close this article with an abstract from it, which gives the principal features of his invention.

Crude nitrogen gas is heated in a serpentine system of tubes until the pressure is double that of the air. It is then admitted into a cylinder in which it presses forward a piston, and is allowed to expand. Next it passes into an apparatus where it is cooled, and consequently diminished to half its bulk. The cooling is effected in a new arrangement, which is so constructed that the whole of the heat above that of the external air is transferred to an equivalent volume of air passing in an opposite direction. This heated air is then used as a blast for the fire, $\frac{1}{10}$ going to the hearth of the furnace through a tweer, and $\frac{4}{10}$ mixing with the products of combustion immediately above the fire, so as to complete any imperfect combustion, and also to modify the temperature of the whole mass, so that it may not be likely to injure the iron of the gas tubes, and the remaining $\frac{5}{10}$ being introduced into the system at a point further on. The construction of the system of tubes is such that, by the time the products of combustion reach the open air, they shall have parted with nearly all their heat, and transferred it to the nitrogen contained in the tubes, and hence a chimney draft cannot be used, and the blast has to be produced by a blowing engine. The nitrogen, after having been cooled to half the volume it occupied in the cylinder, is then compressed and forced into the system of tubes at the point furthest from the fire. If this forcing the gas back again into the system of heating tubes appears absurd, it must be remembered that the gas while leaving the heating tubes occupies twice the space it does when being forced back, hence it fills a cylinder of twice the area, and the force that may not be disposed of is equal to half the pressure exerted in the larger cylinder. But the other half of the power is not lost, it is simply conveyed back to the heating tube, and is used again. The losses that arise are those incidental to all engines, such as radiation, conduction, the enormous loss of heat that usually goes up the chimney, together with the still greater loss that is constantly being carried away by the condensed water is avoided—an amount in itself six times as great as that converted into work in the steam engine. The inventor expects his new heat engine to convert 60 per cent of the heat of combustion into work, a duty that is fully 500 per cent above that of well-constructed steam engines.

TIME AND DISTANCE.

At the very bottom of all exact science lies a just conception of time and distance. It may be said that no such thing as an exact science could possibly exist without the ability to accurately measure these relations. In the science of mechanics and its application to practical work, in the shop, and manufactory, they are both fundamental in importance. The terms, speed, velocity, rate, etc., all express the relations of time and distance, and the measure of power to perform work is a definite number of foot-pounds raised per minute.

The unit of work is one pound raised one foot without regard to the time employed in the elevation. The term work, then, does not include the idea of definite time, while the term power does.

This distinction is of primary importance to the correct conception of the laws of applied mechanics. Work is the overcoming of any resistance, whether the time occupied in its accomplishment be long or short. Mechanical power is that which can perform work or overcome resistance in definite time, whether the power be strength of men or horses, the fall of water, or the expansion of steam.

When we attempt, however, to conceive of time and distance we can set no limit to either; they expand to an illimitable extent. We are obliged to conceive of time only as the relation of the succession of events, and of distance as the relation of position. In the measurement of time, we adopt as the unit the interval between two events which succeed each other at uniform intervals. The oscillations of pendulums of uniform length, in the same position upon the surface of the earth are found by experiment, and may be mathematically demonstrated, to succeed each other with perfect uniformity of interval. The rotations of the earth upon its axis also practically succeed each other at uniform intervals. Thus we have both an artificial and a natural standard of time.

From natural standards of distance may be derived artificial ones, and standards of time—as the length of a pendulum oscillating seconds—may be made to correct standards of distance or length. From these two standards may be derived all other measures whatever they may be.

Few have anything like an appreciation of the vast importance of accurate measurement in the natural sciences. But such measurements are all based on time and distance. All weights are primarily derived from measurements of distance, and it follows that all estimation of magnitude, density, hardness, or any other physical property measured by pressure or weight may be referred back to measurement of distance.

It is therefore in and through the consideration of these relations that we gage all our sensations of external things. For size, intensity of color, and light, form, weight, and temperature, all are estimated, and conceived only through some application of these relations. Deprive the mind of any means whereby it may estimate or imagine the distance of a body from the eye, and it can form no conception of magnitude, and it is only by comparison of relative distances of parts from each other that it can conceive form. It is true that form also depends upon direction of outline, but direction is not apparent without extent or distance, and hence this consideration does not invalidate the foregoing proposition.

