Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The second extension case, that of H. Voelter, wood pulp machine, authorized by Congress, as mentioned in my last letter, has been decided in faver of the applicant, provided he will enter a disclaimer to the third claim of his patent, as re-issued June 6, 1871. It appears from the papers in this case that the present rate of manufacturing pulp by the machines covered by this patent is about 60 tons daily, with a steady increase in prospect, as paper made from pulp so manufactured is found to be peculiarly suited for the web newspaper presses. The evidence presented by the applicant shows that this pulp is manufactured at from 2½ to 3 cents per pound, while similar pulp from rags would cost 6 cents. As there were 75,000 tons of Voelter pulp made last year, at a cost of $4,500,000, and the same quantity of rag pulp would cost $9,000,000, it follows that one half of this amount, or $4,500,000, was saved by this process last year, to say nothing of the increase of the price of rag pulp which would result if the competition of the wood pulp were withdrawn; for before this process of wood pulp making was introduced, rag pulp was worth 10 cents per pound—part of this decrease, however, is probably chargeable to the general shrinkage of values.

Our Consul at Liverpool has sent to the State Department a dispatch, which should be considered as a strong warning to American mechanics against going abroad for employment unless under contract, and even then they will find themselves in the disagreeable position of taking the places of men who have struck for wages which are barely sufficient to enable them to maintain themselves and families in comfort, as is the case with the thirty-five carpenters who recently landed in England, who were simply brought over to fill the places of English carpenters on strike. Referring to these men, and to the published statement in some American newspapers that fewer men are out of employment in England than in the United States, the Consul particularly warns our mechanics against the danger and loss of putting these statements to the test, which reports have induced many American mechanics to leave their country to better their condition, and the result has been a large amount of suffering and destitution. To avoid any further augmentation of this suffering, the Consul requests that public warning be given to American workmen not to go to England unless under positive contract with responsible parties. Able-bodied American mechanics are calling upon the consulate daily for relief, and are greatly disappointed when they learn that consuls have no money for such relief purposes. Under these circumstances the Consul deems it his duty to inform the Department that neither skilled nor unskilled laborers who come from abroad can readily find employment in England, except in cases where they are engaged to fill the places of British workmen while on strike.

A dispatch has been received by the Secretary of State from the United States Chargé d'Affaires, at Paris, announcing that the immense exhibition buildings on the Champ de Mars and the Trocadero are nearly completed, and the foreign commissioners are about to take possession of the positions assigned them. It is stated that great solicitude is felt by the administration of the exposition in regard to the intention of the United States Government, no official notice having been received as to whether any commission will be sent to Paris or not. The legation is in daily receipt of letters from the United States, applying for information as to space, etc. The Chargé d'Affaires has been assured by the Commissioner General that the portion reserved in the original designs for the United States will be still retained to last possible moment, but that the time is rapidly approaching when the commissioners must know whether the United States will do anything in the matter or not.

There seems to be considerable doubt here about the Administration taking any steps to have the United States represented officially at the exhibition, except in response to a direct order from Congress, as it is stated that many persons of influence, having an interest in a full representation of American industry at Paris, have called upon the President and Secretary Evarts, and desired them at least to appoint a provisional commission, but no steps have been taken to do even this much, nor do they appear likely to be. This, it is stated, may be owing to circumstances connected with the Philadelphia exhibition, in which neither the action of the French Government nor its exhibit was such as the United States Government had a right to expect. Instead of sending, as other nations did, special commissioners of high rank and experience, France entrusted her exhibit to subordinate attachés of the French Legation, one of whom was so objectionable to President Grant that he is said to have refused to accept an invitation to a public dinner at Philadelphia until he was assured that this person would not be present. The letters attacking the United States, which caused so much stir, although disclaimed by the supposed author, were believed to have been written by one of them. In addition to this, certain of the French exhibitors were found attempting to defraud the revenue, which made it necessary for our customs officials to submit all foreign exhibitors to very annoying restrictions. But independent of these minor matters, the character of the exhibit itself was not what might have been expected from France, and this was believed to be caused by the lack of interest, if not opposition, of the French Government. Secretary Fish, therefore, when the invitation to participate in the exposition was received, transmitted it to Congress without recommendation; and it is reported that he gave substantially the above reasons to the Committee on Foreign Relations, when consulted on this subject, why he was unwilling to urge Congress to accept the invitation. This feeling is believed to be shared to some extent by the present administration, and may explain why it has been unwilling to assume any doubtful authority for the purpose of securing the representation of the United States at the Paris Exposition. Notwithstanding this, it is thought that the matter will be brought before Congress at an early day, as so many American manufacturers are desirous of exhibiting specimens of their wares; and in the present depressed condition of our industries, the administration wishes to do all it can to open new markets for our productions.

