

A FAITHFUL AND TIRELESS SERVANT.

The patient, tireless, hardy beast of burden forming the subject of our illustration has borne an extremely important if not always duly credited portion of the labor of opening up our new western country, both on the great plains and in the mountain regions. In our fully illustrated description of the building of the Pike's Peak railroad, in the SCIENTIFIC AMERICAN of January 24, it was stated that "all provisions, tools, and camping outfits were transported by trail to the various camps along the line on the backs of mules and burros," but, in addition to this general credit, we now present a view, from a photograph, of one of the animals so employed. Odd as the view must seem to most of our readers, it is by no means an uncommon one to those familiar with life at mining camps in the mountains and in many other places distant from the railroad lines. And, with variations in the character of the burdens, these same sturdy, diminutive equines, which would generally be classed as donkeys at the East, or as bronchos, burros, or Indian ponies at the West, have borne a large part of the labor attendant upon the advancing settlement of the plains.

liancy those obtained from the best varieties of commercial indigo. Its identity with the natural product was established by means of its chemical reactions, by dyeing tests, and by spectroscopic examination. The yield is about 60 per cent of the glycocoll taken.—Ber. Berl. Chem. Ges., Amer. Jour.

The Kermes (Coccus ilicis).

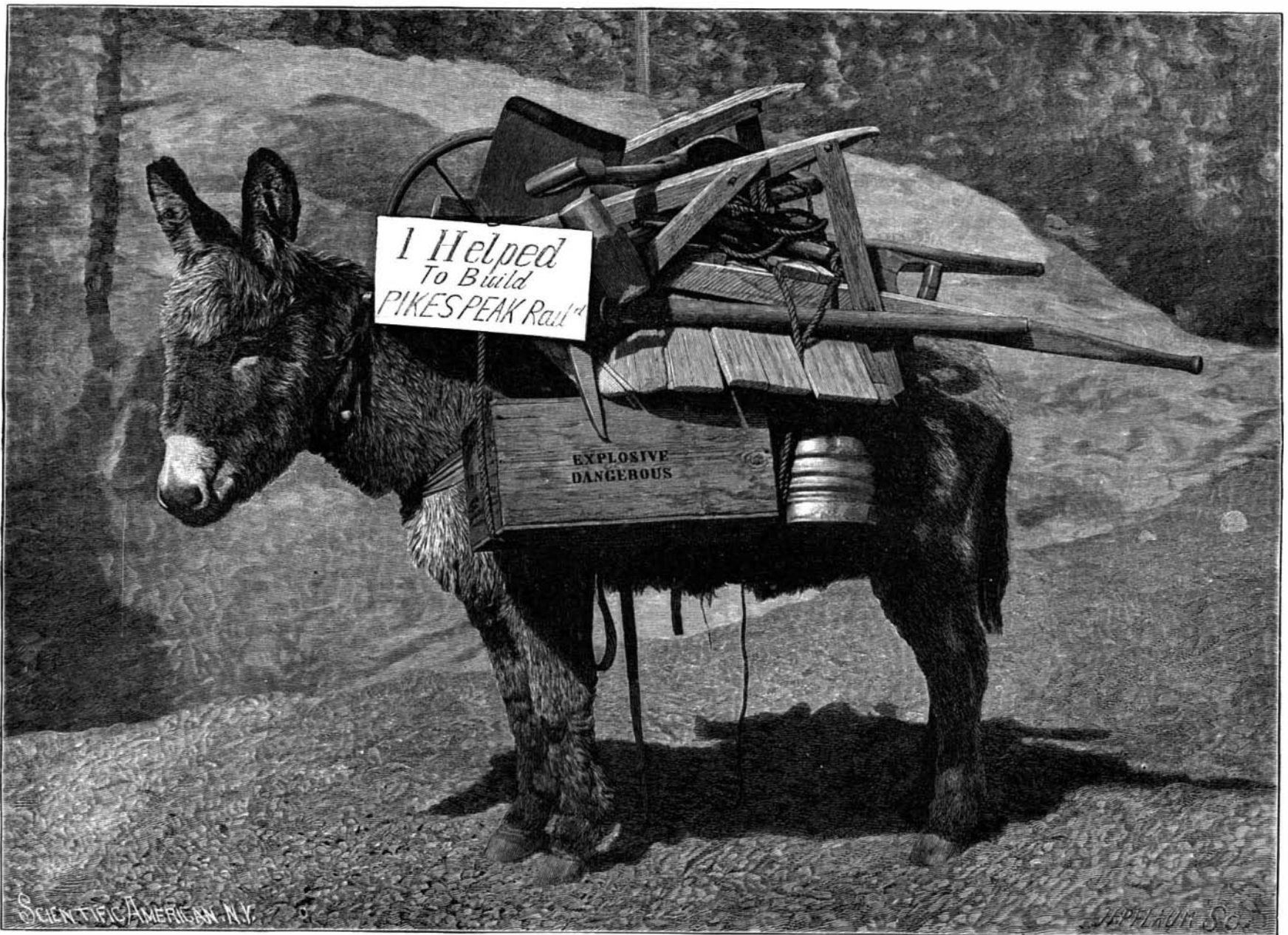
From the earliest stages this insect has been employed to impart a scarlet color to cloth. It was known to the Phœnicians under the name of Tola and to the Arabians and Persians as Kermes or Alkermes (Alsignifying the, as in the Arabian words Alchemy, Alkali).