Even our knowledge—in so far as we have any—of the molecular constitution of masses is obtained in great part through the application of these relations. The definite weights in which chemical combination takes place is only an expression of definite bulks, or volumes, established by measure.

These relations are types of that in which all human knowledge consists. We perceive nothing and conceive nothing but relations, and the combination of relations of which the mind takes cognizance are to it the embodiment of all external things. The idea of relation, however, involves the existence of something to be related, and thus the idea of material existence is inferred; but as we cannot go beyond relations in mental operations, the existence of matter can never be made the subject of actual demonstration.

The existence of force is also inferred from change in the relation of distance, and is perhaps as just an inference as that of matter, though in our opinion not so essential to thought. Neither force nor matter can be estimated as entire entities, we can only conceive of them through relations of mass and movement, which are, as we have seen, only measured by the relations of time and distance.

In considering the ideas of matter and force we stand on the very border line which circumscribes thought, but even here, the moment we attempt to relinquish our ideas of time and distance we become lost in a maze from which we may return, but through which we find no pathway for the human intellect to transverse.

RESIGNATION OF COMMISSIONER FISHER.

The following letter will explain itself:

UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., Nov. 8, 1870.

SIR:—I ask permission to renew the tender of my resignation of the office of Commissioner of Patents, made October 24, and temporarily withdrawn at your suggestion. If there be no reason to the contrary I suggest that the resignation be accepted, to take effect at the close of Thursday, November 10th, inst. I have the honor to be, very respectfully, your obedient servant. SAMUEL S. FISHER.

To his Excellency, U. S. Grant, President United States.

Colonel Fisher has been an able, industrious, and conscientious public servant. The labors and reforms which he has introduced will be felt to advantage in the future administration of the Patent Office.

At the time of our going to press no appointment had been made to fill the vacancy. The names of Samuel A. Duncan, Assistant Commissioner of Patents, William Bakewell, patent lawyer, Pittsburgh, Judge Allison, Registrar of the Treasury, T. C. Theaker, Ex-Commissioner of Patents and patentee, Horace Greeley, President of the American Institute, Clinton Rosevelt, scientist and inventor of the panatechner, J. K. Fisher, steam carriages for common roads, Gideon Welles, Ex-Secretary of the Navy, Jonathan Dennis, Quaker and solicitor, E. P. Weston, the great pedestrian, and other well-known names have been mentioned; and that the interests of female inventors may not escape recognition we suggest the name of Elizabeth Cady Stanton.

ATTEMPT TO ABOLISH THE PATENT OFFICE.

A correspondent of the *Tribune* telegraphs from Washington that "a bill will be presented to and pressed on Congress for the abolition of the Patent Office Bureau. This office has, it is alleged, become too complicated to be beneficial and must either be abolished or have its jurisdiction materially changed."

A correspondent who has noticed this paragraph inquires "Whether if Congress should abolish the Patent Office it would cancel all unexpired patents."

We answer No. If the Patent Office should be abolished now or hereafter it could not affect patents issued before the act of abolishment went into effect. At present there is no likelihood that any such act can be got through.

A Successful Inventor.

Freeman Talbot, of Rockfield, Minn., writes: "I should have acknowledged the receipt of my patent before this were it not that I have been away from home for the last two weeks. During that time I have made more than three times what the patent cost me, and the future looks bright.

"I do not propose to take out more than forty patents more, and would here remind the eager aspirants for my patronage that the able, reliable, long-established, and world-renowned firm of Munn & Co., 37 Park Row, N. Y., are quite capable of doing all my business with the Patent Office to my entire satisfaction; and I am, from a sense of duty to my family and of gratitude to you, obliged to refuse the kind offers of those individuals and companies that have already offered their services."

A Veteran Inventor.

