ground and polished at the points, on one of the most ingenious little machines that I ever witnessed in operation. A small iron cylinder, or wheel, is running horizontally, with a slow motion; a grindstone is also running horizontally, with its edge close enough to the cylinder to grind each point, as it turns past its face; next is a polishing wheel, running in the same direction and position, polishing the pen as it passes. By an ingenious little spring contrivance, the pen is held until it passes the grinding and polishing wheels, when it is let go, and drops into a box. The operator stands and drops them into the receptacles as they pass.

The next operation is slitting the points; this is done after they are tempered. The instrument used for this purpose is similar to a pair of shears. The pen being placed in a guide by hand, the slit is made just deep enough to cut through the steel and allow the points to spring into place again.

Mr. Gillott claims to be the original discoverer of the process for splitting the pen after it was tempered, performing that operation, in a secret room, for years before the process was discovered by others. He commenced life as a penknife grinder, and by this simple discovery was led to fortune. Slitting them while in a soft state, as was formerly done, left the points open, so that it was necessary to close them by hammering, a most tedious and costly operation.

Mr. Gillott informed me that he imported all of his finer quality of paper from France, for the covering of boxes, as it was not manufactured in England. This establishment consumes about 150 tuns of steel per year.

Mr. Gillott, noticing my fondness for mechanics, called a workmanand had him take apart several ingenious machines, explaining to me the several parts. This liberality I very much appreciated. J. E. E.

THE WORKING OF THE NEW YORK FIRE DEPARTMENT.

A writer in the *Evening Post* gives a very interesting account of the successful working of the New York City Fire Department.

In 1860, the amount of home and foreign fire insurance capital in this city was $32,000,000. In 1870 it was $51,000,000. The ratio of fires was greater under the old volunteer, than under the new paid system, which went into operation in 1865. Each engine house has one steam fire engine, with two horses; and one tender, with one horse, to carry hose, fuel, and apparatus. Each of these houses has a company of twelve men. They are provided with comfortable lodgings within the houses, and are, night and day, in constant attendance, except when at meals, which are taken near at hand. It provides the requisite hook and ladder companies of twelve men each, with the same quarters and regulations.

There are now 45 engine houses and 15 trucks for hook and ladder use, making a force of 165 horses and 720 men. There are 5 commissioners, who control the department, a central headquarters, chief engineer, secretary, medical officer, telegraph alarms, bureau of combustible materials, and firemen's library. To these officers are to be added 10 district engineers and 1 chief assistant, who devote their entire time to the service.

THE FIRE TELEGRAPH.

The system of telegraphy in use is the patent of John N. Gamewell, but the machinery to carry out a more perfect system for this city—the batteries and automatic street boxes—are the invention and patent of Mr. Charles T. Chester, one of the most accomplished electricians. Colonel Stephen Chester, of the Potomac Army Engineers, directed the surveys and the erection of the lines to complete it. The entire work—posts, wires, and machinery—cost about $600,000. There are 84 stations, including engine houses, insurance patrol stations, and officers' quarters, to which to send messages, and 540 street boxes, from which alarms of fire may be sent to the central office. The telegraph alarm apparatus, under the hand of a good operator, works with a rapidity and certainty before unknown in electrical apparatus. It consists, in brief, of three parts:

1. A receiving apparatus, which has the capacity to receive and note 56 alarms of fire, from all parts of the city, at one and the same time. With this apparatus the modern hotel annunciator is so connected, that it instantly drops a figure, showing the line of wire over which the alarm is coming, and at the same instant marks, upon a coil of paper, the number of the station. Each of the 56 wires, which together cover the whole city, includes a given number of stations, and it required great skill to arrange them that they do not interfere one with another, since a part or all might be in use at the same time. Fifty-six pens, moved by 56 relay magnets, are arranged under this coil of paper. Each pen and magnet is connected with some one of these 56 wires. The street boxes are so arranged that, when an alarm is to be sent to the central office, the current of electricity, which always flows through the line, may be broken so as to cause the discharge of any one of these little magnets. This works 4 results in the receiving apparatus at the office, namely: strikes a loud gong or bell, throws into view the number of the wire on which the alarm comes, starts the register wheel and marks the number of the box where the alarm is made.

2, A transmitting apparatus, equally beautiful, instantaneous and perfect in its work.

3. An apparatus for testing the condition of all these wires; for discovering at once in the office any break or injury within a few yards of its actual locality; or for testing the connection of any of these lines with exterior lines going out of the city.

