an example the cylinder tubular boiler; the same rules apply to the two or more flue or cylinder boilers.

In case the duct from the boiler to the chimney is carried under the ground, great care should be used to have it so arranged as to be easy of access for clearing, the upright part and in the angles large, and that the duct be either square or round, not a parallelogram, in order that as little surface as possible may be presented to the passing current.

These under ground ducts have sometimes given trouble in certain localities, in sugar houses, distilleries, breweries, and other places where fermentation is going on, liberating large quantities of carbonic acid gas, which being heavier than air fill the lower spaces and render it impossible for the products of combustion to pass to the chimney until the gas is removed. We have done this by exploding a few ounces of gunpowder by means of a slow match in the duct, taking care to have the breeching closed so that the gas be blown up chimney.

The above difficulty only occurs when the boiler is newly set, or has been standing cold for some time.

EDITORIAL CORRESPONDENCE.

Who is Prussia?—The Question Answered but not Settled—The German Spirit and its Characteristics—The King—His Habits—Bismark, the Iron Man—The Habits of the People.

Berlin, July 23, 1867.

In the show window of one of the numerous shops in the beautiful street called "Unter den Linden," is a characteristic double picture. One represents a solitary mounted figure clothed in the splendid uniform of an Austrian Huszar. Underneath are the words, "Who is Prussia?" The other represents two mounted cavaliers—one an Austrian, the other a Prussian. The latter answers laconically "Here is Prussia," having, in the mean time, drawn his sword and knocked off the Austrian's cap in the coolest manner possible.

Such, at this moment, is the situation of the two nations which the group represents. Austria seeking to control the destinies of the German Confederation, finds in Prussia a power to dispute her claims, and in the seven weeks' war of 1866, the former inquires "Where is Prussia?" One year ago, on the sanguinary fields of Konniggratz and Sadowa, the question was answered, "Here is Prussia."

Germany has always puzzled me a good deal—and when the question has been asked, "Where is Germany?" the answer has been: Austria, Bohemia, Bavaria, Westphalia, Wurtemburg, Saxony, Prussia, Hanover, Hesse Cassel, Saxa-Coburg, Saxa Weimar, besides a score of other petty Dukedoms—a sort of mosaic work of little states—so that a traveler is fairly bewildered by their number. At one time the provinces of Renish Prussia could not be reached from Berlin, in a direct route, without passing through territories governed by other rulers. The success of Prussia in war has altered this state of things, and now she has a free pass to go in a straight line. The King of Hanover has voluntarily exiled himself rather than to yield his regal rights, but his Queen refuses to go, and is compelled to submit to the authority of of the King of Prussia, who, it is said, appoints her household servants. The Duke of Nassau, for the same reason, takes up his abode in the mountains of Switzerland, and reminds his people that for six years his father was wrongfully deprived of his ducal rights, and if need be, he can stay away as long. It must not be supposed that the success of Prussia in war has made a homogeneous people. On the contrary, while the population on the lower Rhine shout lustily, "God save the King and Bismark," up the Rhine, and much nearer to this capitol, there is a sullen bitterness of feeling which often vents itself in language of unmistakable disapprobation, and the presence of the most loya troops are required to secure obedience.

Military surveillance, however, is not so rigidly exercised over the people in Prussia as it is in France. The Germans are a brave and well educated people, and it would not be safe to undertake to reduce them to a position of military vassalage such as exists in Russia, Austria, and, to a great extent, in France, where the masses are unlearned, and by long habit have bowed the neck to the most grevious burdens.

It is said that every soldier in the Prussia army is able to read and write. By law all the children, male and female, between the ages of six and fourteen, are compelled to attend school. They are taught reading, writing, and the elementary studies generally, to which is also added singing and religious instruction. It is not at all strange, therefore, that in time of war an army so composed should be strong and reliable—a band of Spartans who fight for "God and Fatherland." The whole population is trained for war, but not for the army, so that when the war-cry is sounded the people drop their implements of peace and seize the musket, to the use of which they are thoroughly well skilled. Two years ago King William and Bismark were very unpopular, but the events of 1866 have rendered them both objects of mingled pride and popularity. Had they failed, a fearful retribution would have covered them with oblivion and contempt.