The United States Consul at Munich has forwarded to the State Department circulars announcing an exhibition of hops, and of tools and implements used in their cultivation, to which all nations are invited to contribute. The exhibition will be held in Nuremberg, from the 7th to 15th of October, and may possibly help to open a market for many of the appliances connected with hop growing that have been patented of late.

From a letter just received in this city from our Chargé d'Affaires at Madrid, it appears that Spain has reduced her tariff on imported goods, but has excepted England, France, and this country from the benefits of the reduction, so that hereafter English, French, and American manufacturers who send goods to Spain will have to pay from 30 to 50 per cent more than those of Germany, Switzerland, and other European nations.

Commander Rodgers, of the United States steamer Adams, reports to the Navy Department that he has discovered a bank of considerable extent in 17° 6′, south latitude, and 36° 44″, west longitude. It is situated about 135 miles east of the coast of the province of Espirito Santo, Brazil, and 130 miles northeastward of the Island of Abrolhos, in the South Atlantic Ocean. It is right in the course of vessels bound southward and northward from Rio de Janeiro. One of our papers here expresses a hope that it will be a long time before there is a *run* on the bank.

Washington, D. C. OCCASIONAL.

Reforms Needed in Railway Bridge Construction.

To the Editor of the Scientific American:

It seems as if the recent railway accidents, and particularly the one near Des Moines, Iowa, might call attention to some of our engineering miss-constructions. In this case a masonry culvert is built on short piles. The water washes away the earth that holds the piles in an upright position, and they go down like a row of bricks. To simplify it, drive your cane in the earth three inches, put your hat on the head of the cane, dig or wash away the earth at the bottom of the cane, and it falls. Short piles may be a handy method of holding a structure up, but it is a sure method of letting it down in a water way. At the ditch to which these short piles are driven a concrete foundation can as easily be laid (or at least concrete can be put around the piles, holding them together). On such a foundation masonry can be securely built, or, what is better, make the whole structure a monolith of béton. The structure then holds itself securely together, there is no thrust. If a part is undermined, the rest supports it. The weight may be distributed over a large surface, or the culvert may be made in the shape of a pipe, forming its own invert which becomes its foundation. In a thousand years there seems to have been no improvement in masonry structures. We have copied to an extent the old superstructures, and have gone without foundations. The Washington monument is a sad specimen of our national skill as engineers, and the cracking and fall ing specimens of architecture in New York city are evidences that we should begin at the bottom.

JOHN C. GARDRIDGE, JR.

Operating Canal Lock Gates.

To the Editor of the Scientific American:

The subject of opening and shutting canal lock gates is being considerably discussed here owing to the aggravating interference of drift, mud, etc., with the working of the machinery of the lower gate of lower lock of the DesMoines Rapids Canal. I would suggest an effective and simple means of accomplishing the opening and shutting, namely, to employ a strong jet of water through two way nozzles, to be placed permanently in the toe of the gates. and there may be other jets along the foot of the gates to clear away mud, drift, etc., in the passage of the gates, while a greater number of the nozzles playing from the opposite side of the gate would propel it in the required direction.

Keokuk, Iowa. ALEX. BLACK.

Defective Rubber Hose.

To the Editor of the Scientific American:

N. D. in your issue of August 18 complains of the inferior quality of rubber hose as at present made. He thinks that, with more care in its manufacture, its value would be at least double what it is. I beg to inform him that though the greatest care is taken in its construction it will remain in its present defective state just so long as it continues to be handmade. Let us review the process of making hose, and in doing so I think I can show plainly where its weakness lies. Any one acquainted with the nature of rubber is aware of its great expansion during the process of vulcanization. To control this expansion within proper limits is to add strength, to be unable to control it is to weaken it. A long hollow mandrel or pole is taken and around it is wrapped a thin coat of rubber in sheet form. This constitutes the inner lining. Then a strip of cotton duck saturated with rubber is wound around, one, two, three or more times, according to the number of ply required. A coating of rubber like that used on the interior is then put on the outer side. It is wrapped up in cloth, vulcanized, and the hose is made. When it comes to putting the wrapper around, if one twist is slacker than another or one edge does not evenly overlap the other, when the expansion takes place at that place there will be a loose spot or blister; after a short time in use the continual bending backwards and forwards will further rupture these already weak spots. From its imperfect make, it permits the water to circulate between the layers of cotton duck which soon becomes rotten.