Dioscorides calls it *kokkos*, and Pliny *coccum* and *granum*. In the middle ages it received the epithet Vermiculatum, or "little worm," from its having been supposed that the insect was produced from a worm. From these denominations have come the Latin *coccineus*, the French *cramoisi* and *vermeil*, and our own words crimson and vermilion. The *Coccus ilicis*, or kermes, is found in great numbers in India and Persia, attaching itself to the leaves of a small oak, the kermes oak (*Quercus coccifera*), a low bushy shrub with

duce as much coloring matter as ten or twelve pounds of kermes. Cochineal has supplanted kermes, and the latter is now only cultivated by the poorer inhabitants of the countries in which it abounds, especially in India and Persia, and the peasantry of Southern Europe.

Another species of kermes (*Coccus polonicus*) is very plentiful in Poland and Russia, and is sometimes called the scarlet grain of Poland. Before the advent of cochineal, this insect formed a considerable branch of commerce. In the neighborhood of Paris, and in many parts of England, the *C. polonicus* is found upon the roots of the perennial knawel (*Sceleranthus perennis*), a plant not uncommon in Norfolk and Suffolk. The color which it furnishes is nearly as fine as that of cochineal, and capable of giving the same variety of tints. The insect was formerly collected in the Ukraine, Lithuania, etc., and though still employed by the Turks and Armenians for dyeing wool, silk, and hair, but especially for staining the nails of Turkish women, it is rarely used in Europe except by the Polish peasantry.

The same may be said of other species which the



A HELPER ON THE PIKE'S PEAK RAILROAD.

Our engraving was made from a photograph sent to us by Mr. John Potter, of Colorado Springs, Col.

Synthesis of Indigo-carminine.

Heymann has succeeded in effecting the synthesis of indigo-carminine, the disulpho acid of indigo, by acting upon phenyl-glycocoll with fuming sulphuric acid. If, for example, phenyl-glycocoll be mixed in a test tube with ten to twenty times its mass of fuming sulphuric acid containing 20 to 25 per cent of sulphuric oxide, and gently warmed, it dissolves with a yellow color, evolving sulphurous oxide gas. On pouring the solution upon ice, it rapidly assumes the greenish-blue color of indigo-carminine. For its production the following method gives the best results: One part of phenyl-glycocoll is mixed with 10 to 20 parts of sand and then introduced into twenty times its mass of fuming sulphuric acid, warmed to 20° or 25°, containing 80 per cent sulphuric oxide; the temperature not being allowed to rise above 30°. The glycocoll goes easily into solution with a yellow color, which at once, with evolution of sulphurous oxide, passes into the deep-blue color of the indigo solution. To remove the concentrated acid, the mass is diluted with sulphuric acid of 66° B. The coloring matter is isolated by farther dilution with ice and the addition of salt. As so prepared the product is completely pure indigo-carminine. The colors obtained in dyeing with it far exceed in bril-

