Correspondence.

Garnets and Peridots.

To the Editor of the Scientific American:

Being interested in an article by G. F. Kunz, in your issue of July 11, 1891, entitled "Gems of the United States," I will say that I spent three years in the vicinity of the "garnets and peridots" mentioned in that article, and am very familiar with the particular place where they are found abundantly.

I think that the author is misinformed in regard to the finding of them. He says, "they are collected from ant hills and scorpion nests by Indians," etc. Only the very smallest are so gathered, from the size of a pin head to about the size of a rape seed, which are so thick and plentiful that they can be scooped up with the hands as a person would scoop up water using both hands.

The larger ones are gathered after the rains, when they seem to come to the surface.

I have an opal in my possession found at the same place which I consider a stone of much value.

EDWARD F. EASTMAN.

Park City, Summit Co., Utah.

P. S.—I once sent a large bottle (through a Prof. Bibikov) to New York City, for which my share (one-half) of the receipts was $8.

Jet Propulsion.

To the Editor of the Scientific American:

The suggestion of Mr. W. H. Wetherill, in your issue of the 11th inst., that possibly the thrusts from a jet pipe intermittently worked might produce greater propulsion results than the constant jet, is, I think, a step backward instead of forward. It has been the aim of the friends of hydraulic propulsion to produce a powerful, medium, and constant jet; powerful, in that it would strike the water of flotation with such force as to impart to it the resistance of a stone wall; medium (nozzles 12 inches in diameter for a Cunarder 500 feet in length), so that an excessively large quantity of water will not be carried in the vessel, also presenting orifices of a size that will not impair the strength of the hull; constant, on the principle of the screw propeller, which has a continuous thrust; no starting and stopping, which create great waste of power.

There is no danger of boring a hole in the water with a constant jet and a practical size nozzle, as the propelling jet is constantly encountering a new quantity of the resisting element with a greater directness and power than that of the screw. In short, it is no more practical to have intermittent jets than to have intermittent screw propellers. JOHN W. HAHN.

Newton, Mass., July 14, 1891.

Friction of Belts on Pulleys, Etc.

To the Editor of the Scientific American:

Will some one please give us the reason for the difference between the friction of a plane surface and that of a belt on its pulley?

According to the established laws of friction, conditions of surface being equal, it is increase of weight rather than surface contact that increases friction. This applies to plane surface, but not belt friction. We know from practical experience with belt machinery that increased arc of contact without increased tension increases friction.

The reason for this difference between plane surface and belt friction does not appear to be well understood, if known at all. I have been pumping the scientific world some time for the reason, and without success—have been told there has never been any given.

Chetopa, Kansas. J. A. LOUGH.

[The laws of friction apply to belts as well as to plane surfaces, only that we do not interpret them according to the facts as they are, and not as we carelessly see them.

A flat surface contact may be increased without adding to the gross weight on the whole surface, and the friction may not vary. With a belt, every inch that it is wrapped on the circumference of a pulley adds an increment to the frictional weight. The law of the composition of forces fairly demonstrates the belt lap question, and may be illustrated thus: A belt lapping one-quarter around a pulley with one hundred pounds tension each way will have a total pressure on the pulley by the formula for the resolution of forces of 141 pounds. If the belt laps on one-third of the pulley, by the same formula it will have a total pressure of 174 pounds; and if it laps on one-half of the pulley, it will have the total pressure of 200 pounds. In this way, if continued for more than one-half of the circumference of the pulley, the pressure will be proportionally increased.

Therefore we may safely infer from the facts that the law of friction is correct; but its application cannot be applied to elastic bodies drawn over cylindrical surfaces by its broadest terms.—EDITOR.]

FOR a good solution for removing the blue from steel so as to leave as clean as before coloring, try acetic acid, or solution of chloride of tin (stannous chloride).

Gums, Resins, and Balsams.

In the following few notes on several of the better known gums and resins, I have adopted no systematic arrangement. Neither have I said all I should have liked to have said concerning them. But as it was not consistent with the room at my disposal to mention all their various uses, I have suppressed the minor properties and given in as few words as possible the more interesting features.

I have endeavored to give the name of the plant producing each variety, together with its uses, native country and other interesting items.