At all times, night and day, two operators are on duty at the central office. When an alarm is given, the precise engines and trucks which should answer know it. If the fire spreads, and a second alarm is given, those who should respond know it; and so of a third, which brings into action all the force that can possibly be required.

RAPIDITY OF THE SERVICE.

The horses are all selected, groomed, and kept in the best manner. They are kept in sufficient force already harnessed, and so surprising is their instinct and so admirable their training, when the electric gong strikes in the engine house, they back instantly from the stalls into position before the engine, the doors are flung open, and the engine starts on an average in 22 seconds after the alarm is received, often in 18. An alarm, reaching the central office, is transmitted to every engine house, patrol station, and officers' quarters' all over the city, in 45 to 50 seconds. If we add to this instant movement and rapidity of execution, the most perfect fire apparatus which modern science and skill can devise, the unflagging power of steam, an enlarged and skillful method of instructing the officers and men in classes, which General Shaler, president of the Board, has personally introduced, the effective power of this small force stands in bold relief over that of the volunteers when they numbered even 3,800 men.

The causes which elevate and give a higher moral character to the new force are equally effective. The lyceum, in the hall of the central office, now contains a valuable library of 6,000 volumes, the gift of underwriters and private citizens, comprising largely choice biography, travels, history, and practical science, from which all the members of the force can draw and use. Dr. Charles McMillan, the medical officer of the Board, has done much to this end, in his strict examination for admission to the force, in rejecting men of bad habits or physically unsound, and in maintaining a system of competitive examination for promotion, which rests on merit alone.

LOSSES BY FIRE.

The following table of losses by fire from 1866 to 1870 shows unmistakably the good financial results of the system:

	No. of fires.	Loss.
1866	796	$6,428,000
1867	873	5,711,000
1868	740	4,142,000
1869	850	2,626,000

Of the 850 fires in 1869, 807 were confined each to one building, showing the promptness and efficiency of the efforts to subdue them.

The cost of maintaining the present service is about $950,000 per annum; a sum well invested, when we compare it with the immense losses to which we are exposed, and keep in view the growing intelligence, manly habits, and pride of character which the discipline of the organization most seduously fosters. It is most favorable, when compared with the service and the cost of the old volunteer department. The direct cost of that, per annum, was above $500,000, but the indirect expense in other forms was proved before a committee of the legislature to have swelled the sum to rising $1,000,000. The above table, from the careful reports of the insurance department, shows a reduction in losses, from 1866 to 1869, of $3,800,000; and the losses in 1870, since the new charter went into operation, were $506,000 less than in 1869, while the moral and effective character of the force has improved more than in any previous period.

Is the Interior of the Earth Solid or Fluid?

Although the doctrine that the earth is a molten sphere, surrounded by a thin crust of solid matter, was once almost universally taught by geologists, there have of late years been brought forward several arguments to the contrary, which, apparently, are more in favor of its being a solid, or nearly solid mass throughout; and these arguments are fully entitled to our consideration, as our object is not to defend any particular theory, but to arrive, as nearly as we can, at the truth. I will, therefore, in the first place, proceed to scrutinize all which has been brought forward in opposition to the older hypothesis, and then to consider whether any other explanation yet advanced is more in accordance with the facts of the case.

First of all, we are to answer the question as to whether it is possible for such a thin crust to remain solid, and not at once to become melted up and absorbed into the much greater mass of molten matter beneath it? This latter would doubtless be the case, if the fluid mass had any means of keeping up its high temperature, independently of the amount of heat it actually possessed when it originally assumed the form of an igneous globe. The question, however, in reality answers itself in the negative, since it is evident that no crust could even commence to form on the surface, unless the sphere itself was at the moment actually giving off more heat, from its outer surface to the surrounding atmosphere, than it could supply from its more central parts, in order to keep the whole in a perfectly fluid condition; so that, when once such a crust, however thin, had formed upon the surface, it is self-evident that it could not again become melted up or re-absorbed into the fluid mass below.

This external process, of solidification due to refrigeration, would then continue going on from the outside inwards, until a thickness of crust had been attained sufficient to arrest, or neutralize (owing to its bad conductibility of heat) both the cooling action of the surrounding air and the loss of more heat from the molten mass within; and thus a stage would soon be arrived at when both these actions would so counterbalance one another, that the further cooling down of the earth could be all but arrested: a condition ruling at the present time, since the earth-surface, at this moment, so far from receiving any, or more than a minute amount of heat from the interior, appears to depend entirely, as regards its temperature, upon the heat which it receives from the sun's rays.