lity those obtained from the best varieties of commercial indigo. Its identity with the natural product was established by means of its chemical reactions, by dyeing tests, and by spectroscopic examination. The yield is about 60 per cent of the glycocoll taken.—Ber. Berl. Chem. Ges., Amer. Jour.

evergreen spinous leaves, resembling holly. The kermes is also found in the southern countries of Europe and in the south of France. In parts of Spain, the kermes oak grows in great profusion, as on the sides of the Sierra Morena. Many of the inhabitants of Murcia gain a livelihood by collecting kermes. This work is for the most part done by women, who scrape the insects from the tree with their nails, which they allow to grow long on purpose.

The insect attaches itself to the young shoots of the shrub; the female affixing itself and remaining immovable, till after having reached its full size, about that of a pea, which it much resembles, it deposits its eggs and dies. It is gathered before the eggs are hatched, thrown into vinegar and then dried in the sun or in an oven. It has been, from time immemorial, used to dye cloth, and is supposed to have been the substance employed in dyeing the curtains of the Jewish tabernacle. As the color which it yielded was more beautiful than the celebrated Phœnician dye, it may have contributed to put an end to the monopoly of the Phœnician dyers.

The kermes yields a brownish red color, which alum turns a blood red tint. Dr. Bancroft showed that when a solution of tin is used with kermes dye, as with cochineal, the kermes is capable of giving a scarlet color quite as brilliant as that which cochineal produces, and to all appearance more permanent. But on the other hand, one pound of cochineal will pro-

duce as much coloring matter as ten or twelve pounds of kermes. Cochineal has supplanted kermes, and the latter is now only cultivated by the poorer inhabitants of the countries in which it abounds, especially in India and Persia, and the peasantry of Southern Europe.

cochineal has eclipsed, such as the coccus, found upon the roots of *Poterium sanguisorbis*, an insect formerly used by the Moors for dyeing silk and wool a rose color; and the *C. uva-ursi*, which, together with alum, dyes crimson.

All these species owe their coloring property to a principle called carmine.—G. E. Cope in Science-Gossip.

Locusts in Denver.

Our Colorado correspondent, writing from Denver, July 29th, says: "The city last night was full of grasshoppers, or rather Rocky Mountain locusts. Their stay was brief. They were apparently hastening in a bee line for the grass on the streets of Omaha. They came in immense swarms from the west, passing on toward Kansas and Nebraska, a few thousands only spending the evening here for rest and recreation."

They are supposed to breed beyond the range west of the city, and were driven across by the violent but brief storm. So abundant were they that the radiance of many of the electric lights was perceptibly obscured and many of the sidewalks were made slippery. The last visitation of grasshoppers to Denver occurred in 1874.

INDIA ink is made from fine lampblack compacted and cemented with glue. The finest black is derived from pork fat. The glue is made from buffalo hide.

Lac (*Coccus lacca*).

This insect, like its congener the cochineal insect, belongs to the order Hemiptera. Its habits and economy are nearly identical with it. When a colony of several males and females select a branch of a tree for their home, they puncture it, and a milky exudation follows, in which they are soon entombed, and which furnishes them with both food and shelter. It forms irregular dark-colored, resinous masses on the twigs of the trees which it surrounds, and which is gradually added to until they are sometimes nearly an inch in diameter. To each male insect it has been computed there are not less than 5,000 females, the males being twice as large as the females.