King William is in one sense an accidental Sovereign, for although of the royal family, he succeeded to the throne in 1861 upon the death of his brother, who left no heirs. The shop windows of Berlin testify to the general admiration in which the King is now held by the people The photographic art seems to have exhausted itself in presenting him in almost every posture that befits his position, and the chisel is now being employed to mold the kingly features into comely form, though it must be confessed that His Majesty is by no means a poor subject. He has a somewhat commanding figure, a bright blue eye, with a smiling open countenance, which reveals a great deal of the *bon homme*, while his habits are very simple and correct. At his summer residence of Babelsberg, in Potsdam, either himself or some one else has shown a great deal of excellent taste and good judgment. It is not exactly a palace; on the contrary, it has the outward air and style of a fine place upon our own romantic Hudson. The gardens are very beautiful and well kept, and but for a knowledge of the fact beforehand, nothing inside would indicate to the visitor that it might not be the residence of some private gentleman who had plenty of money to purchase fine pictures and other rare and beautiful objects of art and *vertu* The bed-chamber of the King is a curiosity, for instead of finding richly carved furniture, garnished over with tinselry, the visitor sees a small plain cottage bedstead made of maple wood, and provided with a blue cotton chintz curtain and a leather pillow, while upon the walls of the room there are no ornaments other than some neatly framed steel engravings, chiefly of battle scenes. The sitting room adjoining is also quite simple, and with the exception of many beautiful small articles, it is less elaborate, and much more sensibly furnished than would satisfy some of our would-be nabobs who ape the manners and customs of aristocratic wealth. The King was at one time excessively fond of the chase, and the halls of Babelsberg, in the number of mounted stag and deers' heads, abundantly testify to the skill of the royal hand.

Bismark is the power behind the throne—"an iron man"—who destitute of that magnetic influence which draws the multitude—insensible to fear, and courting not the eclat of popular applause—furnishes the State with cold, calculating brains. Gen. Moltke, a name but little known in our country, is regarded by the Prussians as entitled, more than any one else, to the credit of the military plans of the campaign of last year. The Royal family, in the persons of the Crown Prince and Prince Frederick Charles, distinguished themselves as commanding generals. They both exhibited the characteristics of Frederick the Great, who could play the flute, write poetry, and fight a battle.

To speculate upon the future of this nation is useless; but certain it is, that the people so suddenly expanded are by no means free from apprehension that in some way a new war is approaching; but I trust that human sacrifice to elevate and maintain Kings and Emperors, who seem to be a great set of commercial and political robbers, may finally come to an end in the universal peace and brotherhood of nations. I cannot, however, dismiss this subject without expressing a word of commiseration in behalf of the present King of Saxony. He was just stupid enough to sympathise with Austria. The result has been, that though occupying his royal palace at Dresden, he has really none of the attributes of a King. His army is commanded by the King of Prussia, and he has not even the poor privilege of controlling his own telegraphs, post-offices, and railways, and even his custom house appears to have disappeared, as no examination of baggage took place on the Saxon frontier. The Saxons say he is still king; but ask them how, and with a shrug and a grunt they answer, "we don't know."