We have next to consider the argument that, if the earth's exterior were in reality only such a thin covering, or crust, like the shell of an egg, to which it has often been likened, that such a thickness would be altogether insufficient to give to it that stability which we know it to possess, and that, consequently, it could never sustain the enormous weight of its mountain ranges, such as, for example, the Himalayas of Asia, or the Andes of America, which are, as it were, masses of rock piled up high above its mean surface-level.

At first sight, this style of reasoning not only appears plausible, but even seems to threaten to upset the entire hypothesis altogether. It requires but little sober consideration, however, to prove that it is rather, so to speak, sensational in character than actually founded on the facts of the case; for it is only requisite for us to be able to form in our minds some tangible idea of the relative proportion which the size of even the highest mountain bears to that of the entire globe itself, to convince us, if such a crust could once form and support itself, that it could with ease support the weight of the mountains also. The great Himalayan chain of mountains rises to a maximum altitude of 31,860 feet, or six miles above the level of the sea; and if the earth could be seen reduced in scale down to the size of an orange, to all intents and purposes it would look like an almost smooth ball, since even the highest mountains and deepest valleys upon its surface would present to the eye no greater inequalities in outline than the little pimples and hollows on the outside of the skin of an ordinary orange. If this thin crust of the earth can support itself, it is not at all likely to be crushed in by the, comparatively speaking, insignificant weight of our greatest mountain chains; for, in point of fact, it would be quite as unreasonable to maintain such a disposition, as to declare that the shell of a hen's egg would be crushed in by simply laying a piece of a similar egg-shell upon its outside.

That a very thin spheroidal crust, or shell, enclosing a body of liquid matter, such as an ordinary fowl's egg, does possess in itself an enormous degree of stability and power to resist pressure from without, is easily demonstrated by merely loading a small portion of its surface with weights, as long as it does not give way under them. Even when placed on its side (or least strong position), it is found that a portion of the shell, only one quarter of an inch square, will sustain several pounds weight without showing any symptoms of either cracking or crushing; or, in other words, this simple experiment indicates that if the external crust of the earth were but as thick and strong in proportion as an egg-shell, it would be fully capable of sustaining masses, equal in volume and weight to many Himalayas, piled up one atop of another, without any danger whatever to its stability.—*Extract from a Lecture by David Forbes, F. R. S.*

The Revenue of the Patent Office.

For several years past, the funds received at the Patent Office, from inventors, for the transaction of their business, have been, by act of Congress, turned over to the Treasury, and the Patent Office sustained by specific appropriations, yearly made for that purpose. We desire to call attention to the injustice and unfairness of this matter. The Patent Office is not only a self-supporting office, but its revenues are large and flourishing, and steadily increasing. Transferring to the Treasury, the moneys received by this bureau from inventors and other applicants for patents, is raising revenue from a source whence it should not be done; while appropriating from the Treasury to sustain the Patent Office, tends to create the impression that it does not support itself.

The money paid to this office is not a legitimate source of revenue to the Government. It comes from individuals, and is paid into the exchequer of the Patent Office for a specific purpose, that of facilitating the business of these individuals. It is unjust and unfair to divert a cent of it for other purposes. In our opinion, all the moneys received at the Patent Office should be used solely to carry on the business of that office, and to give increased facilities for the transaction of that business.

As the law now stands, we apprehend there is more of delay and obstruction in the dispatch of current work in this office, than there should be. The office is crowded for want of room, and inventors are compelled to wait for months ere their affairs are brought to a final and successful termination. The Commissioner of Patents and his entire force of assistants devote themselves with unusual and most commendable energy and faithfulness to the prompt and speedy performance of their duties, but they find it a matter of impossibility to proceed as fast as they desire, and as rapidly as the necessities of the work demand.

Every application for a patent, or claim for an extension, etc., should be made almost immediately upon its being filed in the Patent Office, thereby assisting inventors and tending to increase the business of the office. If the Commissioner of Patents were empowered to retain and disburse, as the necessities of the office demanded, the moneys received therein, the speedy transaction of business would be insured. And we think Congress should look into this matter, and change the present mode of transferring Patent Office funds to the Treasury. Its revenues should be expended solely upon itself, and should not be diverted to any other purpose whatever.

[We copy the above remarks from the *Republican* (Washington city), and are glad to find that influential journal interesting itself in Patent Office reforms. The suggestions are worthy of consideration.

