Secondary Spectra.

Professor O. N. Rood, of Columbia College, New York city, communicates a paper to the *American Journal of Science and Arts*, on the secondary or residual spectrum found on passing a ray of white light through two prisms of different substances arranged to compensate each other for color. This secondary spectrum is generally of small dimensions and peculiar appearance, and is due to the circumstance that the spacing of the colors in the two original spectra is not accurately correspondent. In dimensions, it varies with the amount of the disproportion of the original constituents.

The writer, after alluding to Sir David Brewster's investigations in the same direction, observes that, by proceedings of a different kind, he has succeeded in producing secondary spectra, comparatively gigantic in size, which display the fixed lines with a distinctness which allows the study of their peculiar construction by an ordinary spectroscopic mirror. The constituents used are one spectrum furnished by oil of cassia, bisulphide of carbon, or even flint glass, and the other a normal spectrum obtained by the diffraction grating. Thus it is considered that a very near approach is made to the maximum difference of spacing attainable in the present state of optical science; and hence to the secondary spectrum is given its maximum dimensions.

The lines of the solar spectrum not being adapted for the study of the arrangement of the secondary spectrum, a number of chemical lines of easy identification were selected. The cases considered in experimenting were three. 1. Where the opposing spectra are of equal or nearly equal lengths. 2. Where the spectrum from the grating predominates. 3. Where the prismatic spectrum is the longer of the two. Measurements are given, in each instance, of both primary spectra, also of the actual secondary spectrum due to the same in combination, and of the secondary spectrum obtained by construction. In the last case, Professor Rood finds that the distance of any two lines apart in the secondary spectrum will be equal to one half the corresponding distances in the primary constituents; and that the secondary spectrum, thus constructed, will always be half the size of the actual physical spectrum which it represents. From this, he deduces a formula by which, taken in connection with maps of the primary spectra, he is enabled to construct a correct map of the secondary spectrum in any case.

This construction furnishes a simple means of determining the size and arrangement of the secondary spectrum furnished by two prisms of selected angles, placed in any desired positions relative to the incident ray and to each other. The accuracy of the result depends on the exactness with which the measurements on the primary constituents are effected, and, it is considered, may practically prove useful in dealing with the secondary spectra in optical instruments.

In order to reveal the nature of the secondary spectrum at a glance and permit of its study in a qualitative way, instead of using the slit as a source of light, a pin hole is employed; and the refraction edge of the prism being vertical, the diffraction grating is revolved in its own plane, somewhat so that its lines shall be no longer vertical. This process reduces the secondary spectrum to a line which, on rotating the grating or prism, assumes various curves. It is considered, therefore, that a true secondary spectrum must be regarded as a resultant spectrum in which any two, even closely adjacent, lines are united; even although the actual union of different tints has not been effected and the general appearance still resembles that of one of the primary constituents.

A Trap to Catch Lions.

In Algeria, there is annually a great loss of life and property, by the depredations of lions. The loss of property is estimated at $50,000 a year. The inhabitants cut away the forests as a means of protection against the wild beasts. M. Cheret devotes himself wholly to their extermination. As an assisting means in this, his life work, he has invented a lion trap, made as follows:

The frame and bars are of iron. It is 10 feet long, 6 feet 6 inches wide, and the same in hight. Mounted on three cast iron wheels of small diameter, it can be moved on difficult ground. The upper part opens with folding doors, like a wardrobe, which close of themselves at the slightest shock given to springs of steel. Catches retain the lids as they fall, and imprison the animal as soon as he touches the bottom of the trap. The plan is to place this trap, properly baited, on the ground frequented by the wild animals, and then, when the game is caught, to wheel the machine away to some menagerie prepared for the purpose.

Fatalities from Lightning.