The soil of Prussia is generally poor, but by patient industry and careful tillage it has been made to yield an abundance of grain, grass, and fruits, besides horses, cattle, swine, and geese, which seem to abound in the more northern sections, Her natural productions of iron, lead, copper, silver, salt, coal, marble, and granite are very abundant, while the mountains and forests afford a generous supply of wood and timber. The Germans are a steady, industrious, and externally moral people. A very rigid pietist would exclaim that they are an irreligious people. To some minds of peculiar caste this might easily be made to appear, but a somewhat careful observation satisfies me that such a charge would be in a great degree unfounded. Throughout the large cities and towns there is much less external vice than appears either in our own Country or in Great Britain. They all love their wine and beer, but gin, rum, and whiskey are not used, therefore drunkenness in the public streets is rarely ever seen. In the city of Leipsic, which contains 85,000 inhabitants, there were only thirty arrests made for drunkenness in three months. Can the same be said of any city in the United States of one half the size of Leipsic? The Germans go to church on Sunday. Their churches are generally well filled, and as for their congregational singing, it cannot be beaten. At nearly all their churches, both Protestant and Catholic, the choirs are made up of the whole body of worshippers who pour out their music in most rapturous strains. It is impossible that this land of philosophy, science, literature, and song—which gave birth, also, to the great Reformation, should be essentially immoral or irreligious. The Germans, it is said, resort to the beer garden on Sunday. That is true; but no one can fail to notice that the most perfect decorum is always observed, and without the presence of the police. I think, however, that the universal habit of swilling beer by all classes, old and young, which obtains throughout all Germany, is a bad practice, and tends very materially to destroy those finer physical developments which are more common among the rural population of our country. The people, however, are amused in very simple ways, and seem to be happy. They are provided with parks, museums, open air or suburban gardens for beer drinking, concerts, and plays, all of which suit their gregarious habits. Therefore, as regards the habits and moral character of the people, I do not see that in the aggregate we have any superiority to boast of.

Berlin is a fine city. The public buildings and palaces are numerous and usually very fine specimens of architecture, and by no means wanting in taste in the interior adornments. The museums and picture galleries are rich in ancient and modern curiosities, sculptures, and paintings. I was particularly pleased with the very superb collection of Egyptian antiquities, which is said to be one of the most curious in Europe. Such museums constitute great educational establishments which instruct the whole people. The streets and public places of Berlin abound also in fine memorials to the great men of the nation, but owing to the flatness of the ground in and around the city, for miles in every direction, much of the fine architectural effect is lost. The weather has been miserable. I have never before experienced such cold weather in mid-summer. On the 20th of July, wrapped in an overcoat and dressed in winter clothing, I was stirring about the streets of Berlin in search of health and curiosities.

S. H. W.

Special Correspondence of the Scientific American.

MARINE ENGINES AT THE EXPOSITION.

Paris, July 23, 1867.

The number of large marine engines in the Exhibition is not great, there being not much over half a dozen, and of these but one is in motion under steam. There is, however, a tolerably large collection of models, many of them executed at great expense and showing perfectly well the design and construction of other forms of engines. In the French annex, the engines for the *Friedland* have been erected, with the line shaft and screw propeller in place, and are to be supplied with steam from two of the eight boilers which the engine will require when in actual service. In another building, devoted entirely to the objects from the works of Messrs. Schneider & Co., Creusot, are two marine engines, one a three cylinder back-acting, and the other having but two cylinders of smaller diameter. In the Swiss annex is a paddle engine with two inclined cylinders, and lastly, in the English building, is an engine built by Messrs. John Penn & Son, and of their usual type of trunk engine. Beginning with the last mentioned, there is nothing strikingly new in design to notice, but it is remarkable for the beauty of the workmanship throughout, from the smoothness of the castings to the finish of the rods and bearings. The main pillow blocks are formed in well ribbed castings projecting from the face of the cylinder, and on the other side of the shaft are placed the condensers and air pumps, connected with the cylinders and framing only by the sole plate. The air pumps are placed quite low down, so that this connection comes very near the line in which the strain of the pumps will act, and is ample for sustaining this. The pumps are worked by rods, directly from the pistons of the engines. The exhaust passes from the cylinders through copper pipes over the shaft. The momentum of the reciprocating parts is counterbalanced by weights secured to the back of each crank cheek by a wrought iron strap passing around the latter, an arrangement which brings the counterweight just where it should be, while the straps are finished in such a manner as not to disfigure the crank shaft. The link motion is used for reversing, in combination with another valve placed above the steam chest for cutting off at any point from one third to one fifth There is, of course, the objection to this arrangement, of the large space beneath the cut-off valve. The engine has surface condensers, the tubes being arranged in a vertical, cylindrical casting above the air pumps, and covered at the top with a large bonnet. The condensing water is supplied by a pair of centrifugal pumps placed back of the condensers and driven by a very neat pair of vertical engines, with the cylinders above. These, though constructed entirely separate from the main engine, are placed so as to be within reach of the engineer standing on the platform, for starting the engines. This first pair of engines is kept in motion by a portable engine connected by gearing to its shaft coupling. Messrs. Penn & Son have also on exhibition a set of twin screw engines with boiler, such as they make for ships' launches, and intended to work at a high speed. The boiler is of the locomotive type, and the cylinders are bolted to the sides of the fire box and the shaft bearings also lower down, but the strain between the two is sustained by a strong bolt passing directly from one to the other. In the same room is a working model of one quarter size of a pair of vertical screw engines by Wm. Denny, of Dumbarton, kept in operation by steam from the boiler of the portable engine already referred to. The central space of the engines is occupied by the surface condensers, the cylinders being placed above these, and having their guides formed on the sides of the condensers. These engines are said to be very much liked where in use. Messrs. Humphreys & Tennant also exhibit two beautifully executed models of their styles of engines, on a scale of one twelfth full size. One represents a form of engine which has been advocated for some years by this firm, in which the required economy of room athwart ships is obtained neither by back action nor the use of a trunk, but by employing a very short connecting rod. The makers argue that the amount of friction caused by the great inclination of the rod, is after all not excessive, and preferable to the evils attending the other modes of construction. Their other model, however, is of the more usual back-acting type. Four piston rods transmit the motion of each piston to its cross head, and the air pumps are also worked directly from the pistons. These makers have established a reputation for the construction of very economical engines.