I. S. Clough, of this city, and who by the way is a true philosopher, writes to us as follows: "Promptness in business is one of the most prosperous traits for business men. I have to thank you again for your successful manner of application for a patent, you having taken out several for me since 1849—the last one on a complete ash-sifter, which I applied to you to procure for me on the 5th of October, and on the 13th I received official notice that the patent was allowed. This speaks well for the way the cases are managed at the Patent Office, where they always are much assisted if a finished model in all its parts, showing the benefit of the improvement, is sent with each application. This, with your manner of explaining the same, so truly written out and illustrated, makes all satisfactory and easily understood."

LETTERS FROM THE SOUTH.

COLUMBUS, Ga., Oct. 17, 1870.

Southwestern Georgia—Savannah—Atlantic and Gulf Railroad—Orange Fever—Macon—Columbus—Cotton Factories and Water Power—Railroads.

Southwestern Georgia, of which Columbus is the northern angle, is the great peculior cotton region of the State. The soil is mostly underlaid with rotten limestone. Just here commences the granite range. The land is fertile, but the people are poor, for they depend almost entirely on cotton as a crop, merely entertaining the foolish idea that corn will not grow on their lands. Albany is the center of this section and has its outlet through the Atlantic and Gulf Railroad to Savannah. This railroad traverses for the greater part of its length vast tracts of pine barrens, whence the markets of Savannah and the world are supplied with lumber. They claim to average about three million feet per month. It connects southward with Florida, whence, I am informed, quantities of canned pineapples are brought. It seems that this fruit is brought to Cedar Keys, there put up, and thence sent to Savannah by rail. In the hight of the season as much as two car loads a day are shipped. The saving of sugar by being enabled to use riper fruit is said to be very great. Another article of commerce sent over this road to Savannah and thence to Europe, is black (or sea island) cotton seed for oil making. Of this 500 tuns were sent in six months of 1870. This railroad also connects, via the Macon and Brunswick Railroad, with the to be great city of Brunswick. For fifteen or twenty years the fine harbor has remained almost unimproved except by occasional efforts to bring it into notice. Now it has passed into the hands of Northern capitalists, and if they do not make it in reality what it has been so long in name—a city—it will not be through lack of enterprise and good location. It is already rapidly improving. The M. and B. R.R. has just been finished, and another to Albany and Eufaula is building. The idea is thence to connect westward and make Brunswick the great cotton-shipping port.

The orange fever has raged for some years in Florida with great violence. When put on paper that a tree yields so many oranges, and that there are so many trees to an acre, and each orange worth so much, an immense profit is made out. It is also represented to be a very easy way of making a living. But it must be remembered that it takes years for an orange grove to grow and bear well, and good orange lands near transportation are already taken up, and sell very high, and when hauling comes in profit goes out. As Col. Haines, of the A. and G. R.R., says, "I want the line of my road, and Florida too, settled up by Northern people, but they must not expect to find any place here that they can live without work."

Savannah is a very active place, and has this year largely increased its cotton shipment. The town has a sandy soil and is almost a perfect level. It is supplied with water by pumping to the top of a reservoir tower, from which the water is distributed to the city. The pressure is not very great, but answers amply for the hight of the houses there. A great point of interest in the city is the Cemetery of Bonaventure. It is a rather private affair, but well worth a visit. The evergreen oaks hung with the somber gray moss have a melancholy look, almost an appropriate one. Savannah has no manufactures, if we except some steam and rice mills. Money is worth too much to trade in and to advance it on cotton for manufacturing.

Macon, the great interior cotton mart of the State, is similarly situated, though there was a small cotton factory run by steam, which I was informed had a rather sickly existence—more from bad management than any real permanent cause. This place is at present the great manufacturing town of Georgia, and is likely to be still greater. It is located on the Chattahooche river, which, three miles above, commences a series of falls that end near the middle of the town. From thence the river is navigable all the year to the Gulf. The hight of this fall is about 165 feet. On this line there are three factories and one large flour mill. The upper factory, called the Columbus Manufacturing Co., R. H. Chilton, President, owns land up and down the river for a mile, and has a fall of 42½ feet, with water and sites sufficient to run 600,000 spindles. The factory now contains only 4,000 spindles and 96 looms. The pickers and cards are English, the rest American machinery.

Next below and in the limits of the town is the Muscogee Factory, running 4,000 spindles and 60 looms. The building is not full. The looms and spindles are American, the cards English.