The human mortality from lightning is not generally on a large scale, and might be very much reduced by precautions on the part of builders; so thinks the *Building News*. Arago estimated that the number of deaths from this cause amounted in France to about 70 in the year; Bondin calculated that from 1835 to 1852 1,308 so perished; none in November, December, January, and February, but most in June and August. The lowest rate is assigned to Belgium, and the next to Sweden, the United States and England being about on a par. As a rule, however, these fatalities do not occur inside a structure of any kind. The peril, as experience shows, is less in a crowded town than in a village or in the open country, and, naturally, the more elevated structures are the most liable to be struck. Fuller, indeed, in his "Church History," asserts that there scarcely ever existed a great abbey in England which had not been, at one time or another, wholly or partially destroyed by lightning, and his citations, taken in comparison with the records of our own times, are certainly remarkable. In all cases it is the spire, the tower, and the dome which has been mutilated. As to ordinary habitations, all sorts of theories are in vogue on the subject of danger and safety. Some rely on thick glass in the windows, and some on register stoves; others recommend stone roofs instead of slate, and others tell timid people that they should live in a hollow. It is contended on this side that there should be the least possible admixture of metal in the combination of an inhabited structure; and on that, that all the bells beneath the roof should be kept continually ringing, just as, in obedience to an old superstition, cannon are fired at sea. The mass of evidence upon this topic points, however, to the one conclusion already suggested, that a good lightning conductor is the solitary safeguard; but that, unless good, it is worse than none.

Cumberland Gap Cave.

A correspondent, A. L. S., says, in reference to this remarkable formation, described in our issue of September 13, that, after General Morgan's retreat from that spot, the cave was explored for a distance of four miles by Confederate soldiers, and a new opening was discovered, 3 miles from the one mentioned by H. B. N. The place has never been thoroughly investigated, but chambers, far surpassing in grandeur that described by our earlier correspondent, have been found. In penetrating the rock, it is found that the new entrance leads for 6,000 yards through sandstone; and in this section of the cave, vast quantities of human bones of gigantic size were found, some of the skulls being large enough to put on over a man's head. It is intended, during the current month, to thoroughly explore the cave.

NEW BOOKS AND PUBLICATIONS.

PHYSICAL GEOGRAPHY. By Arnold Guyot, Author of "Earth and Man." New York: Scribner, Armstrong, & Co.

This is a very excellent work on a most interesting branch of study, and is a model school book, full of accurate information, placed before the reader in a lucid and concise style. It is well illustrated with maps and wood engravings.

A CATECHISM OF HIGH PRESSURE OR NON-CONDENSING STEAM ENGINES, including the Modeling, Constructing, Running and Management of Steam Engines and Steam Boilers. By Stephen Roper, Engineer. Philadelphia: Claxton, Remsen, & Haffelfinger, 624, 626, and 628 Market Street.

This is yet another handy book on the steam engine, and it contains much needed general information, as well as descriptions of many American improvements and specialties.

PRACTICAL DESIGNING OF RETAINING WALLS. By Arthur Jacob, A.B., A. I. C. E., late of H. M. Bombay Service. Price 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren Streets.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From August 29 to September 4, 1873, inclusive.

BLOWER.—P. S. Justice, Philadelphia, Pa.
BURNISHING PHOTOGRAPHS.—G. P. Critcherson, Worcester, Mass.
ELECTRIC TELEGRAPH.—J. B. Stearns, Boston, Mass.
GAS.—W. Steers, New York city.
PRINTING PRESS.—G. F. Pabst, New York city, *et al.*
RAILWAY CAR SPRING.—H. Gardiner, New York city.
SEPARATING METALS.—S. W. Kirk, Philadelphia, Pa., *et al.*
SEWING MACHINE.—J. Knous, Hartford, Conn.
SURFACE CONDENSERS.—J. P. Bass, Bangor, Me.

Recent American and Foreign Patents.

Improved Hame Fastener.

Thomas L. Booker, Shady Grove, Va., assignor to himself and E. H. Booker, Donaldsonville, S. C.—The object of this invention is to provide ready and convenient means for adjusting and fastening hames on the collars of horses and mules; and it consists in a connecting band, screw bolts, and clips at the ends of the hame. The invention is specially adapted for draft horses, and for plantation use.

Improved Rotary Churn.

William H. Bunch, Windsor, N. C.—The body of the churn is provided with a closely fitting cover, to the lower side of which, upon the opposite sides of its center, are attached wings or stationary dashers. These wings are made curved upon the side against which the milk dashes.

Improved Picture Hangers.

Franklin W. Ely, Duluth, Minn.—The picture frame has a web attached to it at two points, one being below the center of the frame or picture, and the other near the top. The web, similar to suspender webbing, is doubled at one or both points where it is attached to the frame; but to outer portion a ring is attached, with which the suspending cord is connected. The use of the slide is to vary the inclination of the picture or frame. By moving the slide upward, the web is shortened, and the frame is brought nearer to an upright position; and when the slide is moved down the effect is contrary.

Improved Candlestick.