The rest of this annex is chiefly devoted to models of ships, both of the navy and those constructed by the principal British builders for the merchant service, at home and abroad. The former comprises a collection of half models of all the screw vessels constructed for the navy since the introduction of the propeller. The changes that have taken place in the forms of vessels in the last quarter of a century, are very strikingly shown by these models, and of these changes, the most remarkable are those which have occurred since the adoption of iron plating, and rams.

The larger Creusot engine is intended for the iron-clad *l'Ocean*, and is of 950 nominal horse-power, but will work up to 3,800 actual horse-power. It is quite similar in its most

important features to the Indret engines for the *Friedland*, and a description of the former will suffice for both. As already stated, there are three cylinders side by side, acting on cranks placed at angles of 120° with each other. The middle cylinder alone receives its steam directly from the boiler and is unjacketed, while the outer ones are jacketed and receive their steam from the exhaust of the middle cylinder, forming together the equivalent of the low-pressure cylinder in engines on Woolf's plan, so common in Europe. It will be seen that with this arrangement with three cylinders, it becomes necessary to commence the release of steam from the high-pressure cylinder at about three-quarters the stroke, but it is not necessary on that account to cease admitting fresh steam to the cylinder, since that which passes out of this, acts on the piston of the adjoining cylinder, which is just commencing its stroke, though if a higher degree of expansion is required, the steam may be suppressed at any portion of the stroke. One important point, however, which has been attempted in the construction of these engines has been to make as many of the parts as possible interchangeable, and with this object the valves for all three of the cylinders are made exactly alike, and are set so as to open and close at the same relative point in each case. This latter condition involves the suppression of the steam at about three fourths the stroke, and introduces some anomalies in the distribution, which do not exist in the ordinary arrangement with two cylinders. Tracing out the distribution of steam to each cylinder, it will be seen that we have, first, three fourths the stroke of the high-pressure cylinder with full boiler pressure steam; then, admission to the second cylinder, and expansion in both till the latter has made three fourths of this stroke or the first crank two thirds of a revolution; then suppression in the second, and at the same time the piston of the first being at about one fourth of its return stroke, opening of the valve to the third cylinder and expansion between that and the first until the completion of the revolution. The valves are of the D-shape, and the steam is admitted beneath and released above them, the valve faces being placed on the top of the cylinders. The valves are worked from cranks in a revolving shaft connected with the main shaft by gearing; and with an arrangement of internal gears by which the advance of this secondary crank shaft may be changed as required for reversing. The exhaust connections are made by means of copper pipes of elliptical section, so made to economise hight, and furnished with stay bolts along their shorter axis. The condensers are of the ordinary kind, and the air pumps are placed below and are worked from arms forged on the piston rods. The pumps are of the ordinary double-acting kind, and, as is too frequently the case with this form of pump, the delivery valves being placed at the top of the water chamber and the foot valves at the bottom, all the air contained in the condensed steam has to pass through the body of water in the pump, which it can not do rapidly, from its finely subdivided state, and accordingly the vacuum obtainable in the pump is very much impaired. The foot valves should be placed at the top of the body of water, the delivery valves being close by, so that the air immediately passes out at the latter without having to percolate through a great mass of water. The shaft of this engine is furnished with a strong universal joint coupling—simply a Hook's joint. The pillow-block brasses are in two pieces, and are set up sideways only, by wedges and nuts above the binders. The framing is very stout and extends directly across from the cylinders to the condensers on the level of the main shaft. The other pair of engines by the same makers are very similar in general construction of details, but are of the ordinary cylinder type, with valves placed at the sides and worked by a link motion. They are of 265 nominal horse-power, being one of a pair of such engines intended for one of the new French vessels.