Cleveland, O. H. J. MERREUS.

A Reply to the Question of Axial Change of the Earth.

To the Editor of the Scientific American:

The earth's axis and its inclined position seem to depend upon attraction of gravitation, or magnetism in the direction of the north star. Such an attraction to be permanent must be exerted upon the mineral portion of our globe, and we find the greatest amount of land in the northern hemisphere; but the corroding agencies before alluded to are gradually wearing it away, and, in obedience to the law of centrifugal force, this débris is gradually finding its way to the periphery or equator; hence we find our northern shores rock bound coasts, and as we approach the equator, sandy flats. The same peculiarity exists in the southern hemisphere. The diameter of the earth at the equator is 20 miles greater than at the poles. The water exhibits the greatest parts of this distention, and forms a belt from 5 to 10 miles in depth around the earth at the line. To what extent the mineral deposits have accumulated there we cannot tell; but whenever they shall have accumulated to such an extent at any point of the equator as to exceed that in the northern hemisphere, that part will gravitate toward the north or polar star, opposite points on our present equator will become the new poles, or axis in doing so, this great belt of water in finding its new position will sweep over one half the globe, a quarter upon each side, thus causing another deluge, throwing up new mountain ranges, burying continents and elevating others, bringing arctic regions into tropical climes and portions of our present equator into arctic frosts. This, like all the preceding revolutions of our planet, will be sudden and violent.

Philadelphia, Pa. ALEXANDER BOND.

ANCIENT LIFE IN AMERICA.

Professor O. C. Marsh, of New Haven, recently delivered before the American Association for the Advancement of Science an address on the "Introduction and Succession of Vertebrate Life in America." According to present knowledge, he stated, no vertebrate life is known to have existed on this continent in the archæan, Cambrian, and silurian periods, yet during this time more than half the thickness of American stratified rock was deposited. Fishes are known in the upper silurian of Europe, however, and there is therefore a probability that they will be yet discovered in our strata of the same age, if not at a still lower horizon. Passing through the various geological periods, Professor Marsh noted the extinction or increase of various orders of fishes, and then, referring to the amphibia, stated that the latter are so nearly allied to the ganoid fishes as to leave little doubt of their descent from some member of that group. The earliest evidence of their existence on this continent is in the sub-carboniferous, where footprints have been found which probably were made by labyrinthodonts, the most ancient representatives of the class.

ORIGIN OF THE BIRDS.

During the mesozoic period some of the strangest forms of reptilian life made their appearance and became extinct. Then came the dinosaurs, true reptiles, yet having characteristics peculiar to birds of the ostrich order, so that it is possible that they were the parent stock of all birds. Professor Marsh's account of the great saurian monsters of the cretaceous strata is wonderfully interesting. He told of vast lizards, some sixty feet in length, which inhabited the inland cretaceous sea when the Rocky Mountains were just beginning to rise above the waters. In a valley of this old ocean bed he had seen seven different skeletons of these monsters in sight at once. There were also the huge plerosauria, the veritable dragons, having a spread of wings of from ten to twenty-five feet, and one colossal dinosaur, when erect, stood thirty feet in height.

BIRDS WITH TEETH

existed in that strange world. The aquatic hesperornis, nearly six feet in height, had teeth set in grooves in its jaws. It was a carnivorous, swimming ostrich. The ichthyornis, a small flying bird, had teeth set in sockets, while strange enough, the companions of these ancient toothed birds were pterodactyls, without teeth.

There came a period at last when the dinosaurs and other mesozoic vertebrates disappeared, and mammals henceforth became the dominant type. Then lived a great sloth, which, after the elevation of the Isthmus of Panama, crossed over from the northern to the southern continent of America, there found a more congenial home, and there in time became extinct. In the middle eocene, west of the Rocky Mountains,

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THE DINOCERATA,

a remarkable group of ungulates, made its appearance. Nearly equalling the elephant in size, this animal had shorter limbs, while arming its skull were two or three pairs of horn cores, besides enormous canine tusks. In the lower eocene appeared the progenitor of the horse, the eohippus, about the size of a fox and having well developed toes. In the lowest eocene appear the artrodactyles, the ancestor of the pig, and in the upper eocene comes the oromeryx, whence probably sprang the deer.

THE PRIMATES AND MAN.

