from various points of view with great trouble and at much personal risk.

The picture represents the canyon at the head of Diamond Creek, where the vast rocky walls rise abruptly to the hight of from 3,000 to 6,000 feet. At the bottom of this gloomy and terrible abyss flows a stream of dark water, flecked here and there with foam. In the background is a line of lofty bluffs, many of them crowned with masses of rock of enormous size and fantastic shapes, in which domes, towers, spires, and minarets are faintly outlined.

REAR-HORSES.

General Engelmann, of Illinois, has found by experience, that the best way to get rid of the grasshoppers in a vineyard is to raise rear-horses there, which are also known as devil's horses, *alias* praying nuns, *alias* intelligence bugs, *alias* devil's riding-horses, but the correct English name of which is "camel cricket."

FIG. 1.

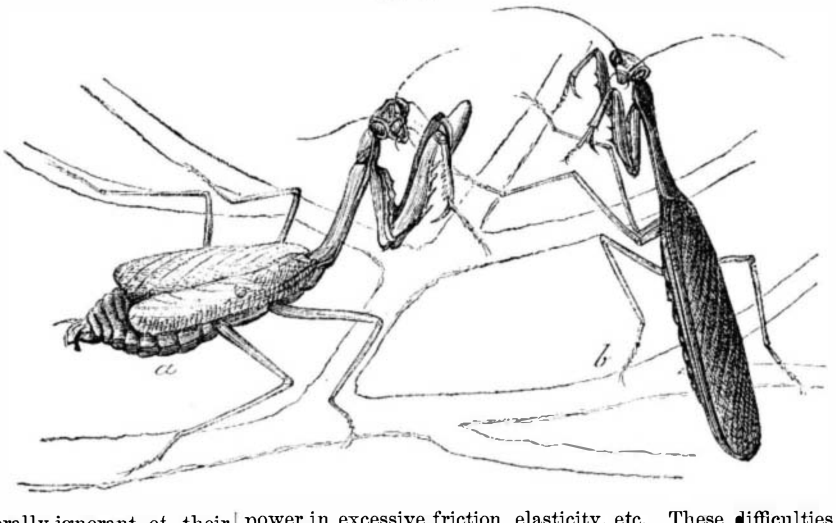


Fig. 1 gives a very good view of the sexes of this insect, *b* representing the male, which is of a brown color, and *a* the female, which is of a green color. The female has such short wings that she is incapable of flight; but the male flies as readily and as strongly as an ordinary grasshopper. The General's mode of colonizing this insect in his vineyard, is to collect the masses of eggs in the dead of the year and place them upon his grape vines. Fig. 2 will enable the reader to recognize these singular egg masses whenever he may happen to meet with them. Persons are very generally ignorant of their real nature, and on the principle that "everything that is unknown must be something hateful and destructive," are apt to cut them off and throw them into the fire. They should, under no circumstances, be destroyed. As a general rule camel crickets are only found in the central and southern parts of Missouri, in the southern part of Illinois, and in other southerly regions. But Mr. D. B. Wier is domesticating them at Lacon, on the Illinois river; and on one occasion one of their egg masses was found as far north as Lee county, Northern Illinois. We are inclined to believe that, with a little care and attention they may be acclimated at points further north than these.—*American Entomologist.*

TRANSMISSION OF POWER.

BY WILLIAM S. AUCHINCLOSS, HONORARY COMMISSIONER TO THE PARIS EXPOSITION 1867.

LEATHER BELTING.

An examination of the different leather departments, and the varieties of belting in actual use, reveal a tendency on the part of manufacturers to improve the quality of wide belts by securing 2-inch strips along their edges. Specimens of this character are exhibited by Messrs. Webb & Son, Stowmarket, England; Mr. William Ruland, of Bonn, Prussia; H. Lemaistre & Co., Brussels, Belgium; Placide Peltereau, 32 Rue d'Hauteville, Paris; Poullain Brothers, 99 Rue de Flandre, Paris; and others of less note. The material forming these strips is (with a single exception) leather of the same quality as the belt. The methods of attachment are variable, as laces, threads, rivets, eyelets, and brass screws. The English use the threads, Prussians the laces, and the French all the varieties enumerated. Mr. P. Peltereau, proprietor of one of the largest houses in France, makes a remarkable display, not only of belts and their mountings, but of different kinds of leather; such as tanned elephant hide, varying in thickness from one fourth to one half an inch, and hippopotamus hide, from one inch to one and a half inches in thickness. His 8-inch and 10-inch belts have leather facings two inches wide on their edges. Each of these facings is attached by two leather laces, whose stitches have three fourths of an inch span, and run in parallel lines, separated by one and one fourth inch.