The distinctions between gums, resins, and balsams may be briefly tabulated as follows:

Resins are the inspissated or thickened juices of plants. They are generally mixed with an essential oil, are insoluble in water, but are soluble enough in either alcohol or the essential oils. Their general characters are inflammability and fusibility. Their ultimate components are carbon, oxygen, and hydrogen.

Gums are soluble in water, but are insoluble in alcohol.

Balsams or *gum resins* contain a quantity of gum, are partly soluble in water, partly so in alcohol, or in other words, they take both alcohol and water to perfectly dissolve them.

Gum arabic is produced by several species of acacia. It is quite soluble in water, but in alcohol, ether, and oils it is insoluble. It forms an acid solution, as permalate of lime is present. Several of the metallic oxides combine with it. It is very nutritious, so much so that the Arabs who gather it nearly live upon it during harvest time. We import it from the Levant, Barbary, Senegal, Cape of Good Hope, India, Cairo, etc.

Gum senegal, the product of *Acacia senegal*. This is the best kind of Arabian gum. It is much more clear than gum arabic, sometimes entirely white, in drops as large as a pigeon's egg. Its principal use is in the manufacture of silks, muslins, crapes, etc., to give them the requisite amount of stiffness and glaze. It is also mixed with the colors in calico printing to give them solidity.

Gum tragacanth or gum dragon. This is obtained from *Astralagus tragacantha*. In appearance it resembles twisted ribbons, of a brownish white color, opaque and rather ductile. When pulverized in a mortar it is of a white color. The operation of pulverizing is a difficult one, and should be performed in a hot mortar, the gum having been previously heated to 212° Fahr. This gum has a remarkable power of consistence, a small piece swelling up to many times its own size. It has not, however, such a strong power of adhesiveness as gum arabic, but if equal parts of the two be mixed together it forms a nice white gum, very suitable for fastening plants to paper, and other natural history work. The tree is itself a native of Crete.

Gum sandarach. The product of *Callitris quadrivalvis* is a native of Barbary. This gum is chiefly used in the manufacture of varnishes, for which it is peculiarly adapted. The Turks employ the wood in the construction of their mosques, it being very tough and possessing great lasting qualities. Importation about fifteen tons per annum.

Barbary gum, a very darklooking kind produced by the *Acacia gummifera*. In the manufacture of lozenges and confectionery it has valuable qualities. It calls for no special comment. We import it from the Morocco coast.

Gum gedda, an inferior quality of the foregoing. Reddish color.

Canada balsam. This is supplied by the *Abies balsamifera*. It is contained in blisters in the bark. The blisters are punctured, and the balsam is collected as it exudes. This is a most useful substance, being in great demand in a number of manufactures, etc. It is used in cementing lenses together. In microscopy comment is needless, but besides being an excellent preservative, it gives great transparency to the object. We import nearly all of it from America.

Guaiacum. This resin exudes from the *Guaiacum officinale*, a native of Jamaica and the surrounding islands. A piece of paper treated with tincture of guaiacum takes on a green tint under the violet rays, when exposed to the prismatic spectrum, through oxidation. Red rays destroy the color. Solubility, 90 per cent in absolute alcohol. Lignum vitæ, the hardest and heaviest wood known, and which sinks on being placed in water, is the timber of this tree.

Copal. This is the product of several leguminous plants in Africa, East Indies, South America, and Australia. It is generally seen in large angular lumps, often as large as a hen's egg, of a bright yellow color, and very transparent. The African variety is of a darker color, and not so transparent, its surface appears dusty. The Australian is the largest. That from the East Indies is the product of *Hymenæa courbaril*. In lumps sometimes nearly square and generally covered all over with slight indentations. It is known as gum anime. Chiefly used for fine varnishes.

Gum mastic, the product of *Pistacia lentiscus*. In small ovoid and round tears about the size of a pea and rather flattened. The tree is a native of Chio and Northern Africa. To obtain the resin the bark is cut transversely, after which the mastic exudes in small drops and either hardens on the bark or falls to the ground; that which falls to the ground is the inferior quality. It has a fragrant smell, and is much used by the Turkish ladies in their toilet. A fine varnish is made from it. Dentists also use it for stopping hollow teeth. About ten or twelve tons are imported annually, mostly from the Levant.