We come now to the highest group of mammals, the primates, which includes the lemurs, the apes, and man. This order has a great antiquity, and even at the base of the eocene we find it represented by several genera belonging to the lower forms of the group. In considering these interesting fossils, it is important to have in mind that the lemurs, which are usually regarded as primates, although at the bottom of the scale, are only found at the present day in Madagascar and the adjacent regions of the globe. All the American monkeys, moreover, belong to one group, much above the lemurs, while the Old World apes are higher still, and most nearly approach man.

In the lower eocene of New Mexico we find a few representatives of the earliest known primates, and among them are the genera *lemuravus* and *limnotherium*, each the type of a distinct family.

The oldest known remains of man on this continent differ in no important characters from the bones of the typical Indian, although in some minor details they indicate a much more primitive race. These early remains, some of which are true fossils, resemble much more closely the corresponding parts of the highest Old World apes, than do the latter our tertiary primates, or even the recent American monkeys. Various living and fossil forms of Old World primates fill up essentially the latter gap. The lesser gap between the primitive man of America and the anthropoid apes is partially closed by still lower forms of men, and doubtless also by higher apes, now extinct.

The real progress of mammalian life in America, from the beginning of the tertiary to the present, is well illustrated by the brain-growth, in which we have the key to many other changes. The earliest known tertiary mammals all had very small-brains, and in some forms this organ was proportionately less than in certain reptiles. There was a gradual increase in the size of the brain during this period, and it is interesting to find that this growth was mainly confined to the cerebral hemispheres, or higher portion of the brain. In most groups of mammals the brain has gradually become more convoluted and thus increased in quality as well as quantity. In some, also, the cerebellum and olfactory lobes, the lower parts of brain, have even diminished in size. In the long struggle for existence during the tertiary time the big brains won, then as now; and the increasing power thus gained rendered useless many structures inherited from primitive ancestors, but no longer adapted to new conditions.

Another of the interesting changes in mammals during tertiary time was in the teeth, which were gradually modified with other parts of the structure. The primitive form of tooth was clearly a cone, and all others are derived from this. All classes of vertebrates below mammals, namely, fishes, amphibians, reptiles, and birds, have conical teeth, if any, or some simple modification of this form. The edentates and cetaceans with teeth retain this type, except the zeuglodonts, which approach the dentition of aquatic carnivores. In the higher mammals, the incisors and canines retain the conical shape, and the premolars have only in part been transformed. The latter gradually change to the more complicated molar pattern, and hence are not reduced molars, but transition forms from the cone to more complex types. Most of the early tertiary mammals had forty-four teeth, and in the oldest forms the premolars were all unlike the molars; while the crowns were short, covered with enamel, and without cement. Each stage of progress in the differentiation of the animal was, as a rule, marked by a change in the teeth; one of the most common being the transfer, in form at least, of a premolar to the molar series, and a gradual lengthening of the crown. Hence, it is often easy to decide from a fragment of a jaw to what horizon of the tertiary it belongs. The fossil horses of this period, for example, gained a grinding tooth, for each toe they lost, one in each epoch. In the single-toed existing horses, all the premolars are like the molars, and the process is at an end. Other dental transformations are of equal interest, but this illustration must suffice.

The changes in the limbs and feet of mammals, during the same period, were quite as marked. The foot of the primitive mammal was doubtless plantigrade, and certainly five-toed. Many of the early tertiary forms show this feature, which is still seen in some existing forms. This generalized foot became modified by a gradual loss of the outer toes, and increase in size of the central ones; the reduction proceeding according to systematic methods, differing in each group. Corresponding changes took place in the limb bones. One result was a great increase in speed, as the power was applied so as to act only in the plane of motion. The best effect of this specialization is seen to-day in the horse and antelope, each representing a distinct group of ungulates, with five-toed ancestors.

THE sharpening angle of ordinary soft wood planing machine irons should be about 35 degrees, and for hard wood tool cutters, 50 to 55 degrees.

The Uses of Fish Skins.

Although the skin of some marine mammals, such as those of the seal, walrus, and the white whale or beluga (known as porpoise leather), have long been commercially employed, it is only lately that attention has been more generally directed to the utilization of fish skins on an extended scale. Their employment hitherto has been very limited. Eel skins have been used for the thongs of whips and the attachments of flails, dried sole skins to clarify coffee, and some shark and ray skins by workmen to smooth and polish substances, and also to make a kind of shagreen leather.

At the Maritime Exhibition held at the Westminster Aquarium this year Mr. G. Kent, of Christiana, Norway, exhibited a variety of tanned skins, among which were:

1. Whale skins tanned; the size ranges from 12 inches broad by 60 feet in length, suitable for wheel bands, for driving machinery, etc.