Samuel D. Hill, Downieville, Cal.—This invention consists in arranging the socket of the candlestick for different sizes of candles, by making it in two pieces connected by a slotted band spring.

Improved Metallic Lathing.

Timothy O'Callahan, Boston, Mass.—The object of this invention is to furnish an improved metallic sheathing for the inner walls of buildings. The ceiling and side walls of a building may be covered with sheets of cheap metal, having stamped, cast, or otherwise connected to its face dovetail shaped studs. The studs are in the shape of truncated pyramids, with face recesses for the firm adhesion of the plaster to be placed around and over them. These sheets are to be nailed or otherwise secured to the wall. Much less plaster is required for filling the space between the studs than for covering the ordinary lathed wall, and the work is performed in less time, while the plaster dries quicker, and is not so liable to crack.

Axle Box and Sleeve for Vehicle Wheel.

William H. Cowell, Columbus, O.—In this invention the axle is made of wood and the skein is fitted to the axle in the usual manner. There is a nut on the outer end of the skein and the sleeve is made of sheet metal and fitted on to the axle over the skein. A recess opens in this sleeve for the retention of the lubricating material. The interior of the pipe box is chambered out for containing the lubricating material, and the box is cast on a chill, to render it hard and durable. The sleeve may be made of sheet steel or composition metal, and not being confined, except by a lug or other device, to prevent its revolving with the wheel, it may be turned, when worn, upon one side, thus presenting a new surface for the bearing.

Improved Advertising Lamp.

Francisco R. Warner, Paris, France.—This invention consists of a metallic frame of peculiar form, adjustably attached to a lamp post and provided with removable glass plates, upon which the advertisements are displayed.

Improved Portable Steam Engine.

Reinhard Scheidler and John H. McNamar, Newark, Ohio.—This invention consists in the improvement of the heaters of portable engines. The pump is arranged in a vertical position on one side of the boiler near the smoke pipe, attaching it to a vertical supporting plate having a concave side, fitting the boiler and bolted to it; also having a bearing at the upper end for a countershaft for driving the pump, said shaft extending across the top of the boilers, in front of the smoke pipe, to a bearing on the other side, where it carries a pulley for turning it by a belt from the crank shaft at the front end of the boiler. The plate is detachably connected to the boiler, so that it can be taken off readily for shipping. The portion of the shaft having the crank for driving the pump connects with the other portion by a clutch which is shifted by a lever, so that the pump can be worked or not, at will. This arrangement is claimed to afford a simple, compact, and reliable connection of the pump in a portable engine, so that it can be stopped without stopping the engine whenever it may be required to do so, which often happens, and causes considerable unnecessary delay in all portable engines having the pump directly connected to the cross head in the ordinary way. Moreover, it saves the unnecessary loss of power expended in running the pump when it is not required.

Improved Mallet.

Albert Holbrook, Providence, R. I.—The object of this invention is to furnish a durable rawhide mallet for the use of machinists and others in putting together, taking apart, fixing, or adjusting metallic or wooden machinery, and for all similar purposes. It consists in a mallet with one or more rawhide heads secured in a metallic socket, which is made of metal in one solid piece. The handle is secured in the socket in the ordinary manner. The socket or body has a recess at one or both ends which receives the heads. These heads are made of rawhide coiled up and dried, and then turned to the desired size and shape, and secured by means of a screw inside the socket.

Apparatus for Preserving Beer on Draft.

John W. Moore, Bellefonte, Pa., assignor to himself and P. Gray Meek, of same place.—This invention relates to means for introducing air into casks to take the place of the liquid drawn out; and it consists in the combination, with a flexible bag or air holder, of a valve and bellows mechanism of a novel construction. Into the bung hole of a cask containing beer or other liquid that would be injured by contact with air is fitted a hollow bung having a nozzle formed upon its inner end, to which is secured the mouth of the bag, made of rubber or other suitable material, and of sufficient size and elasticity to fill the cask when expanded. By this construction, as the liquid is drawn out of the cask, the air will enter the bag through the hollow bung and expand said bag to take the place of the liquid drawn out.

Improved Extension Table.

