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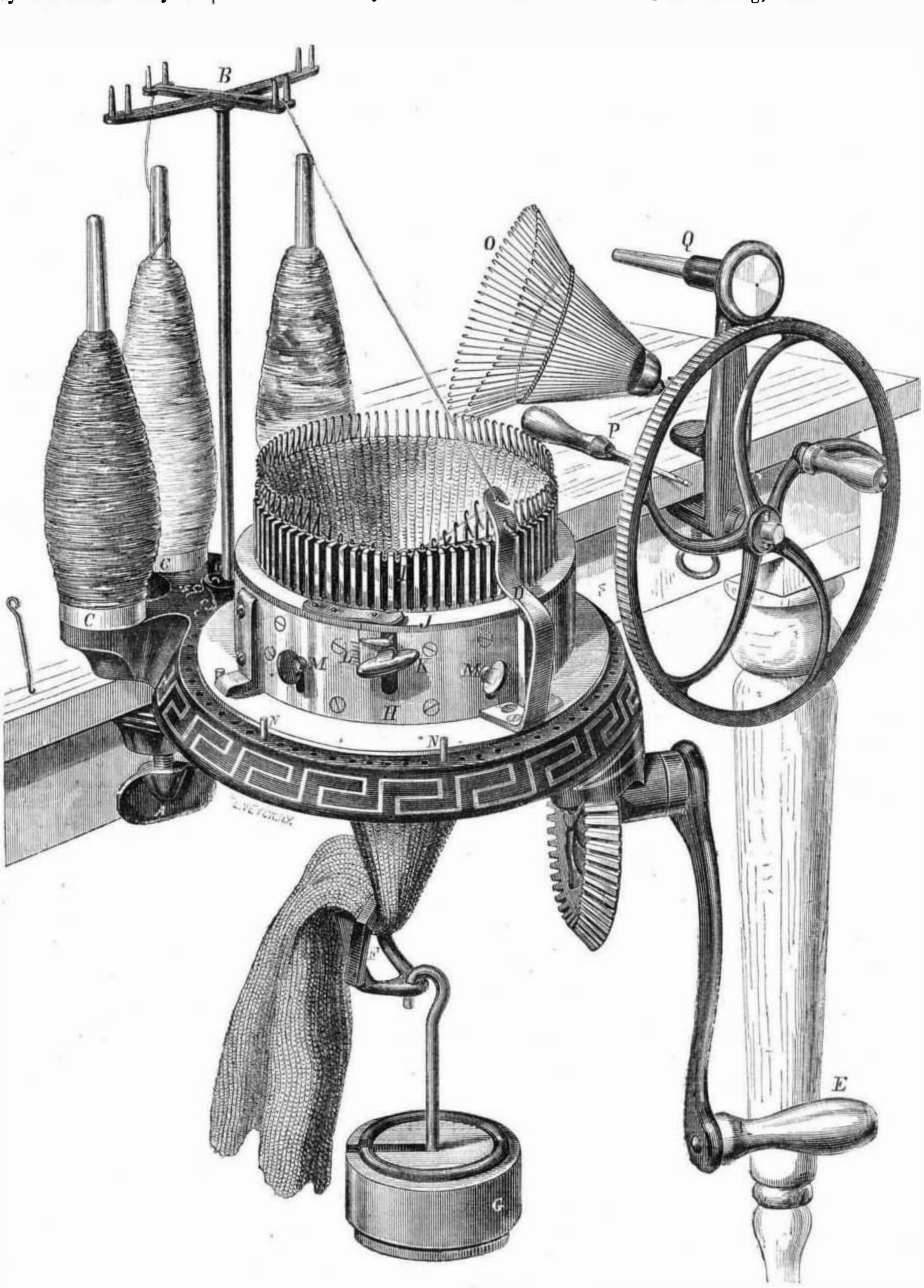
THE BICKFORD FAMILY KNITTING MACHINE.

The machine we this week bring before our readers is one which, in the accomplishment of varied results through the employment of the most simple means, has been rarely equaled. Those who have seen the complicated knitting machines, at work in the large factories, which at present fill the American market with knit goods, have been accustomed to regard them as essentially and necessarily complex. The inventor of this machine has shown, however, that only a few parts are necessary to accomplish a great variety of work, and also that these parts may be of forms easily understood, put together, and operated by those unfamiliar with machinery.

We have taken great pleasure in personally inspecting and operating this machine, and have become convinced that it comprises all that is essential for family use.

It supplies a means of fabricating many articles of usefulness in every household. A great many ornamental kinds of work undertaken for the purpose of filling up leisure hours, but becoming tedious and burdensome before they can be completed by hand, can be begun and finished in an hour or two in such a perfect manner, and with such facility that the delight in making them is not marred through prolonged labor. We can conceive of nothing more fascinating to a tasteful mind than the rapid production of forms of beauty and usefulness effected by this machine.

The merits justly claimed for it are, the variety of work it executes, its non-liability to get out of order by transportation or use; the perfect manner in which it is made; ease in working, and absence of noise in running; the little skill required to operate it; and its capacity to knit anything that the most expert operator can knit or crochet by hand, from a watch cord to a bed blanket. The machine, having no tension, does not wear or tear the yarn to pieces; it can therefore be raveled and knit over and over again.