The design of the engines built by Messrs. Schneider & Co., appears to be the most common for large power in the French marine. As already stated the engine which is in operation, built at the Indret works, is of the same kind, and in addition to this, among the very interesting collection of moving models exhibited by the French admiralty, the design occurs more than once. It will not be necessary to say much more in reference to the Indret engine therefore, except to mention a few points of difference between it and the one already described. One of the most noticable of these differences is in the arrangement of the guides for the main crosshead. In the Creusot engine, these consisted of a pair of top and bottom surfaces on each side of the journal of the connecting rod, and between that and the arms to which the piston rods were attached, as often found in our own engines. The bearing on the crosshead was formed by two blocks of cast iron encircling the wrought iron crosshead, and secured to each other by feathers on their meeting faces. The wearing faces of these castings are recessed and filled with Babbitt metal. In the Indret engine only a single bearing is used directly beneath the connecting rod journal, and this is made very wide so as to give ample surface when running ahead, but the lips which form the upper bearing over the sides of the crosshead block have apparently not half the surface so that the conditions for running backwards are not so favorable, though perhaps there is as much surface as is necessary for the purpose. The condensers are placed at the extreme sides of the engine, outside of the piston rods of the outer cylinders; the space therefore between the three sets of guides and connecting rods is entirely clear. Beneath the guides are pumps worked in some cases by rods from the steam pistons, and in others by lugs projecting downward from the piston rods. The arrangement of valve gear is the same as in the engines already described. These engines are working regularly every day, but one boiler being fired to supply them with steam, and they appear to run very smoothly, requiring but moderate attention. The appearance they present when operating in this manner with the blades of the huge screw beating the air and creating a strong current is novel and imposing. They are so arranged that visitors can walk around every part of them and examine the working of each portion. In the same annex is Meazeline's three cylinder engine of 450 nominal, or 1800 actual horse power. It is very similar to those of the same type already mentioned, and is a very creditable job as regards workmanship. Beside it stands another engine of similar size and type, in which the singular and not disadvantageous plan has been adopted, of omitting in the erection, nearly all the main castings and framing, thereby showing all the details of the moving parts—portions which in the usual course are entirely hidden through their construction. The outer packing ring of the pistons is of cast iron, a single ring, the full width being used. The follower bolts are secured from working loose by portions of a ring of wrought iron, let into a groove turned in the follower just by the side of the square bolt heads. As these rings in their turn are held in by screws, the question is, how much less liable these latter are to work loose than the follower bolts would be with no additional provision. The foot valves are placed at the side of the air pump chamber but in an inclined position, the valves being on the under side. These consist of long rectangular rubbers, giving a long and narrow opening on each side of the guard, by which arrangement it is supposed they will have stiffness enough to close promptly, notwithstanding their downward inclination, while the upper end of the valve, at which most of the air would escape, being close to the delivery valve, the air would have but a small volume of water to pass through before making its exit from the chamber, a circumstance always favorable to the attainment of a good vacuum.