THE Glue Works, at Peabody, Mass., manufacture 2,260,000 lbs. per annum.

Knapp's Dovetailing Machine.

This machine is called a dovetailing machine, yet, although it makes an admirable substitute for the dovetail joint, the work it performs cannot strictly speaking be called dovetailing. The joint made by it is shown in the details at the bottom of the accompanying engraving. This joint, which is a combination of scollop and dowel work, will, we think, commend itself to all mechanics who examine it, as not only elegant in form and appearance, but strong, durable, and easily put together. It, therefore, matters little what name is applied to it.

The machine which does this beautiful work is extremely neat and compact, only occupying about a square yard of floor room. It receives its power from a belt passing over the tight and loose pulley, A, on the lower shaft, B, on which are a flange pulley, and a twenty-inch pulley, that, in connection with two arbor pulleys, runs a portion of the cutting tools.

On the upper shaft, C, is a pulley, connected by a belt with the flange pulley, and two cams, D and E. The cam, D, moves the tools into and from the stock being worked, while the cam, E, with a pawl attached, plays in a ratchet at the base of the sliding table, F, on which is placed the stock, moving it along to receive the operation of the cutting tools. On this table are placed four pieces of drawer stock, two fronts and two ends, which are securely held in their positions by means of the four compression screws, G G G G. This table carries along the work of two drawers at a time, taking drawers from eighteen inches in depth down; on this table are arranged groove gages, adjustable to the various sizes of drawer.

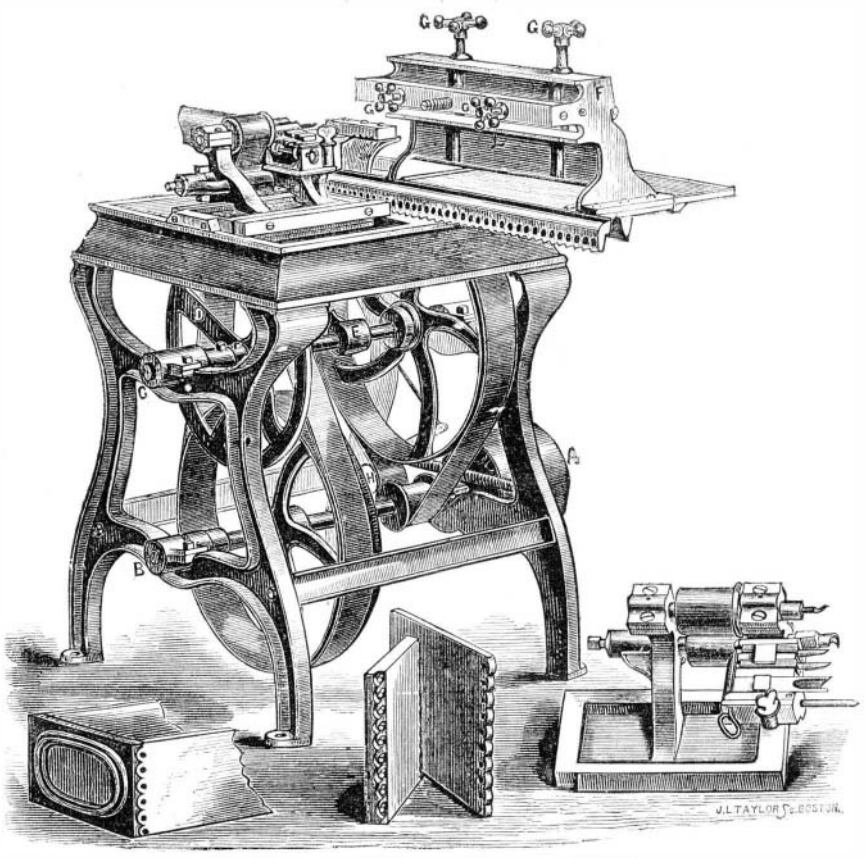
H is a binder pulley, worked by a cam and spring, which operates to stop the movement of the tool carriage, I; this carriage contains on the lower tier, a hollow augur that cuts the spindles on the fronts and backs of drawers, and on the upper tier, four tools to cut the ends, a bit that cuts the holes in the scollops, followed by two V tools and a gouge that form the scollop. The three latter tools are on an adjustable head, which may be thrown back or entirely removed while the pins and holes are being made for the backs of the drawers, or for any other purpose; these knives are retained in position by a thumb screw.

