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 light, 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" and that which brings the fruit to perfection through the "lateral roots" now, where there is a vigorous growth of leaves and no fruit, it is evident that there is some defect in the furnishing quality of the lateral roots, the sap root giving a superabundance of sap. This can be obviated thus: Let the farmer dig a trench (commencing some six or eight feet from the tree in order that the lateral roots may receive no injuries) deep enough to enable him to strike the "tap root" some three or four inches from its junction with the main portion of the tree. Cut this with a saw or sharp knife, fill up the excavation and the good effects will be seen the following season. This should be done before the sap rises.

READER.

Richmond, Va.

Philosophy of Preserving Eggs.

MESSRS. EDITORS.—Cobbet says, "A preserved egg need be run from, than after." The thousand and one recipes given from time to time are in fact as worthless as the mermaid stories or those of the snake monster of the sea. Many who put forth these stories for the million do not know what a fresh egg is; many do it for notoriety, and some ignorantly. No egg is fresh that will shake; this is because it has lost some of its albumen. No egg has ever been preserved over a month that will not shake, except it be air-proofed, which is a term not generally understood, and is a new process. If they are put in solution, no matter what it is, the egg will absorb it; if put up in dry measures the albumen will escape by transpiration through the shell. The egg has been coated with every conceivable composition, even in solid stone, and galvanized, yet the watery material escapes. The philosophy of this is that there is air in the egg before it is treated, and this uniting its oxygen and carbon, produces decomposition by carbonic acid gas, the yellow of the egg first breaking, then follows the destruction. Eggs are naturally designed to last as long as the hen requires to get her brood, and the life germ can be preserved a few weeks—seven or eight—but no longer. The egg itself may be kept in a preserved state for two years by greasing with butter, oil, or lard, but from the time it is thus put up to the end of two years it will daily lose its albumen by transpiration, and while its carbonic acid escapes to a certain extent, the egg meat will be reduced fully two thirds, and will shake. For culinary purposes they will do very well. But we want a whole egg, not a half one, and we want them fresh. Butter and lard and suet have been used for half a century, still nothing has recommended itself over the old liming system in a commercial point of view. The theory always has been, and still is, that to keep an egg fresh the air must be excluded. It is the only philosophical treatment of it that can be made. Eggs are composed of more than half a dozen chemical ingredients, and these components are very volatile; hence the atmosphere with its powerful agencies works quickly upon it. Externally kept from the air, the latter is powerless to do it harm, but the air inside no mortal can prevent, and that alone in time will decompose the egg. AN EGG STUDENT FOR FIFTEEN YEARS.

New York city.

To Make Castings Free from Scoriæ.

MESSRS. EDITORS.—Your correspondent, J. C. W., in No. 6 current series, page 87 speaks of his difficulty in getting sound castings. Has he ever tried a "stodge catcher," which is nothing more than a large sprue set in front of the pouring sprue and gated heavy from one to the other? It should be gated not quite so heavy from under the stodge catcher to the casting in the nowell. Then by pouring fast enough to keep the iron well up in the stodge catcher the scoriæ that goes into the pouring sprue will rise and stay in the catcher.

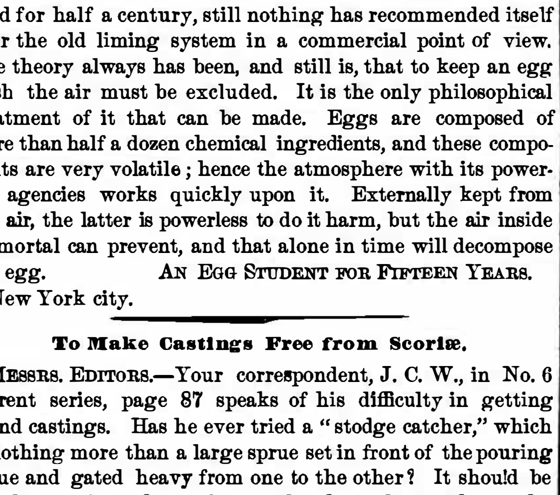
Iron should be poured hot, whether in dry or green sand molds; I consider it a great mistake to let iron cool in the ladle. If the mold is just right the iron can hardly be too hot. When the iron is poured hot the stodge rises, but if it is cooled down to the point many molders prefer, the scoriæ catches on the sides of the mold and make an unsound casting. JOHN K. RICHARDS.

New York.

JOHNSON'S UNIVERSAL LATHE CHUCK.