The engine by Messrs. Escher Wyss & Co., in the Swiss annex is a very neat job, but presents no particularly striking novelty in its design. There are a pair of inclined cylinders of about 30 in. diameter by 42 in. stroke placed side by side and connected to the upper frame, containing the main pillow blocks, by the guide bars only in the direction of the strain. These are of wrought iron and made tolerably heavy to resist flexure, but appear rather light from being unsupported throughout their length. The top casting is as usual, supported on turned wrought iron bolts resting on the bed plate below, to the further end of which the cylinder castings are also bolted. The air pump is vertical and single acting, placed directly beneath the crank shaft and worked by a connecting rod and trunk from a crank in the center of the shaft. The exhaust from one cylinder passes through a high arched pipe into the exhaust chamber of the other and thence a horizontal pipe leads along the bed plate to the condenser under the shaft. The valve motion is of the ordinary shifting link kind.

While we are in the Swiss annex we must notice a very good horizontal engine that is placed there, where not half the people who visit the Exposition will see it. It is fitted with a gear for variable expansion which seems to be very well designed and not liable to derangement, though it is not at all new in its general features. The steam chest is placed on the top of the cylinder and the valves, which are balanced poppets, are situated at each end of the former. These are raised by means of revolving cams on a shaft running from a bevel gear wheel at the shaft along the side of the cylinder, and the governor by moving a wedge-shaped piece causes the closing of the valve, under the action of the cam, to take place earlier or later as the case may be. The cut-off gear is in fact almost identical in its operation with that applied to some of Wright's segmental engines. The exhaust is effected by separate valves placed beneath the cylinder. The governor is on Porter's principle, and a very noticable fact is, that this governor has been generally adopted on the Continent since the Exhibition of 1862 when Mr. Porter first brought it before the European public.

Just outside of this building we find in the portion of the grounds allotted to the Russians, a model of an apparatus by which it is proposed to conserve the power usually expended upon the brakes of trains descending steep inclines of railways, and to apply it to trains running up the hill. It consists merely of a frame carrying four wheels on top of which by the intervention of friction gearing is mounted a pair of heavy flywheels. The tractive power of the train in descending is expended in imparting velocity to the flywheels, and this is to be used for assisting the return trains in their ascent. The model incline is about 110 feet long and has a rise of about one in 25. The machine used upon it is very well made and it really appears to reserve and give out a large proportion of the force expended in the descent, but it will at once occur to practical men how many drawbacks there would be to its use in practice. In the first place it would be necessary to apply the reserved power at once, or it would expend itself in internal friction, and if the trains could be so timed as to render this possible the old plan used in coal mines of connecting the loads to the opposite ends of a rope passing over a pulley at the top might better be employed. Then again the inequality of the speed at the top and bottom of the incline, owing to the accumulation and expenditure of momentum would be a disadvantage, besides the great weight of flywheel that would be required to store up any large amount of power, or else the very excessive loss inevitable with high speed. This is doubtless a problem on which very many have exerted their ingenuity, and it is not improbable that we may some day have a practiced solution of it. Certainly the great injury to permanent way from the use of the heavy locomotives necessary at present on steep gradients besides the cost of furnishing power to overcome the force of gravity is an inducement to seek some means of equalizing the tractive force required. The storing up of power in a small space either permanently or temporarily is an exceedingly difficult task, and were we able to do so, great economy of coal would, in many cases, be possible. But as a rule there is no such concentrated essence of power at our command as a lump of coal, and, as yet, we have not been able to recompress it into the same space when once liberated.

SLADE.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

Sneering Allusion to the Steam Bureau.

