary by the other is called an eclipse. These varied aspects are all illustrated on the October sky. For within the limits of the month, specially favorable for star gazing, there will be the conjunction of the two brightest planets of the solar family, the occultation of a bright star by the moon, a total eclipse of the moon, and a partial eclipse of the sun.

The right ascension of Jupiter on the 1st is 9 h. 58 m.; his declination is 13° 13′ north; and his diameter is 31″.

Jupiter rises on the 1st about half past 2 o'clock in the morning; on the 31st he rises a few minutes before 1 o'clock.

VENUS

is morning star, and though her brilliant face is becoming dim for a time, she still retains her power to please. Her path lies so near that of Jupiter that the history of the one during the month includes that of the other. We have already described the meeting of the two most brilliant gems of the planetary brotherhood on the 6th. The principal actors have a companion of lesser renown. The first magnitude star Alpha Leonis, or Regulus, is a near neighbor of both Venus and Jupiter, during the first part of the month, the yellow star contrasting finely in tint with the deep gold of Jupiter and the softer hue of Venus.

Venus is in conjunction with Regulus on the 7th, at 7 o'clock in the evening, being then 55 south of the star. At this time the bright trio will be almost in line, Jupiter being farthest north, with Regulus nearly between him and Venus.

The right ascension of Venus on the 1st is 9 h. 44 m.; her declination is 12° 46 north; and her diameter is 21·6″.

Venus rises on the 1st about a quarter after 2 o'clock in the morning; on the 31st she rises about 3 o'clock.

MERCURY

is morning star during the month. He reaches his greatest western elongation on the 5th, at 3 o'clock in the morning, being then 17° 58′ west of the sun. It is the last time during the year when he is favorably situated for being seen with the naked eye as morning star, and only sharp-sighted observers will succeed in picking him up. He must be looked for 8° north of the sunrise point, and 20° southeast of Jupiter and Venus. The best time for observation is an hour before sunrise.

On the 9th, at 3 o'clock in the morning, Mercury is in conjunction with Uranus, the latest comer among the morning stars, seeming to pass 1° 10′ north of his distant neighbor.

The right ascension of Mercury on the 1st is 11 h. 33 m.; his declination is 3° 56′ north; and his diameter is 7·4″.

Mercury rises on the 1st about half past 4 o'clock in the morning; on the 31st he rises not far from half past 6 o'clock.

SATURN

is morning star, and as he rises now at half past 9 o'clock in the evening, will soon be in convenient position for easy observation. His high northern declination and increasing brightness make him a prominent object, and one easily recognized. He has wandered away from the neighborhood of his last year's companions, Aldebaran and the Pleiades, but has now established himself midway between two bright twinklers, Capella on the north and Betelguese on the south. He is preparing his forces for a brilliant career in the coming winter.

The right ascension of Saturn on the 1st is 5 h. 55 m.; his declination is 21° 51′ north; and his diameter is 17·8″.

Saturn rises on the 1st at half past 9 o'clock in the evening; on the 31st he rises at half past 7 o'clock.

NEPTUNE

is morning star, and is in good position for telescopic observation. He may be found in the constellation Taurus, about 7° south of the Pleiades, and remains nearly stationary during the month. A good instrument directed toward that part of the sky will quickly reveal the presence of the far away planet in the form of a small round disk.

The right ascension of Neptune on the 1st is 3 h. 24 m.; his declination is 16° 47′ north; and his diameter is 2·6″.

Neptune rises on the 1st soon after half past 7 o'clock in evening; on the 31st he rises soon after half past 5 o'clock.

URANUS

is morning star. He encounters Mercury, who is oscillating eastward toward the sun, and they are in conjunction on the 9th, the only contribution made by Uranus to the incidents of the month.

The right ascension of Uranus is 11 h. 58 m.; his declination is 0° 56′ south; and his diameter is 3·4″.

Uranus rises on the 1st about 5 o'clock in the morning; on the 31st he rises about half past 3 o'clock.

MARS

is evening star, and enjoys the distinction of being the sole planet on the sun's eastern side, his six companion planets being congregated on the sun's western side as morning stars. He may be found in the constellation Libra early in the evening, where he shines as a faint reddish star.

The right ascension of Mars on the 1st is 14 h. 40 m.; his declination is 16° south; and his diameter is 4·6″.

Mars sets on the 1st at 7 o'clock in the evening; on the 31st he sets at half past 5 o'clock.

THE MOON.

The October moon fulls on the 4th at 5 o'clock in the evening, standard time. The moon is in conjunction with Neptune on the 7th, and with Saturn on the 9th. She makes her nearest approach to Jupiter on the 14th and to Venus on the 15th, when the brilliant planets and the waning crescent will form on successive mornings pictures which one never tires of beholding. On the 16th the moon is near Uranus, on the 17th near Mercury, and our fair satellite completes the circuit by paying her respects to Mars three days after her change.

OCCULTATION OF BETA CAPRICORNI.

On the 26th, the day before her first quarter, the moon occults the third magnitude star Beta Capricorni. If the weather prove favorable, the interesting phenomenon will be easily visible. The immersion of the star will take place at 19 minutes after 9 o'clock in the evening, Washington mean time. The occultation will last 58 minutes, and the immersion will take place at 17 minutes after 10 o'clock. The observer will see the star suddenly disappear behind the moon's dark edge. It will remain hidden from view nearly an hour, when it will suddenly reappear on the moon's bright edge, and star and moon will rapidly recede. The moon is frequently occulting small stars, but she does not often capture so large a prize as Beta Capricorni.

TOTAL ECLIPSE OF THE MOON.

There will be an eclipse of the moon on the 4th, visible as a total eclipse in Europe, Asia, Africa, and the Atlantic Ocean. Dwellers in this vicinity will enjoy the latter part of the show, for the moon will rise eclipsed, and the eclipse will end about 6 o'clock.

ECLIPSE OF THE SUN.

There will be a partial eclipse of the sun on the 18th, invisible in the United States, but visible in Western Europe and Asia. Our loss in being on the wrong side of the earth when the event takes place in not very great, as only 0·639 of the sun's diameter is eclipsed.