2. White fish, for upper leather, which can be prepared in pieces of 12 feet by four feet.

3 Skins of various flat fish, dressed and prepared for gloves. Fine upper leather can be made, often to be had in sizes up to 3 feet square.

4. Skins of soles, dressed and tanned suitable for purses, etc.

5. Skins of thornbacks, suitable for cabinet makers instead of sand paper, and very much more durable.

6. Skins of eels, dressed and dyed, suitable for braces and other purposes.

In Mon. Chas. Varey's "Scientifique Correspondence" from Paris, of August 7, mention is made of an industry carried on at Colburn, in Canada, in the skins of species of silurids for glove making, and this is to be prosecuted on a larger scale, both for the flesh for salting and the skin for currying.

Shoes have been made in Gloucester, Massachusetts, from the skins of the cusk or torsk (*Brosmus vulgaris*), the use of which has been patented. If this material for shoes proves what it promises, it will open up a new market for fish skins, which will no doubt be highly profitable. In Egypt, fish skins from the Red Sea are used for soles of shoes. In the Animal Products Collection at the Bethnal Green Museum there are some tanned sole skins shown. The skin of the losh or burbot (*Lota maculata*), cleansed, stretched, and dried, is used by country people in many parts of Russia and Siberia to trim their dresses, and instead of glass for the windows of their dwellings, being as transparent as oiled paper. It is also utilized by some of the Tartar tribes, as material for their summer dresses, and the bags in which they pack their animal skins. The inhabitants of the eastern coasts of the middle of Asia clothe themselves with the tanned skins of the salmon. It is asserted that it makes a leather as tough as wash leather. The scale marks give a very neat pattern to the leather.

W. Brozowsky, in his "Waarenkunde," Vienna, 1869, under 'Fish Skin," says it is obtained from the sea angel (*Squalus squatina*, Lin.; *Squatina lævis*, Cuv.), the thorny shark (*Squalus acanthias*, *Sq. carcharias*), the tigered shark *Sq. caniculata*), and some skates, as the angel skate (*Raja rhinobatis*) *Rajo Sephen*, etc. The skins of these skates and sharks have spines of different sizes instead of scales. The skins are used for polishing, and, after the star-formed spines have been smoothed down with sandstone, for covering boxes and cases, etc.

The "Waaren Lexicon" of T. C. Schedel enumerates the following fishes: Sea dog (*Squalus blainvellei*, Riss, Aiguillat, Blain), *Sq. aranthias*, and other small sorts, *Sq. carcharias*, Lin., *Sq. canicula*, and *Sq. catullus*.

Guibourt (sixth edition, by Dr. G. Planchon, 1870–71, vol. iv.), says, "The sephen of the Red and Indian seas, belonging to the genus *Trygon*, produces the tuberculous and hard skin called galuchat, after the name of a Paris workman who employed it first. The greater part of the selacians, namely, the roussettes, sharks, humantins, aiguillats, leiches, etc., have a rough skin, which is used for covering boxes, and also for polishing wood. The greatest confusion exists among merchants as to the names given to the different skins. Each tradesman applies, according to his fancy, the name of *peau de requin, peau de chien de mer, chagrin*, and even *galuchat*. I endeavored to obtain specimens of the various skins, in order, if possible, to determine the species.

"1. Shark skin, from a young shark; small, imbricated scales, somewhat translucid, with longitudinal lines, the borders or edge entire and circular. The edge is free on the body, but attached on the fins. The skin serves for covering cases, etc., but is not rough enough for polishing.

"2. Skin of mottled *roussette* (*Scyllium*, Cuv.). Tuberculous, imbricated, horny, fine and hard scales, very near one to the other, and transparent, each triangular. Skin much used for polishing. Some persons state that 'false galuchat' is made of it by rubbing off the scales, which leaves a square figure that becomes very showy when the skin is applied on a green paper. I rather believe (continues M. Guibourt) that the false galuchat is made with the skin of the aiguillat.

"3. *Peau de leiche* (*Scymnus*), sold to cabinet makers under the name of *peau de chien de mer*, is covered with nearly rhomboid tuberculous semi-transparent scales, arranged one near the other in quincunxes.

"4. *Peau d'aiguillat* (*Spinax acanthias*, Cuv.). Viewed with a magnifying glass, this skin appears covered with small square opaline scales, not rough like the preceding, but much used by the 'gainiers' or sheath makers, for its glossy nacreous aspect.