The other mill is the Eagle and Phœnix, and is the largest in the South, having lately been enlarged. As it has a widespread reputation not only for the character of its goods, and its good management, but also from its using in so great measure English machinery, I will notice it more fully. The power used is in each mill or building—two double Leffel turbines, 56 inches in diameter. Other wheels in each drive the pickers, and one stands ready to drive a fire pump. Another 40-inch wheel drives the workshop machinery. Hight of fall is 14 feet. The two mill houses are 220 × 57, and five stories high. The picker room is 80 × 40, and three stories high. The finishing room is 120 × 40 feet. The dye-house is 120 × 40; and the machine shop 54 × 50. The office and ware-room building is 124 × 40, and two stories high.

They run 18,000 cotton spindles and 2,000 woolen spindles, All the woolen and about two thirds the cotton spindles are American. Of the looms, 8 run on cotton blankets, and 60 on woolen goods; 186 are American, and 350 are English. Of the American looms they have nearly every make, and endeavor to use every new improvement that promises to be valuable. An experienced Glasgow dyer does their work in that line.

I asked as to the value of the English machinery compared

with the American. The general superintendent, Mr. Young, was decidedly in favor of the English. He thought the looms did far more work, could be run at higher speed, and the spindles would do just as much. He did not believe in the ring-traveler, but would stick to the old English throstle. I asked the foreman of the spinning rooms his opinion. He said the American ring-traveler would do nearly or quite one fifth more than the throstle, but for high numbers of yarns the throstle did best.

Mr. Young gave me a history of his experience in cotton manufacturing in Georgia. He said years ago while he was keeping a country store, a man came along with a wagon-load of spun yards and wanted to sell it to him. "Why, I told him, the country people wouldn't buy his factory-made thread—every woman in the country had a spinning wheel. He insisted on leaving it with me, and said if I did not sell it he would take it back. Three months after he came along, and I had not only sold all but needed more. That was about the first factory-spun yarn sold in Georgia." Previous to the war there were thirty-three cotton and woolen factories in the State; now there are twenty-five—some not rebuilt.

In the loom rooms, I was told, they could get 50 yards per day from the English loom, and about 40 from the American. The American spindle, running on ordinary yarns, made from 5 to 5½, the English 4 to 4¾ ounces of yarn per spindle per day.

This factory uses a little over 3,000 bales of cotton a year and nearly 200,000 pounds of wool. The wool is almost entirely drawn from So. W. Georgia. Their cotton blankets are a specialty and peculiar to them in this country; they get their idea from France. The factory was erected by Capt. U. J. McAllister, who has made many improvements in machinery, and, as he told me, always got them patented through the Scientific American Patent Agency.

These mills are an example of what the people of the South can do if they choose. They have a capital all paid in of $1,250,000, of which only $125,000 is from the North. Mill No. 1 paid a dividend of 18 per cent in 1868; in 1869, mill No. 2 was commenced, and has but lately been finished and filled with machinery. Two mills located here were burned during the war. The Company own other fine water powers, and with the same enterprise may treble their capacity.

Columbus is destined to be the great manufacturing place of the South. There is no such water power elsewhere, and nowhere else such ease of transportation. Then, too, it is in the midst of a fine cotton-growing region, and shipped last year over 75,000 bales of cotton. I asked the cost of manufacturing here compared with the North, but did not get a satisfactory answer. It was evident they did not desire to tell. Yet there is at least the difference in the price of cotton, and the difference of transportation and cheaper labor. In a pamphlet issued by General Chilton, he claims that it costs $22 more to manufacture 500 pounds of cotton in Massachusetts than at Columbus—all charges and freights included. Labor is abundant, there being hundreds of poor whites anxious to get such work. General Chilton told me he had to turn them off daily.

There are three more cotton factories in the adjoining county of Upson, running about 7,000 spindles in all. In Columbus there are two large founderies and machine shops, and one agricultural implement manufactory; also near by, is Ennis' Novelty Wood Works, for spokes, hubs, etc., and patent wheelbarrows.

A railroad in Alabama will soon connect the town with the Alabama coal fields, and another southwards to Bainbridge, will give rapid and better communication to Savannah *via.* A. & G. R. R.