The trees most usually affected are the *Ficus Indica* and *F. religiosa*, which both abound in a milky juice. When the season arrives the natives collect the encrusted twigs, which in this state are known commercially as "stick-lac." It contains about seven per cent of resin and one-twentieth part of coloring matter. To separate the sticks, coloring, and other foreign matter, the stick-lac is placed in large vats of hot water, which melts the resin and thus liberates all impurities. It is then taken out and put in oblong bags of cotton, and a man standing at each end of the bag holds it over a charcoal fire. By this plan the resin is liquefied and drops through and falls on to the smooth stems of the banyan tree, placed purposely to catch it. This flattens it out into thin plates, and it is then known to us as shell-lac. If the coloring matter has not been well washed out, the resin is left of a very dark color. Thus we find in the lac market, orange, garnet, and liver varieties, that which most nearly approaches to a light brown color being the best.

When separated from impurities, pulverized, and the major portion of coloring matter removed, it is known as "seed-lac."

Sometimes it is melted up and made into small cakes. In this state it is known as "lump-lac." The water which remains behind after the lac has been

softened is rich in a coloring matter akin to that of cochineal, so that when strained and evaporated, a beautiful purple residue is left. Cut into cakes this forms another important article of commerce, viz., "lac dye."

Shell-lac is soluble in anhydrous alcohol, ether, fat, and volatile oils. In the alcoholic solution it forms a fine varnish.

Hydrochloric and acetic acids also dissolve it. It is necessary sometimes to bleach it, for the manufacture of colorless varnishes, sealing wax, etc. This is effected by dissolving in caustic potash, and passing chlorine gas through the solution. It can then be pulled and twisted into sticks. Seed-lac is much more soluble in alcohol than shell-lac. Lac dye is soluble in sulphuric and hydrochloric acids. The mordant for use in dyeing is generally bi-tartrate of potash and protochloride of tin.

The chief use of lac is for the manufacture of varnishes and sealing wax. The differently tinted sealing waxes are produced by adding vermilion for red, ivory black for black, and verditer for blue (sometimes small is used). For a white wax, the lac is simply bleached as before mentioned.

To obtain the fine golden color sometimes seen, powdered yellow mica is incorporated with it. Shell-lac is imported from Assam, Siam, and an inferior quality from Bengal.

Pegu stick-lac is exceedingly dark, and therefore not fitted for the finer uses of lac; but the finest lac, of a very light sherry color, comes from Cicar.

We receive something like 1,000,000 pounds annually, but a large portion of this is again exported to Germany, Italy, and other foreign countries.

After the first melting of the lac it is usually more tenacious than after subsequent meltings, which tend to make it hard and brittle. The ancient Chinese were well aware of this property, as is evinced in some of their works of art, which remain perfect to this day. They are usually small boxes, either in wood or metal,

which have had a thin coating of lac, and while soft and plastic, had been moulded into various beautiful forms. Some of these works of art fetch considerable prices.—*H. Durrant, in Science-Gossip.*

Improvements in Water Gas.

BY J. C. REISSIG, LA PLATA, AND J. LANDIN, STOCKHOLM, SWEDEN.

When steam is passed through incandescent carbonaceous fuel maintained at 550°—750° C., a gas is produced which consists mainly of hydrogen and carbonic acid, with only small quantities of carbonic oxide. When the fuel is maintained at a higher temperature, the proportion of carbonic oxide increases until, at a temperature of 1,000°, the resulting gas consists of a mixture of about 40 per cent of carbonic oxide and 50 per cent of hydrogen, with only about 5 per cent of carbonic acid. This is known as water gas, and its use is often objected to on account of the poisonous properties of the carbonic oxide contained.

The main object of this invention is to produce a gas containing but little carbonic oxide, and to increase its calorific power by removing the carbonic acid from the combustible gases. The process consists in passing steam (preferably superheated) or water through fuel contained in externally heated retorts, or in water gas generators, maintained at 550°—750° C. The resulting gas, consisting of hydrogen and carbonic acid, in the proportion of 2 to 1, is cooled and freed from sulphur impurities in the usual way. It is then passed through an absorbing apparatus containing carbonates of alkali or alkaline earths, preferably solutions of sodium carbonate (soda) or potassium carbonate (potash). These substances readily absorb (especially under pressure) the carbonic acid, forming bicarbonates, from which the carbonic acid is easily removed by the action of a moderate vacuum, especially if aided by heat. The remaining gas consists principally of hydrogen, and is ready for use, while the solutions are again available for unlimited repetition of the absorbing operations, etc.