The cam, D, in addition to moving the tool carriage, I, moves a guide pin in and out of the guide holes at the base of the stock table, F. The tools are all adjustable to suit light and heavy work, by a nut at the back of the tool carriage.

All the parts of the machine are made so that they can be reduplicated, in case of any accident or breakage. The countershafts are of tempered cast steel, and the boxes are all chambered and Babbitted.

It is claimed that an ordinary workman can make from 250 to 300 cabinet drawers per day with this machine, with an expenditure of only fifteen minutes per day in keeping the tools in order.

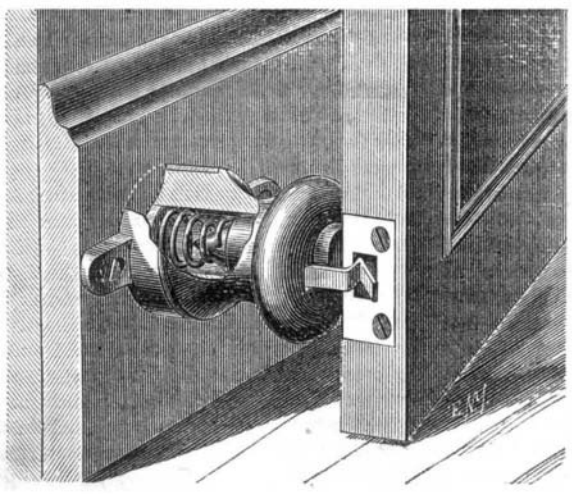
The machine has, we are informed, been introduced into some of the largest and best furniture manufactories in the country, and is giving the best satisfaction, as attested by many certificates shown us. Parties desiring to witness its operation can do so by calling at the furniture factory of J. T. Allen & Co., 48 Elizabeth street, New York. Further information may be obtained by addressing the Knapp Dovetailing Machine Company, Northampton, Mass.



KNAPP'S DOVETAILING MACHINE.

IMPROVED DOOR STOP.

The device herewith illustrated is not open to an objection made to some other elastic door stops, viz., that, when the door strikes the stop, it is thrown back again. In this stop the door is not only stopped without shock, but is caught and held from rebounding.



Its construction will be readily understood on reference to the engraving.

A hollow pillar of wood, or other suitable material, is attached to a metallic foot-plate, screwed to the base board, in such a position that, when the door is swung open, a catch plate, let into the edge of the door, near the bottom, engages with a spring catch which projects from the hollow pillar.

In the hollow of the pillar is a cushion of wood or other suitable material, which rests upon a spiral spring, as shown, a portion of the pillar being broken away to show the arrangement of the interior. This cushion receives the shock, while the catch holds the door from recoiling.

Patented May 31 and December 13, 1870. Address, for further information, Fahrney & Donaldson, Rockford, Ill.

Proposed Revision of the English Patent Laws.

IT appears, at last, that there is hope that the English patent laws are about to undergo wholesome revision. Mr. Hinde Palmer, Queen's counsel, who is reported to be a friend of the working man, has taken the business in hand, and proposes to bring in a new bill, based upon sounder principles. It is expected that Mr. Macfie and Mr. Samuelson, who go for the get-all-for-nothing principle, will do all they can to defeat Mr. Palmer's reforms. The patent system in England ought to be amended, so as to recognize the primary right of the inventor to take the patent, and thus put a stop to the legal stealing of other men's ideas.

JOHNSON'S IMPROVED ADJUSTING PLUMB AND LEVEL.

The quick and accurate adjustment of a plumb and level is something which will appeal to the common sense of every mechanic as a great convenience. The level shown in the engraving has attached to it a provision for leveling which is both extremely simple and accurate.

The spirit glass in the level is set in an iron case, which is connected to the top plate by means of the screws, which pass through a flange at each end into a brass nut below. A spiral spring surrounds each screw, and the adjustment or inclination of the level is secured by contracting or expanding either one by means of the screw.

The level can also be adjusted by means of the long spiral springs, so as to work at an incline of a considerable angle.

The plumb tube is connected with a pivoted arrangement, which enables it to be adjusted by means of a center screw in the face plate, on the edge of the level. Therefore, to adjust plumb, it is necessary to simply turn the center screw to the right or the left, as the case requires.

The action of the center screw on the plumb tube operates to move it radially about the pivot, a very slight movement of the screw being sufficient to perform the adjustment.

The length of the springs enables the user of the instrument to set his own glasses easily and perfectly, while the liability to breakage is decreased.