Coal is now brought from Tennessee. The town is supplied with gas made from wood. It has no water works, but John E. Birkenbine, of Philadelphia, was there to examine localities, and report on the possibility of erecting suitable works. It is one of the needs of the place, especially as it will have a large manufacturing population, and should be well supplied with water. Good water can readily be had from the hill north of the town. H. E. C.

Nerve Telegraphs.

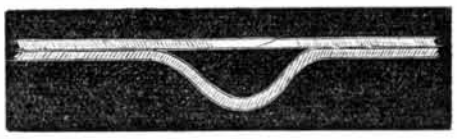
Within the flesh or muscular part of the body are two distinct sets of nerves, namely, the motor and the sensory nerves. By the sensory nerves the brain receives intelligence of all outward actions, and the mind becomes conscious of external things, such as light, scent, sound, taste, and touch, of pain or pleasure. The motor nerves, on the other hand, convey the intelligence or will of the mind from the brain to the outward world, by directing the muscular motion. If the brain desires the hand to strike the strings of a harp, it does so by the motor nerves; but the sound which is returned is conveyed to the brain by the sensory nerves. Intelligence from the brain to any part of the body, and conversely, is conveyed by the nerves at a velocity of 112 feet per second; that is, at a speed of one mile in 47 seconds. Quick as this may appear, the time between a wound given and the pain felt is appreciated. By what means the mind or will acts over the nerves we are unable to say. Persons who have what is figurately termed "an iron will" can endure pain with almost stoic indifference. Neither tears nor laughter seem to move them. Others there are who have so little command over their nerves that trivial things affect them greatly. To train the mind to exercise its will over the nervous system is highly beneficial.—*S. Piesse.*

Fire-Arms in Turkey.

The *Levant Herald* says the Porte has decided upon converting a large number of the Springfield and Enfield rifles into Remingtons, and several thousand breech-pieces on this latter system have been purchased in Vienna. As soon as the conversion has been effected the new arms will be served out to portions of various regiments with a view to test their practical value on a large scale. The military and naval preparations are being pushed on at Tophaneh, Zeitoun-bournou, and in the arsenal, in all three of which large numbers of hands are working extra time. In addition to the arms and munitions which are being rapidly manufactured in these establishments, a considerable contract for cannon on Krupp's system has been given to a house in Vienna, whence several batteries of mitrailleuses have also been ordered, in addition to those already purchased in Belgium and America.

BRAZING BAND SAWS.

A correspondent of the *English Mechanic,* gives the following directions for brazing band saws: 1. Make a splice with a file on flat way of saw, the length of two teeth. 2. Get a



piece of flat iron, and bend it into the same shape as in the diagram, and with some small binding wire bind the saw perfectly straight and firm to the flat iron, so that the splice may come directly over the curve. 3. Wet the splice with clean water and rub on some powdered borax. 4. Make a stiff paste with spelter and borax mixed with water. Take a piece the size of a small nut and lay on top of splice. Put the splice between two pieces of charcoal and with a blow-pipe direct a steady flame from a gas-jet on the paste.

TAX OF TRANSPORTATION.—The country that exports the commodity of smallest bulk, is almost wholly freed from the exhausting tax of transportation. At Havre—ships being little needed for the outward voyage, while ships abound—the outward freights must be always very low. France, in 1856, exported silks and cloths, clothing, paper, and articles of furniture, to the extent of $300,000,000; and yet the total weight was short of fifty thousand tuns—requiring for its transport but forty ships of moderate size, and the services of perhaps two thousand persons.—*Carey.*

TRADE-MARKS AND DESIGNS.—Some of our prominent manufacturers have just discovered the existence of the new law, which authorizes foreigners to patent their trade-marks and designs, and find that it will seriously cripple their right to continue the practice of copying designs of foreign carpets, delaines, and other stuff goods. We are assured that a powerful effort will be made at the next session of Congress to repeal this law; therefore it behooves those who wish to protect their designs to do so at once. If the law should be repealed it cannot affect existing design and trade-mark patents.