Christian Rieger, Morrisania, N. Y.—This invention consists in extension rails, hinged to the rails of the side table, and to extension legs. These extension rails are each made in two pieces, connected together by pivoted strips on the bottom and top of the rails. When the rails are extended, they are held in position by means of knob buttons. These buttons are attached to one part, and turn on a central pivot over on to the other part, thus holding the two pieces parallel with the rails of the side table. The cover of the table is in two parts, hinged together like ordinary card tables. When the extension rail is drawn out, the half of the table top is turned over on to it, thus making a square table. When the extension rails are folded, they are in a position with the half of the top turned back and resting on the other part of the top. There is a spring catch on the bottom of the drawer frame which engages with a lip on the side rail which holds the parts securely together. When the table is extended, the rails of the four sides present a uniform and finished appearance.

Improved Corn Planter.

William Mull, Rantoul, Ill.—In this invention the seed hoppers are attached to the frame of the machine. The ends of the dropping slide enter the lower parts of the hopper through holes in their inner sides. A spring has its upper end attached to a cross bar of the frame, and its lower end enters a hole in the dropping slide, to bring said slide back to its position when released from the device that moves it. To the slide, toward one end, is pivoted the end of a connecting rod, the other end of which is bent at right angles, passing through a short curved slot in a wheel or disk, and is secured in place by a nut or other convenient means. The wheel or disk is attached to the end of a short shaft which revolves in bearings attached to a cross bar of the frame, and to its other end is attached a bevel gear wheel, the teeth of which mesh into the teeth of a similar wheel attached to the axle, which revolves in bearings attached to the frame, and to its ends are rigidly attached wheels, so that the said wheels may carry the said axle with them in their revolution. In each end of the axle, at a little distance from the wheels, is formed a universal joint, so that the said wheels may accommodate themselves to the surface of the ground, however uneven said surface may be. A further use of the joint is to enable the wheels to be lifted by levers and rods when the machine is to be turned about, or the discharge of seed requires to be arrested.

Improved Door Fastener.

Henry Orcutt, Amherst, Wis.—This invention consists in applying a semicircular bar to a door and arranging a weighted lever to engage therewith (the bar being notched or perforated for the purpose), so that the door may be locked in any position, shut, open, or partly open. The contrivance is designed more particularly for stable, carriage house, barn and shop doors but it is alike applicable for doors of dwelling houses.

Improved Steam Generator.

Harry P. Wright, Bonaparte, Iowa.—This invention consists of secondary return flues, arranged in the masonry along the sides of the boiler, above the furnace, into which the heat is turned at the front of the boiler, instead of discharging into the smoke stack, thus economizing the heat by causing it to pass along the boiler once mere than in other arrangements.

Improved Fireproof Shutter.

John B. Cornell, New York city.—This invention consists of a door or shutter composed of three plates of metal united together side by side, the two outer sheets being plane, and the middle one being bent in zigzag or other form, so as to form channels or spaces between it and the outer sheets for the circulation of air or water to cool the door or shutter in case it is exposed to fire, and prevent the transmission of heat through the door.

Improved Earth Boring Machine.

Joseph Burns, Anamosa, Iowa.—In this invention the square auger shaft has a screw point fixed in it permanently. The lower part of the screw auger is fitted so as to be adjusted relatively to the point, to use said point with it or not, and will have a set screw to fasten it where it is required to be. The upper part of the screw auger is arranged to slide up and down freely, and rests on the lower part when boring. By the bar or plate, in which it is fitted to turn freely and in which it is confined by the collar this part of the auger is connected to cords, which pass over pulleys under, the platform to a drum, which is fitted loosely on the crank shaft, and clutches with it to be turned by it for elevating the borings when moved to the right by a lever, so that studs will engage, and it disengages them and lets the auger fall again when the lever is moved the other way. This shaft is the same one that is employed to turn the shaft for boring, and is itself turned by a shaft, pinion and wheel. The driving power is applied to the shaft by a belt from a steam engine, horse or other power; or it may be turned by hand.

Improved Mold or Box for Brick Press.

John McKenna, Cambria, Pa.—The press boxes for making fire brick have heretofore been cast solid and lined with steel. The steel facing soon wears away, so that the bricks are too large and untrue. The steel has then to be taken out and replaced with new, which can only be done at considerable expense. The object of this invention is to furnish a mold which shall obviate the difficulties experienced in the use of the usual press box.

Improved Plow Coupling.

Thomas L. Thrasher, Paris, Texas.—The invention has for its object to furnish an improved coupling for connecting two plows, to enable them to be guided and controlled by one man; and it consists in the bent bars strengthened at their bends by extra rods, provided at their lower ends with swiveled clamping plates and set screws, and at their upper ends with eyes, slides, and notches to receive the key.