RECENTLY PATENTED INVENTIONS.**Engineering.**

ENGINE CROSS HEAD.—William S. Hughes, New York City. This cross head is made in two sections with aligning tapering bores and diametrical channels, the piston rod having one end tapered to enter the bore and having annular ribs to enter the channels in the walls of the bores, with other novel features, whereby the rod may be attached without threading it, or employing a key, cotter, or similar device. The cross head is so united with the piston that a secure connection is effected, and the piston rotated to another position without altering the distance from the center of the cross head to the face of the piston, the cross head and piston being quickly and conveniently disconnected when desired without injury to either.

GAUGE FOR ALIGNING ENGINES.—George J. Hunt and Thomas F. McKechnie, New Westminster, Canada. This invention provides for adjustable heads with central openings adapted to be secured in the ends of the bore of the cylinder, in connection with a cord holder adapted to be vertically or laterally adjusted to bring it in line with the central openings of the heads. The device is especially designed for use in assembling the parts of an engine to bring them in proper alignment, readily locating in the proper place also the bearings for the main driving shaft and the slides for the cross head, without going through the tedious processes now ordinarily followed.

Mechanical Appliances.

LATHE ATTACHMENT.—Martin L. Weeks, Yantic, Conn. This invention relates to attachments to facilitate cutting threads on small pipes, rods, etc., and doing miscellaneous work of this kind, providing therefor a die holder comprising a flanged pipe with a chambered head at the end opposite the flange and a perforated plate or cover for the chamber, the cover having an inner marginal flange and a central socket. The pipe holder has a base resting on the lathe bed and a perforated disk pivoted on the base, with means for rigidly securing it thereto. It is a simple device, readily manipulated, to firmly hold different sizes of dies and adjustably hold different sizes of pipes and rods in position to be cut by the dies.

PUNCH.—Francis N. Simmonds, San Francisco, Cal. This is a punch for use on iron, steel, etc., and having a removable face. The body of the punch has a shank on which the face is fitted and fastened by a bolt having a pointed head extending centrally from the face. The bolt extends nearly through the shank, its rear end being engaged by nuts in a recess in the rear end of the shank, and in operation its pointed front end first enters the material to be punched before the cutting edge of the face comes in contact therewith. The face of the punch can thus be readily renewed when worn out or injured.

BELT STRETCHER.—Claude Darst, Pomeroy, Ohio. This is a device capable of ready application to large or small belts to draw their ends together to give the desired tension, and to permit the workman to conveniently lace or otherwise fasten together the ends. Combined with sets of toggle levers formed with clamping arms to clamp the belt at each end are sets of connected nuts on which the toggle levers are pivoted, screw rods having right and left hand threads engaging the nuts to move the sets of toggle levers toward and from each other, and to open or close the clamping arms. The screw rods are turned by a suitable mechanism actuated by a hand lever.

ORE WASHING JIGGER.—Thomas Rowe, Ketchum, Idaho. This is an ore washer of

simple and durable construction, designed to completely separate the ore from the tailings. It comprises a main frame, and a vertically reciprocating jigg frame with an endless belt passing over it and cams for raising and suddenly dropping it, with suitable water and ore supply connections, the belt and jigg frame being highest at the discharge end and also inclined laterally.

WAVE FORCE DEVICE.—William Mulholland, Los Angeles, Cal. This is a mechanism whereby the reciprocal movement of waves of water is designed to be converted into rotary motion for the purpose of supplying power. A gallow frame on a wharf supports a walking beam in vibrating position, and there is a flexible connection between the end of the beam and a float in the water, the inner end of the beam being connected by a rope with a grooved pulley on the cross shaft of a tilting frame supporting friction drums, the latter contacting with friction wheels. A number of these devices may be arranged in series and connected to one shaft to utilize power obtained as the result of wave force and gravity.