EXTENSIVE SALT DEPOSIT NEAR BERLIN.—The boring at Sperenberg, near the city of Berlin, about twenty-five miles to the south, had reached, on the first of June last, a depth of 3,090 feet, and for 2,810 feet is through a bed of rock salt. How much deeper the deposit is remains to be tested by further boring. The deposit appears to be quite as rich as the famous Stassfurt mines.

THE only shot tower in New England is, it is said, at Newport. This tower is 150 feet high. The lead is melted at the top of the tower and falls through sieves, cooling in drops of different sizes as it falls, which are caught by sieves of different sizes, and thus sorted for use.

THERE are now ten establishments in Missouri engaged in making pig iron, with a capacity of making 300 tuns of iron per day. Four of these establishments are situated in South St. Louis, three near the line of the South Pacific Railroad, and the remainder on the line of the Iron Mountain Railroad.

QUERIES.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]

1.—IRON CASTINGS.—I have a difficulty to get my iron castings solid on the side which is uppermost in casting; would some brother molder give me a little advice as to the cause and remedy, and oblige?—A Young Molder.

2.—BLACK JAPAN.—Can you inform me how the pitch is prepared that is used in making black japan, and also how the japan is made, so that when put on a coach panel and varnished it does not turn green?—H. W. R.

3.—WATER COLORS.—Will some reader inform me how the liquid water colors in bottles are made; also how the moist water colors in pans are made?—W. C. C.

4.—POWER OF ENGINE.—Would any reader let me know, through the medium of your journal, the pressure necessary to drive a fourteen horse-power high-pressure engine to work at its nominal power and how many revolutions per minute should it go?—J. B.

5.—LACKERS.—Will some obliging reader who is acquainted with lackering give me the recipes for making a good gold lacker, a good green lacker for bronzing, and a pale, colorless lacker?—Indicator.

6.—SILVERING CHEAP LOOKING LOOKING-GLASSES.—Can any of your readers tell me the way to silver cheap looking-glasses? also the materials required, and method of using? Having some pieces of glass that I want silvered for a particular purpose I should like to try and do it myself.—A. M.

7.—CHEMICAL AND BREWING.—The water I use for brewing contains a large quantity of iron. How can I get rid of this iron in the water? It prevents the beer getting bright. Would a filter of animal charcoal, vegetable charcoal, and gypsum do? I want some sort of filter which will ex act the iron without damaging the water in other respects.—Brewer.

8.—REMOVING PAINT AND TAR.—How can I remove oil paint and tar from oil-cloths, tarpaulins, and other fabrics, so as to obtain the body cloth intact? Can some kind reader oblige?—Old Tar.

9.—THE BIRD AND THE BAT.—Will any of your readers inform me of the mechanical principles involved in the flight of the bird and the bat, and also wherein the difference between the two modes consists, or refer me to any work in which I might find such information.—T. R.

10.—WHITE LIGHT.—I am greatly in need of an artificial white light, one by which I can distinguish shades of color; not required to be intense but regular, and moderate in cost first and second. Is there any plan of taking the yellow out of gas or any other artificial light? I have tried tinted glasses for correction, but they do not answer.—J. O. R.

11.—CONTRACTION AND EXPANSION OF METALS.—If iron be heated and plunged into cold water it becomes hard and contracts, but if copper be heated and plunged into cold water it becomes soft. How is this accounted for? It seems a contradiction of the general law, viz., that all bodies expand by heat and contract by cold.—A. C. S.

12.—SOLDERING BRASS TUBES.—Will some reader tell me how to join thin brass tubes without the application of heat?—W. H. D.

13.—DRY COLORS.—I should feel obliged if some of your subscribers will inform me how to make dry colors, such as greens and blues, etc., or name a work which will give the information; also the best work on varnish making.—H. J. D.

14.—A COTTON SPINNER'S DIFFICULTY.—Would any of your readers in the cotton district help a brother spinner out of a difficulty? I have to work a double beater scutcher, and the cotton will stick to the last beater blades, and when it gets on to one side takes all the draft from the other, and so causes one part to choke and make a bad lap. I know there are plenty of books giving instructions as to calculations, but every one who is in the trade knows that to be a very small part of cotton spinning.—Workman.