MESSRS. EDITORS:—The sneering remark of one of your daily cotemporaries relative to awarding to Mr. Isherwood, the distinguished chief of the Bureau of Steam Engineering, "a leather medal for his improved armor" is no doubt intended as a blow at the gentleman.

I have no means at hand of ascertaining whether Mr. Isherwood either ordered or planned the armor of the *Onondaga* but I am confident that if he really did either, it was after profound reflection and exhaustive calculation And knowing the great margin this officer always allows for safety—such as putting a 5-inch piston rod in 20 pairs of 30-inch diameter by 18-inch stroke engines—you may rest assured that if, as has been asserted, 4-inch hammered plates without backing can be pierced by the ordinary naval guns, that Mr. Isherwood has been misinformed in relation to some of the dynamic elements which are germane to this problem, or else he never could have made a mistake on so simple a point. No man understands better than Mr. Isherwood the exact dynamic relations between guns and armor plates. As early as 1862 this important subject had engaged his attention and as a result of his investigations he proposed to build an iron ship of 7,000 tuns, protected by 4½-inch plates without backing. Mr. Isherwood fully appreciated the liability of wood to decay, hence his opposition to the use of such an ephemeral substance.

B.

The Mines of Montana. Better Machinery Needed.

MESSRS. EDITORS:—Montana offers a broad field for scientific research in her immense deposits of mineral wealth, and for mechanical enterprise in the thorough displacement of the old and useless machinery, which has been shipped from the East, and with which we can save but a fraction of the royal metals contained therein. It has ever been the custom to look to the East for light, but in the present case, Messrs. Editors we must look to the West for proper machinery and men to crush, manipulate, and save, with the smallest possible loss, the precious metal contained in the auriferous and argentiferous ores. As a proof of this assertion, I will just cite a case or two in point.

We have here several mills and arrastras constructed; one, with thirty stamps, (fifteen only working), crushes but five tuns per day (of twenty-four hours) while the tailings show a prodigal waste of quicksilver and gold. Another of twelve stamps, obtains but seven dollars per tun, while from the working of a few tuns from the same lode by the common arrastra process, the amount obtained was fifty two dollars and fifty cents per tun. I think, gentlemen, with the light of past experience before us and the proof just adduced, we of Montana and capitalists interested in our Territorial development, would do well to apply to the Golden state for some valuable instruction before investing money in unprofitable machinery. It would relieve many anxious and doubting minds here, it would induce hosts of timid capitalists to invest their superabundant wealth in our mines, and with a branch mint in Helena would usher in a new and glorious era for these rocky mountains and the whole Republic that would help move the moneyed world along.

Hoping soon to see the SCIENTIFIC AMERICAN again, you have the best wishes of your nomadic subscriber and friend.

F. M.

Trout Creek, Montana.

Importance of Good Material in Agricultural Machines.

MESSRS. EDITORS:—Will you in behalf of the farmers, urge that makers of reaping and mowing machinery contend for excellence in the quality of iron used in their implements. There are already a number of patented machines which are each admirably adapted for their work. The serious fault, with many lies in the use of inferior metal for castings, rivets, and cutter-bars.

It may be safely said that the manufacturer who establishes a general confidence in the quality of his iron, will command the bulk of an immense and increasing trade in reapers and mowers. The farmers would cheerfully pay for the assurance of tough, well handled, and honestly made iron work on agricultural machinery.

HAY FARMER.

Frankfort, Ky.

How to Harden Cast Iron.

MESSRS. EDITORS:—Your correspondent N. D. J. of Mass. in your last issue Vol. 17, page 87, inquires for a way to harden small iron castings. The simplest and best way that I know of, is to heat them to a bright red heat and then immerse them in common whale or lard oil. If the scale is taken off the castings, they will case-harden quite deep. I have seen quite a respectable cold chisel made from a piece of common cast iron in this way. The harder the nature of the iron, the better it will harden.

J. W. JOHNSON.

U. S. Armory, Springfield, Mass.

Promoting Fruitfulness of Trees.

MESSRS. EDITORS:—Every one knows that the "sap" which gives life to the leaves is received through the "tap root"