"5. *Peau de sagri* (*Spinax niger*, Cuv.). Same uses as the preceding. The word *Sagri* is Persian; *Sagher*, Turkish, from its resemblance to the dressed leather made from the mule and ass, whence our word shagreen.

"6. *Galuchat* or *sephen* skin, from the back of the *Trygon sephen*, Cloq.. It has numerous round tubercles, which become white by rubbing down, and in the interior opaque and nacreous. The skin is sometimes dyed for different colors, but it is often preferable to leave it the natural color by only half polishing it."

The quantity of ray skins, dried or salted, imported into France in 1863 was about 18,000 lbs. weight, principally from Portugal. Formerly they used to fetch as high as 7 francs the pound, now they may be had for 1s. a pound.

The best galuchat, or what we should call shagreen, is made from the skin of the sephen, which abounds in the Mediterranean Sea, and is also met with in the Red Sea and the Indian Ocean. This skin is remarkable for the size of the osseous protuberances. There are however two kinds of these rays, one with rough skin and the other with smooth.

From a certain portion of the skin of the angel shark (*Squatina angelus*) the Turks make the most beautiful sea-green watch cases. These sharks, which form a connecting link between the genera of rays and sharks, are found in the Mediterranean principally, and the German Ocean sometimes. The skin being very rough, it is employed to polish wood and ivory, as well as for other uses in the arts.

Turners, ebonists, and carpenters in Europe use the rough skin of the blue dog fish (*Squalus glaucus*, Linn.) like emery paper, for smoothing their work and preparing it for polishing. This shark skin is also used by the native workmen of the East for polishing wood and ivory, and it is made into shagreen. The best is that obtained from the *Rai Sephen* of India and the Red Sea. That most used now seems to be the skin of the ray (*Hypolophus Sephen*) which is very common on the Malabar coast, and an extensive commerce is now carried on in them in the Indian Ocean; they are found in the Sea of Oman, and also taken at Mahe. The house of Giraudon, 48 Rue Molière, Paris, makes excellent use of them for morocco and tabletterie.

Peau de Roussette (*Squalus catulus* and *caniculus*, Lin.). This fish, called *chat* at Marseilles, and *crin* in Catalonia, is smaller than the angel fish. The skin, reddish and without spots, is of a uniform grain, flat, and only used to make cases and other articles known as shagreen. These skins come from the Mediterranean, and are imported in bundles by the sailors, selling, according to size, from 30s. to 36s. the dozen.

Peau de chien de mer is another name given in France to some species of *Squalus* or *requin*. That usually found on the French coasts is known under the names of *chien marin, chat marin, roussette tigrée* (*Squalus catulus*, Linn.). Turners, cabinet makers, and carpenters use the skin for scraping and smoothing their work before polishing; metal workers and others also use it. This skin, when worked up with the tubercules with which it is studded, takes the name of galuchat, and is ordinarily dyed green, to cover cases, sheaths, and boxes. Under the name of *chagrin* these skins used to be much employed in Turkey, Syria, Tunis, and Tripoli. That made in Constantinople was considered the best. It was colored black, green, white, and red.—*By P. L. Simmonds, in the Journal of the Society of Arts.*

Rules for Calculating the Speed of Pulleys.

The diameter of the driven being given, to find its number of revolutions:

Rule—Multiply the diameter of the driver by its number of revolutions, and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven.

Ex.—24 inches diameter of driver×150, number of revolutions, =3,600÷12 inches diameter of driven=300.

The diameter and revolutions of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time:

Rule—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of required revolutions of the driven; the quotient will be its diameter.

Ex.—Diameter of driver (as before) 24 inches×revolutions 150=3,600. Number of revolutions of driven required=300 Then 3,600÷300=12 inches.

The rules following are but changes of the same, and will be readily understood from the foregoing examples.

To ascertain the size of the driver:

Rule—Multiply the diameter of the driven by the number of revolutions you wish to make, and divide the product by the required revolutions of the driver; the quotient will be the size of the driver.

To ascertain the size of pulleys for given speed:

Rule—Multiply all the diameters of the drivers together and all the diameters of the driven together; divide the drivers by the driven; the answer multiply by the known revolutions of main shaft.

FILLING FOR CRACKED CEILINGS.—Whiting mixed with glue water or calcined plaster and water makes a good putty for filling cracks in plastered ceilings.

BLACK WALNUT STAIN.—Asphaltum thinned with turpentine will stain a beautiful black walnut color. It must be varnished over.

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