A good universal lathe chuck, one strong, durable, not easily got out of repair, or so choked up with chips and dirt as to

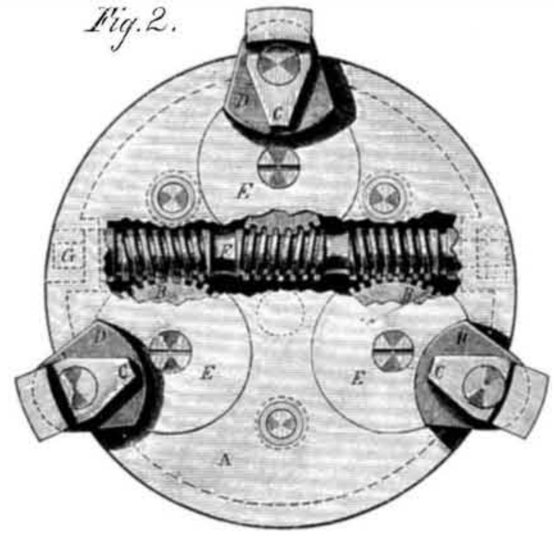
Fig. 1.



be impossible to use without consuming more time than would take to do the job, would be, as every machinist knows, an invaluable tool in the machine shop; but, as most machinists have experienced, one very difficult to obtain. This has confined the use of universal chucks to small work which could not well be done otherwise, and has lead to the use of a less economical class of chucks as a substitute for holding larger work. The chuck here illustrated is upon a new principle, has been most thoroughly and severely tested, and the patentee says, has proved itself perfect to do the work for which it is designed.

A socket wrench applied to the end of the worm shaft revolves the arms carrying the jaws, to and from the center grasping the work with the utmost precision and holding it firmly as in a vise.

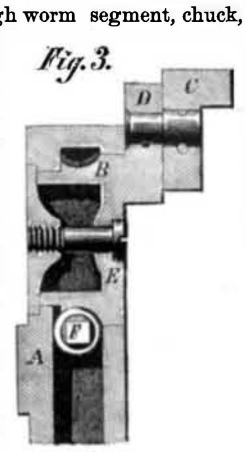
Fig. 2.



The superiority of this chuck consists, briefly, 1st, in its entire freedom from dirt, and impossibility of chips or dirt getting to the working parts of the chuck; 2d, the simplicity of its construction renders it less liable to get out of repair than other; 3d, its accuracy strength and durability; 4th, the jaws, being simple in form, extra jaws for holding odd jobs of peculiar form or shape can be quickly made at a trifling expense.

A brief description and reference to the parts may aid in an understanding of its construction and operation: Fig. 1 is a perspective view of the chuck as ready for use; Fig. 2 is a view with a portion of the face broken away, exposing the right and left hand screw or worm and the worm segments; and Fig. 3 is a cross section through worm segment, chuck, and jaw. A is the body of the chuck; B, segments of worm gears having teeth around about six tenths of their circumferences; C are steel jaws pivoted to the projections, D, on the plates, E, which are rigidly a portion of the worm wheel segments and rotate with them; F is the worm shaft which engages with the gears and is turned by a socket wrench inserted at G, Figs. 1 and 2.

Fig. 3.



As the worm shaft is rotated by the wrench, it revolves the gears so as to bring the jaws either to or from the center. These jaws can be easily adjusted to receive objects of an irregular form, or they can be used as are those on the scroll chuck for the reception of regular shapes.

Patented by William Johnson, and manufactured by Cowin and Johnson, Lambertville, N. J., to whom all orders should be addressed. Responsible agents are wanted in all the principal towns in the United States.

The Central American States.

That portion of the continent lying between North and South America proper, known as Central America is becoming of political and commercial interest to the people of this country, and, because of its presenting the most favorable routes between the two oceans, to the nations of Europe. The following from the Hartford *Courant* will be read with interest:—

The large profits of the Panama railroad revive every now and then certain old projects for the construction of another railroad or the canalization of Central America. There can be no doubt that had the people of the region which lies between Mexico and South America been possessed of ordinary commercial activity, two or three well traveled routes would ere this have been opened from ocean to ocean. But like the inhabitants of other portions of Spanish America, they have been too busy with revolutions and political squabbles to find any time or energy to devote to industry or trade. The five Central American republics all achieved their independence about 1821, and in 1823 formed themselves into a confederation, which lasted until 1839, when it fell to pieces and all the members set themselves up as independent powers. The largest one is Nicaragua, which is about the same size as Georgia; its capital is Managua, with ten thousand inhabitants; its total population is about four hundred thousand, of whom thirty thousand are whites, ten thousand negroes, and the remainder Indians and half-breeds. The next in size is Honduras, having about the same area as Mississippi; its capital, Comayagua, has eighteen thousand inhabitants; its total population is about three hundred and fifty thousand souls. Guatemala is the third of the Central American republics, being a little larger than Ohio; the name of its capital is also Guatemala, with forty thousand inhabitants; the total population is estimated at one million and one hundred thousand, or greater than that of all the isthmian powers together. Costa Rica is the next in size, its area being somewhat more extended than that of West Virginia; its capital, San Jose, contains thirty thousand souls; its total population is one hundred and twenty thousand. The smallest of these powers is San Salvador, which does not cover quite as much ground as Massachusetts; its capital is also styled San Salvador, and its inhabitants number perhaps fifteen thousand; the whole population is believed to reach six hundred thousand. The existing constitution of Nicaragua was adopted in 1858, of Honduras in 1865, and of Guatemala in 1847. The presidents of all the republics serve four years—unless they are overthrown by a revolution—except the executive of Costa Rica, whose term of service is three years. The term Central America is generally considered to include, besides the five republics, the state of Yucatan, in Mexico, and the state of Panama in Colombia.