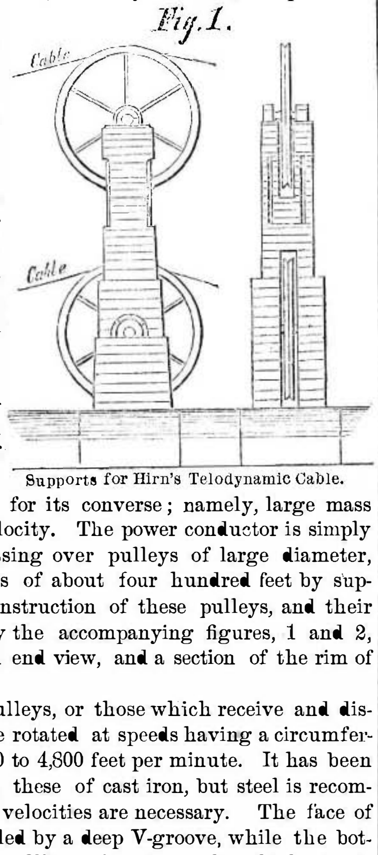
The "inextensible belt," for which, at a previous exposition, he received a gold medal, has steel instead of leather edging strips. These strips, for a 10-inch belt, are two inches wide by one sixty-fourth of an inch in thickness, and attached by two riveted rows of copper tacks. These tacks are one eighth of an inch in diameter, and placed three and one half inches between centers.

Messrs. Poullain Brothers join their single, and compound their double belts with headless one eighth of an inch brass screws. This is accomplished with a very ingenious machine, of which there are several types in the French department. It carries a coil of plain brass wire, which, while being fed to the work, passes through a die of twenty-eight threads to the inch. The screw thus formed enters the belt at a point closely clamped by a foot-lever, and, having passed through, is cut off. Finally, the belt being placed on a surface plate, the points of all the screws are slightly riveted. The most compact and expeditious of these machines is the invention of Mr. Cabourg, 74 Rue St. Honoré, Paris.

Mr. E. Scellos, of 74 Boulevard du Prince Eugene, exhibits what he terms a "homogeneous belt," for 150-horse power. This belt is nineteen and one half inches wide by three fourths of an inch in thickness. It is composed of 104 leather strips three fourths of an inch in width, laid longitudinally with reference to the belt, and laced transversely; the distance between laces is one and one fourth inch, and diameter of lace equals three sixteenths of an inch. The advantage of edge-bound wide belts, where frequent shipping is an essential, we think will be readily conceded; and to what extent they can supplant double belts, is a subject worthy of experimental inquiry. The use of very wide belts is seldom resorted to in the machinery department. One of the stationaries has two central ribbed pulley rims bolted to the arms of its fly wheel; on these run four belts six inches in width; another has two 12-inch edged belts, and so on—the inclination was always to increase the number rather than the width of the belts.

TRANSMISSION OF POWER TO GREAT DISTANCES.

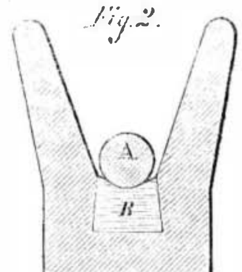
For the transmission of power to great distances, leather and rubber belts are rendered useless by their extreme elasticity, and the expensive character of their intermediate supports; while shafting with bevel gears consumes the applied power in excessive friction, elasticity, etc. These difficulties were studiously met and successfully solved by Mr. C. F. Hirn, of Colmar, Haut Rhin, in the year 1860; the practical working of his invention was partially displayed at the exhibition of 1862. In the park of the present Exposition, his system is clearly shown by the operation of a centrifugal pump, deriving its power from a stationary engine, working on the opposite side of the artificial lake, and distant some 500 ft. from the pump. This so-called "telodynamic system is based on the substitution of a high velocity devel-



Supports for Hirn's Telodynamic Cable.

oped in a small mass, for its converse; namely, large mass moving with small velocity. The power conductor is simply a light wire rope, passing over pulleys of large diameter, and upheld at intervals of about four hundred feet by support-pulleys. The construction of these pulleys, and their supports, is shown by the accompanying figures, 1 and 2, giving a side view and end view, and a section of the rim of the pulley.

The two extreme pulleys, or those which receive and distribute the power, are rotated at speeds having a circumferential velocity of 1,800 to 4,800 feet per minute. It has been the practice to make these of cast iron, but steel is recommended where higher velocities are necessary. The face of the pulley is channeled by a deep V-groove, while the bottom of the latter has a filling of gutta-percha which adapts itself more and more perfectly to the rope and entirely prevents slip and wear. Fig. 2 is a section of the rim of the support pulley, showing the cable A, resting upon the gutta-percha cushion, B. Herein lies the secret of its practical success; a result only attained after most discouraging experiments upon pulleys constructed successively of copper, wood, cast iron, etc., with facings of leather, india-rubber, horn, lignumvitæ, and boxwood. Experience has proved that the loss of power by the telodynamic system is quite trifling, and arises mainly from the resistance of the air to the arms of the pulleys, the friction of their axles, as well as the rigidity of the rope in its passage over the pulleys.