15.—DRY PLATE PROCESS.—Will some photographic reader furnish me with the formula and manipulation of one of the best dry plate processes for a novice in the art to commence with?—A Would-be Photographer.

16.—ENGINEERING ESTABLISHMENTS.—Will some subscriber please state what engineering works employ the largest number of hands, and state the number of hands employed by several of the largest works in the world?—Draftsman.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal.

All reference to back numbers should be by volume and page.

W. R. J. answers the inquiry of I. D., in re ard to coloring butter, and preserving eggs. Ho recommends for coloring butter the juice of fresh carrots, or annotta, but gives no definite directions for the use of these materials. He says eggs may be kept by packing them in salt or bran point downward. He further says W. H. L. can get rid of red ants by sprinkling sugar on a coarse or very porous sponge. The ants will enter the cavities of the sponge to get the sugar, and being thus trapped they may be killed by immersing the sponge in hot water. The sponge may be used repeatedly in this way till the pests are removed The more sponges used the more rapid will the extermination proceed M. W., of Passaic, N. J., also recommends this plan.

Dr. T. A. H., of Ill., says red ants will not frequent a place where heavy coal oil has been smeared. A ring of this substance placed around a sugar barrel will, he says, protect the contents from the ants. Will he tell us whether the odor will not impregnate the sugar? He also recommends the method for keeping eggs given by W. K. J., of Illinois, but adds that it is important to keep them where the temperature does not rise above 50° nor fall lower than 32°.

R. L. C., of W. Va.—Birdlime may be made by boiling linseed oil over a slow fire till it is very thick and glutinous. Its adhesiveness may be proved by trial with the fingers. You will need to use much care not to burn it, and the vessel employed should not be more than one third full of oil. When sufficiently boiled pour it out into cold water. It is considered best to make it thicker than is actually necessary for use, and to bring it back to the proper consistency by mixing it with pine tar.

A. D. G., of Mass.—The theory in regard to the effect on health of the evaporation of water on heaters and stoves, is that the capacity of air to hold moisture is increased by heat, and that if not supplied in the manner alluded to it will seize moisture from the mucus membranes of the nose, throat, and lungs, irritating them, and rendering them unhealthy and susceptible to effect of atmospheric changes.

E. B., of Ill., says red ants may be exterminated by using a solution of one tablespoonful of tartar emetic in a pint of water. This placed where the ants can get it will, he says, prevent all further annoyance from them. Tartar emetic is, however, a deadly poison, and should, if used at all, be used with extreme caution.

G. R., of Mo.—The dark color of the steam escaping from the safety-valve of the boiler of which you speak, was probably due to the violent priming of the boiler. It is obviously impossible to give an intelligent opinion as to the primary cause of the explosion, without a personal inspection of the boiler, and full knowledge of the attendant circumstances.

E. G. P., of Mass., replies to R. L., of La., that he finds no better recipe for welding steel, than extensive careful practice. With that and a clean slow fire, and a liberal amount of borax, he finds no difficulty in welding steel to steel though it *be* hard and "rich in carbon."

W. H. A., of Tenn.—To join together pieces of tortoise shell, dress down the edges to a nice, true bevel, then lap them together and press them between hot iron plates. In practical working, tongs with long flat jaws are used for this purpose.

H. F., of Conn.—Rules for calculating diameters of speed pulleys are given in Fairbairn's "Mechanism and Machinery of Transmission," published by Henry Carey Baird, 406 Walnut Street, Philadelphia.

S. P., of N. Y.—After oil cloth has been well washed and is quite dry from water, it should be brushed over with beeswax, very slightly moistened with turpentine, then well polished with a polishing brush. Don't use soap and water—soap dissolves the oil.

J. A. C., of Md.—In our opinion borax and sal ammoniac constitute as good a flux in welding steel as any of the vended receipts.

J. H. E., of Iowa.—Our files contain all the information you seek on the subject of stained glass. We do not wish to repeat what we have said on this subject at present.

N. L., of N. Y.—No valuable information is conveyed in your article upon astronomy, therefore we cannot publish it.

W. M. W., of Ohio, wishes to know if cast iron can be hardened so as to retain its hardness after he ti