SHEA'S PATENT BARREL AND TANK.

The demand for kegs, barrels, pipes, and tanks is constantly increasing. They are the most convenient vehicles for the conveyance of liquids and many solid materials from place to place, and upon their proper construction depends largely the amount and the condition of the material they hold upon their arrival at the place of destination. The engravings exhibit a new method of constructing barrels, tanks, etc., patented January 29, 1867. Fig. 1 presents a view of a barrel partly in section; Fig. 2 is an end view of the staves of the barrel, and Fig. 3 is a cross section of the improved head. This improvement consists in forming a V-shaped encircling projection, A, upon the edge of the head, leaving a shoulder above and below. It will be seen that when the head is seated in the barrel it forms shoulders above and below the croze, bearing against the chimes and preventing them from being broken. The incline of the edge of the head also gives additional security, as the greater the internal pressure the closer will be the fit of the head to the staves.

Fig. 2 shows a new method of securing the staves one to the other. B represents metallic dowels, slightly curved, to correspond to the curvature of the cask, and feathered at each

Fig. 1

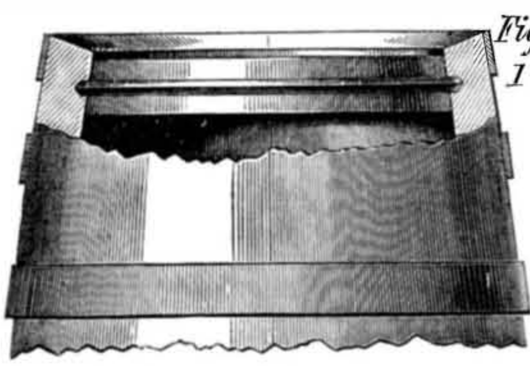
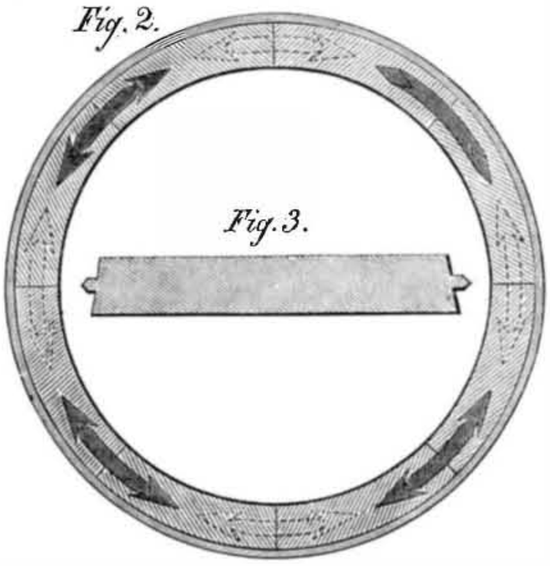


Fig. 2.

Fig. 3.



end. These are driven into suitable recesses in the ends of the staves, thus firmly binding them together. Fewer hoops are required for barrels thus built than for others.

The use of this dowel is particularly applicable to heavy work. The inventor says that, casks made in this way will cost no more than others, require less labor, and will overcome all the disadvantages of the present style of construction. A factory is now being built in New York for the manufacture of casks under this patent, having already very large orders ahead from brewers, distillers, oil merchants, and sugar refiners, who, through their patronage have given substantial evidence of their appreciation of the improvement.

The patentee will sell manufacturing and territorial rights and will furnish the necessary machinery for the manufacture of these improvements, or will alter any now in use at a moderate cost. Address Samuel Shea, Corry, Erie county, Pa., or at Jersey City, N. J., or H. W. Quitzow, 24 South William street, New York city.

SETH GREEN, Holyoke, Mass., writes to the New York Farmer's Club that he is hatching shad by the million, artificially, and he wants to say to everybody that he will give them all the young shad and impregnated ovas that they will come and take away. The day before writing he hatched 5,000,000.

PARISIAN TASTE is rather an indefinable sense. The Chinese have never been accused of over fastidiousness in the selection of their food, but what with horse flesh, frogs, snails, and so on to the end of the chapter, the same may soon be said of this more favored Western nation. The latest delicacy introduced in Paris is whale's flesh, and shark and dolphin steaks.