It has been found that two pulleys, twelve feet in diameter, making 100 revolutions per minute, with a cable of seven sixteenths of an inch diameter, can, by means of a circumferential velocity of 4,000 feet per minute, transmit 120-horse power (to distances less than 400 feet) without sustaining a loss of more than two and one half per cent. If this limit is exceeded, it will become necessary to introduce support pulleys of seven feet diameter, and for these there should be estimated a mechanical loss of about one per cent per 3,300 feet of distance traveled. The pecuniary expense, independent of the ground rent, amounted to $1,000 (gold) per 3,300 feet, plus $600 for the receiving and distributing pulleys, with their respective shafts and supports. It is evident that this system cannot be limited in its application by rectilinear transmission, but is susceptible of all the changes in direction which inclined pulleys can command. There are already between 400 and 500 instances of its employment in connection with the manufacturing interests of the continent. Its advantages in respect to our own country can hardly be overestimated.

CADMIUM AND ITS USES.

BY PROF. C. A. JOY, OF COLUMBIA COLLEGE.

Seven cities dispute the right of having given birth to the immortal Homer, and seven men claim the honor of having discovered cadmium. A learned German has tried to show that Homer was a myth. Cadmium was named after the mythical *cadmia*, but is, nevertheless, a reality.

FIG. 2.

It was in 1818, just fifty years ago, that the attention of chemists was called to some samples of zinc that were sold for medicinal purposes; they gave, when in solution, a suspiciously yellow color with sulphureted hydrogen, and hence were condemned as containing arsenic. A number of chemists were furnished with specimens for examination, and several of them got on track of a new metal at the same time.

Frederick Stromeyer, who was born in Gœttingen, in 1778, and was for many years professor of chemistry at the University in his native city, until his death in 1835, was the first to publish a full account of investigations into the properties of the new substance in September, 1818, and he gave to the metal the name of cadmium.

Karsten simultaneously proposed to call it melinium, from the quince-yellow color of one of its compounds; Gilbert gave it the name of junonium, from the planet Juno, and John christened it klaprothium, after a famous chemist; but all of these strange appellations have been eliminated from our nomenclature, and cadmium is the only one recognized in modern times.

The discovery of cadmium forms an era in the line of scientific research. It was the first metal found in a compound and not in an ore, and it could not have been detected until chemical analysis had reached an advanced state of accuracy. Traces of it were soon found in zinc ores, but it was not until after the lapse of twenty years from the time of Stromeyer's publication, that an ore of cadmium was discovered. Lord Greenock, at that time, described a mineral which had been picked up on his estate, and which proved to be a cadmium blende, analogous to zinc blende, or to galena. The new ore was called greenockite, and since that time it has been found in various localities; it is, however, a very rare mineral.

For commercial purposes, we obtain the metal from zinc ores and furnace deposits. By subjecting zinc to downward distillation, the first portions that come over often contain cadmium. The pure metal is obtained by dissolving the regulus in sulphuric acid, and converting it into a sulphide, by means of sulphureted hydrogen, then re-dissolving and reprecipitating, by carbonate of ammonia, and reducing with a proper flux. As thus obtained, it is a white, soft, malleable, ductile metal, eight and one half times heavier than water. It leaves a mark upon paper the same as lead, and when bent gives out a creaking sound, similar to that known as the "tin cry." It can be distilled the same as zinc, but unlike zinc, when it is set on fire and burns, it gives a brown oxide. It sometimes happens that zinc-white is contaminated by this brown powder and rendered worthless as a paint. Cadmium melts at about 440° Fah., and when alloyed with other metals, causes them to fuse at a lower temperature; a very little of it renders copper very brittle. Seventy-eight parts of cadmium, and twenty-two parts of mercury, was, for a long time, used for plugging teeth, but, as the amalgam oxidizes easily and turns yellow, and the mercury proves injurious to health, this application is pretty much abandoned. Mr. Abel has proposed an alloy for jewelers' use, which is said to be very malleable and ductile, and to possess a fine color. It is composed of 750 parts of gold, 166 parts of silver, and 84 parts of cadmium. We had occasion, when giving an account of the properties of bismuth, to speak of the very fusible alloys composed of bismuth, tin, lead, and cadmium; they melt at a point much lower than cadmium itself.

It is as a yellow paint that cadmium compounds are the most highly prized. By mixing a solution of gum arabic, chloride of cadmium and hyposulphite of soda together, we obtain a fine yellow paint, which is one of the most durable known to artists. There are other ways of making it, and the purity of color depends very much upon the absence of metals that turn black when mixed with sulphur, and the care with which it is dried. The very property that led to the condemnation of zinc-white, and which ultimately brought about its discovery, is the yellow color, now most frequently turned to valuable account.

The keeping properties of the collodion, made sensitive by the iodide and bromide of cadmium, have made these salts great favorites with photographers, and a new use for cadmium has sprung up of late years in this direction.

Manufacturers are getting more into the habit of saving the furnace and flue dust of zinc works, and of separating the cadmium from them, and in this way the supply of the metal is increasing. Salts of cadmium find application in medicine. The sulphate is applied to the eyes to remove specks from the cornea, the nitrate produces violent vomiting and purging, and, in general, when taken internally, the