SPINNING FRAME LUBRICATOR.—Jose Alberto McDowell-Guajardo, Saitillo, Mexico. This is a device for lubricating the top rolls of spinning, slubbing, or similar frames, and is designed to economize labor and the material used as a lubricant. It is a trundling or rolling lubricator, capable of manipulation by hand, and composed of a central oil chamber and parallel circular series of radially arranged main lubricating tubes extending therefrom, the tubes in each series being arranged at equal distances apart. If the oil chamber is of sufficient size and the tubes are suitably connected, there will be no soiling of the main body portions of the top rolls with the lubricant.

STITCHING HORSE.—Henry J. Elskamp, Leadville, Col. This is a horse more especially adapted for use in harness making, and is designed to hold large pieces of leather in position while they are being stitched. The device comprises a seat on which is secured a clamp, while levers pivoted on opposite sides of the seat have their upper ends arranged to press against the clamp, toggle levers operated by a treadle mechanism connecting the lower ends of the main levers. The treadle lever is pivoted in the frame of the seat, and may be locked to hold the jaws of the clamp firmly on the leather, the levers pressing evenly upon both sides of the clamp.

Agricultural.

WINDROWER.—Frank L. Boals, Mansfield, Ohio. This machine is designed to be simple and inexpensive in construction, and easy to operate, in raking or gathering hay or straw into a windrow. Supporting wheels are independently journaled on the main frame, which carries horizontally-revolving rake frames provided with radial arms carrying sweeping teeth, the arms and teeth successively engaging and sweeping the hay toward each other and then rising from contact with it, the mechanism for revolving the rakes being operated by the forward movement of the machine.

Miscellaneous.

THEATRICAL STAGE MECHANISM.—Elmer E. Vance, Columbus, Ohio. This invention provides an apparatus to exhibit an effect on the stage to represent a locomotive and a train of cars, while the apparatus can be folded and packed in a small compass. Wooden uprights are provided with drums and pulleys for supporting and driving an endless cable, the uprights being braced to withstand tension of the cable, and a folding scene representing a locomotive

and a train of cars is supported by one strand of the endless cable and drawn forward by the other strand. The head light, escaping steam, and sparks from the smoke stack are represented by suitable fireworks.

MUSIC HOLDER.—William F. Shaw, Yarmouth, Nova Scotia, Canada. This device comprises a support or shelf having a recess in its rear side and a slot in its front face, a lever pivoted in the recess projecting through the slot, while two transverse rods having cranks connect the lever at opposite sides of its pivot with the inner cranks of the rods, spring fingers being mounted on their outer cranks. The device is adapted for almost instant adjustment to allow or prevent the turning of leaves of music, at the will of the performer, and is convenient for use at a table as well as on a piano or organ, while it may be employed as an easel for supporting pictures, etc.

ICE CREAM FREEZER.—Frederic B. Cochran, New York City. This invention relates to freezers in which a cylinder holding the freezing compound is revolved in the material to be frozen, forming the subject of a previous patent by the same inventor, and provides a simple means for changing the height of the cylinder so that it will project the right distance in the material beneath. The ends of the cylinder protrude through the slots of a casing in which are pivoted levers supporting the cylinder, means being provided for fixing the position of the levers, while one of the ends of the cylinder is provided with a crank.

STOP BEAD FOR WINDOWS.—Walter Bruner and Edward W. Knemeyer, Fort Madison, Iowa. With a window frame having vertical grooves at opposite sides of its middle bead are combined tubular rectangular metallic stop beads entering the grooves, there being weights in the beads and pulleys at their upper ends, with the sashes and cords passing therefrom over the pulleys to the weights. This stop bead is designed to take the place of ordinary wooden beads, and its construction is such that it may be applied to old window frames as well as new, and will form convenient receptacles to carry the window weights.