Gum dammar; this is a light colored substance which is obtained from the *Pinus dammara*, native in India, from whence it is exported. It is very useful in making varnishes, especially photographic. It is soluble in benzole, only partly so in alcohol, and is used sometimes as a substitute for Canada balsam.

Gum gamboge, a product of *Hedradendron gambogioides*, native on the Malabar coast and in Ceylon. It is a gum resin, and is obtained by puncturing the bark of the tree when the flowers begin to appear. We know it best by its appearance in amorphous masses, but it also takes the form of hollow rolls and solid cylinders. The best hollow rolls come from Siam. From this gum the beautiful yellow color of gamboge is manufactured.

Gutta percha, the inspissated juice of *Isonandra gutta*. When freshly gathered it is rough, dry, slightly soluble and very inflammable. To render it fit for use it is immersed in boiling water; this softens it and makes it capable of being moulded into any shape, which it retains when cold.

The juice is found between the bark and the wood. Its uses are too numerous to specify, many being too well known.

Caoutchouc, India rubber, is the product of many euphorbiaceous plants. We get most of it from the Brazils and Central America. In Brazil it is obtained from the *Siphonia elastica*, which grows to a height of between fifty to sixty feet, and in Central America it is obtained from *Castilloa elastica*. Most of that we now use comes from Central America, where the juice is simply collected into cups, from incisions made in the bark. To coagulate the milky juice and convert it into rubber fit for exportation, the juice of a vine called "achuca" is mixed with it, and so powerful is its action that five or six minutes is sufficient to produce coagulation. The Brazilian method slightly differs. The juice is first collected in clay bowls, it is then smeared over various shaped moulds, made also in clay and taking the form of bottles, balls, spindles, etc. Successive coats are laid on, each one having previously been allowed to thoroughly dry, either in the sun or in the smoke of a fire, which blackens it. When a sufficient thickness is obtained, the clay is washed out, leaving the India rubber ready for exportation. The trees yield twenty or thirty gallons of juice, and when we consider that each gallon will produce two pounds of market India rubber, the harvest is not so bad. Other trees producing caoutchouc are *Siphonia brasiliensis*, *S. lutea*, and *S. brevifolia*.

Dextrine, British gum, torrified starch. To produce this gum, starch is heated until vapor rises; by this procedure the starch becomes soluble both in cold and hot water, and all its gelatinous character disappears. It can also be made by moistening 1,000 parts of dry starch with very dilute nitric acid. It is formed in small blocks and dried in the open air, afterward being placed in an oven heated to 152°. After this they are pulverized and again dried by heat. In color dextrine is pale yellow, insoluble in alcohol, more flexible and not so brittle when dry as gum. Dextrine and starch have the same chemical composition, $C_6H_{10}O_5$. The gum on the back of postage stamps is dextrine.

Turpentine. This valuable fluid is the product of several trees, principally *Pinus palustris* and *P. tæda*. Most of it comes from the United States, generally in large barrels, of the consistence of treacle or honey. The oil is obtained by distillation and the remainder is the common resin, sometimes called rosin, which is applied to a variety of uses. There are several kinds of turpentine, viz., Venice turpentine, procured from the *Abies larix*, Strasburg, from *Abies pectinata*, Bordeaux turpentine, from the *Pinus pinaster*, and Chio turps, from the *Pistacia terebinthis*.

Gum thus or frankincense, an odoriferous product of the *Boswellia serrata*. It is of slight use except for its odor, which the Roman Catholics turn to account in their churches. Employed also by the ancient priests of Egypt, its odor destroying the foul emanations from the sacrifices. It is imported from India and sometimes the Levant.

Asafœtida (*Narthex asafœtida*). This flows from incisions made in the root of the tree. In color it is milky white, but after it has been dried it takes on a pinkish tint and is curiously mottled. It has a most unpleasant odor. Afghanistan and Persia is the home of the tree. It is used medicinally as an anti-spasmodic in cases of asthma.—*H. Durrant, Hardwicke's Science-Gossip.*

ZINC expands up to the melting point. A bar of hammered zinc 6 in. long will expand one one-hundredth of an inch in raising the temperature 100° Fah.