A point of superiority claimed for this improvement, besides those already mentioned, is, that the iron case slides on screws which are threaded in brass nuts below. This enables the box to move through greater space, and does not strain the thread of either screw or nut; while brass will hold a stronger thread than gray cast iron.

This tool is more especially designed for machinists and other mechanics requiring great accuracy in levels and plumbs. In the old way of setting the glasses in plaster, no matter how perfect the level may be at first, there is a liability to some change by shrinkage in the wood, which impairs the extreme delicacy of the instrument, so that while it is perhaps sufficiently accurate for ordinary kinds of work, it will not do for the leveling of very nice machinery, etc.

Patented Jan. 20, 1868. For further particulars address William Johnson, Hedenberg Works, Newark, N. J.

How to Keep a Situation.

The following bit of good advice is from the *Working Man*, and is worthy the attention of all our readers:—

Lay it down as a foundation rule, that you will be "faithful in that which is least." Pick up the loose nails, bits of twine, clean wrapping paper, and put them in their places. Be ready to throw in an odd half hour or hour's time, when it will be an accommodation, and don't seem to make a merit of it. Do it heartily. Though not a word be said, be sure your employer will make a note it. Make yourself indispensable to him, and he will lose many of the opposite kind before he will part with you.

Those young men who watch the time to see the very second their working hour is up—who leave, no matter what state the work may be in, at precisely the instant—who calculate the extra amount they can slight their work, and yet not get reproved—who are lavish of their employer's goods, will always be the first to receive notice that times are dull, and their services are no longer required.

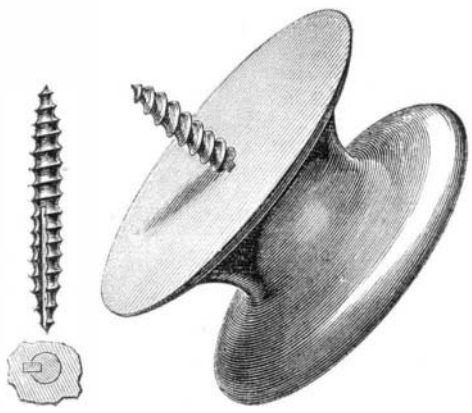
Method of Tinning Copper, Brass, and Iron in the Cold and without Apparatus.

F. Stolba contributes to Dingler's *Polytechnic Journal* the following method, of performing the above processes, which we find condensed in the *American Chemist:* The requisites for accomplishing this object are: 1st. The object to be coated with tin must be entirely free from oxide. It must be carefully cleaned, and care be taken that no grease spots are left; it makes no difference whether the object be cleaned mechanically or chemically. 2d. Zinc powder; the best is that prepared artificially by melting zinc and pouring it into an iron mortar. It can be easily pulverized immediately after solidification; it should be about as fine as writing sand. 3d. A solution of protochloride of tin, containing 5 to 10 per cent, to which as much pulverized cream of tartar must be added as will go on the point of a knife. The object to be tinned is moistened with the tin solution, after which it is rubbed hard with the zinc powder. The tinning appears at once. The tin salt is decomposed by the zinc, metallic tin being deposited. When the object tinned is polished brass or copper, it appears as beautiful as if silvered, and retains its luster for a long time. The author uses this method in his laboratory to preserve his iron, steel, and copper apparatus from rust. This method would become of great importance if the tinning could be made as thick as in the dry way, but this has not as yet been accomplished.

IMPROVED METHOD OF ATTACHING KNOBS TO SCREWS.

Mineral knobs are usually made with screws inserted while the material, of which the knobs are made, is in a plastic state. Wooden knobs, are, however, usually attached to drawers or doors by passing a screw through the drawer or door from the inside into the knob, which is awkward; or by passing the screw through the knob from the outside, which is unsightly. It is obvious that wooden knobs, provided with fixed screws like porcelain knobs, would be much more convenient in use.

This is accomplished in the simple and useful invention illustrated herewith. The screw is made with a gimlet point



at each end, and has a key seat cut in it from the middle to the end which enters the knob. The end having the key seat is then inserted in the knob; and a brad, being driven down into the wood so that it partially enters the wood and fills the key seat, effectually holds the screw, so that it may be screwed into a drawer in the same way as porcelain knobs are now inserted.

The manufacture of the improvement, except the driving of the brads, may be done entirely by machinery, and the inventor has, by this means, undoubtedly opened the way to a much more extended use of wooden knobs than has hitherto been the case. Patented May 5th, 1868. Address, for further information, C. H. Thurston, Marlboro', N. H.