CABINET FOLDING BED.—Arthur A. Zimmerman, New York City. This invention provides a novel construction in which the entire bed accommodations, when in closed adjustment, will present an ornamental exterior. It contains means for adjustably counterbalancing the weight of the couch portion and its belongings, and auxiliary devices are embodied, partly automatic in their adjustment, which, when the bed is lowered, assume positions at the side of the bed, to afford the usual toilet facilities. The bed complete may be readily taken to pieces for transportation to the place where it is to be set up for use, the facility with which this is effected being one of the prominent advantageous features of the construction.

VEHICLE REACH COUPLING.—George E. Macy, Orlando, Florida. A detachable or adjustable slidable connection is provided by this invention, which dispenses with the usual front hounds and slide bars, also the usual sand bolster, thereby simplifying the construction of a wagon. A slidable bar, adjustable along the reach, has a fork at its front end to receive the front axle and bolster, which are united with it by the king bolt, and the bar has band-like clips through which the reach passes, independent locking means being provided for securing the bar and reach together. The device may be used on either one or two horse wagons, but is especially designed for one horse wagons for farm use.

COUPLING FOR SLEIGHS.—Richard Eccles, Auburn, N. Y. This is a strong and simple thill coupling to which the thills of a sleigh may be

easily attached, and is also adapted to form a support for the shifting bar, that the thills may be easily changed from the bar to the coupling. It consists of a vertically apertured bar having transverse apertures and spaced ears, each extended to form a brace, one curved upwardly and the other downwardly. This coupling facilitates the shifting of the thills when desired to allow the horse to follow a well beaten path and the sleigh to follow the track.

INCUBATOR.—Frank C. Beardsley, Billerica, Mass. This invention provides an improved construction in which heat and moisture are designed to be effectively and equally distributed to insure a safe development of the embryos. The heating chamber has a metallic bottom and is arranged over a hatching chamber containing trays, the heating chamber being heated by a pipe discharging into it, while below the trays are arranged moisture boxes into each of which extends a pipe connected with the outer air, the inflow of which is regulated by a damper. The temperature is regulated by means of a thermometer arranged upon the free end of a lever, which is actuated by the expansion and contraction of the mercury.

ORANGE SIZER.—John J. McClelland, Leesburg, Florida. This is a machine for separating oranges into grades of different sizes, and consists of a rotary feed table having pockets with gates at their bottoms, which are gradually opened by one or more cams as the table revolves. The oranges are dropped through the gates into compartments for the different sizes, the extent of horizontal travel on the table and of the opening of the gates being so related that the different sizes are dropped at different points in the travel of the table, the smaller oranges first and the larger ones successively in the order of their size.

HITCHING POST.—Lafayette B. Hopkins, Council Grove, Kansas. This is an attachment for application to ordinary posts, providing for the ready hitching and unhitching of horses and operating to take up the slack, so that the horse cannot get his foot over the hitching strap. A weight box or casing is attached to the post by lugs or ears, and in the top of the casing is journaled a pulley to guide the hitching chain above the top of the post, the chain passing over the pulley and being connected at its inner end with a weight which slides vertically in the box.

GAME TABLE.—John P. W. Patillo, Greenville, Texas. This invention relates to parlor billiards, providing therefor a table on one end of which is an upright casing in which is arranged a series of vertical levers, each carrying at its lower end a ball touching neither the rail nor the floor of the table. The levers are so connected within the casing that on one of the balls at their lower ends being struck by a ball on the table, according to such rules as may be made for the play, a card containing a picture or numeral will be made to appear at one of several openings at the top part of the casing, the game admitting of many variations according to number and positions of balls played etc.

TOY BOWLING ALLEY.—John R. Pettit, New York City. This is a miniature device adapted to mechanically project the ball toward the pins when the latter are arranged after the usual style in playing, and means are also provided for stopping a ball sent to the projecting mechanism before the pins are set up or the projector adjusted. A gum band spring slides the pusher bar forward as it is released by a latch plate engaging a trigger rod.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.