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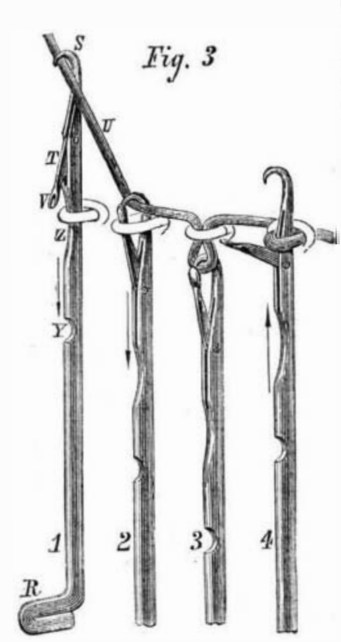

Fig. 3

Referring to the engraving, Fig. 1, it will be seen that the machine, exclusive of needles and the toothed wheel, consists of only sixteen parts, as follows: A, thumbscrew to fasten machine to table; B, yarn stand; C, pins for bobbins; D, yarn carrier, and sliding ring to which carrier is attached; E, machine handle; F, buckle; G, weights; H, revolving cylinder; I, needle cylinder; J, ring clasp; K, cam and screw for changing length of stitch; L, indicator, to show distance moved; M, swing cams and their thumb screws; N, pins for knitting flat web; O, set-up; P, looper.

The three first and the three last enumerated, as well as the buckle, F, and the weight, G, are not moving parts, the latter being only eight in number. To enable the reader to comprehend the action of these parts, we must first explain the stitch taken in the knitting of an ordinary stocking after the ribbed top has been knit, and the work is proceeding in the leg or foot. Fig. 3 represents four of the needles with the yarn looped thereon, as when the machine is at work. The needle employed is shown complete at No. 1. In the other numbers a portion of the lower part is broken away. The needle consists of a body, an angular bent portion or foot, R, a hook, S, and a latch, T. The latter is pivoted to the body of the needle at U, and works partly in a slot formed in the body. The latch has, moreover, a spoon-shaped end, shown at V, which, when the latch is closed as shown in needle No. 2, meets and partly shuts over the point of the hook, S, so that the loop formed on the needle easily slips off when the latter makes its downward movement.

Fig. 2

The needle as thus described is not a new invention; but Mr. Bickford, the inventor of the machine under consideration, has made important improvements in its form, which obviate all the devices hitherto considered necessary to close the latch. One of these improvements is the depression or hollow, shown at Z, Fig. 3. This allows the loop, when passing off the needle, to always pass under the point of the opened latch, so that the latter is closed by the loop itself, avoiding all strain upon the needle, or liability to break from rigid parts getting out of adjustment. The deeper depression, Y, is also another improvement, the use of which will be explained when describing the process of narrowing, further on. Now let the reader suppose one line of stitches already formed on these needles, as shown in the engraving, and the thread of yarn, to be knit, so held that the needle marked 1 will hook over it when the latter descends The thread will be drawn down by the needle until the latch, T meets the loop previously formed This loop, sliding along the body of the needle, lifts the latch and closes it into the position shown in No. 2. The loop then slides off the needle as it continues to descend, and the thread, being drawn down through the former loop, forms a new loop, through which the needle will pass in rising, as shown in No. 4, opening the latch, and leaving the hook free to engage the yarn when the latter is brought under it again, and so on.

Now, it is obvious that if we supply mechanism that will bring the yarn under the hook at the proper moment, and also move the needles up and down successively, and also provide a device for supporting each row of loops till the next row is formed, we shall have a machine that will knit a straight tube.

As soon as the reader understands how this is done, we shall be able to explain how widening and narrowing can be done, and how a variety of stitches can be made, or a flat web knit.

Fig. 2 shows the parts employed for moving the needles up and down. M, in this figure, represents cams. These are screwed on to the inside of the revolving cylinder, H, Fig. 1, their position being directly under the set screws, M. As these cams are carried around by the revolving cylinder, the angular bent part or foot, R (see Fig. 3), of the needle passes through the curved space between the cams, Fig. 2; and as the needles are held from moving sidewise, by being placed in grooves formed in the needle cylinder, I, Fig. 1, they are forced up and down as desired. Each row of loops is also sustained until the next is formed, by means of the needles themselves, as the needle cylinder prevents their bending inward, and keeps them in a vertical position, as shown in Fig. 1.

On the bottom of the revolving cylinder are formed teeth which mesh into a bevel gear turned by the crank, E. The yarn being wound upon a bobbin, is placed on one of the pins, C. It is passed over the yarn stand, B, and thence through a hook in the top of a bent bar, D, called the "carrier." This carrier is fastened to the revolving cylinder, H, which carries the cams, and travels with it, carrying the yarn, and holding it in just the right position to be caught by the hook of each needle as the latter is depressed by the action of the cams.

We have now all the conditions established for knitting a straight tube. If we attach the buckle, F, and hang on the weights, we have but to turn the crank to cause the machine to knit continuously.

The crank may be turned either way, but as the carrier in the position shown will not hold the thread in advance of the cams when the motion is reversed, the needles will descend before the thread is brought under them. The position of the carrier must therefore be so changed as to move in advance of the descending needles. This is effected as follows: The carrier, D, is attached at its base to a sliding flat ring, which moves about the cylinder, H, its motion being limited by stops to a little more than enough to pass the cams, and take its proper position to lead the thread in advance of the needles. If it be desired to knit backwards and forwards, the pins, N, are inserted in the holes of the fixed base of the machine, as shown in Fig. 1. The heel of the carrier striking against one of these pins, is held from further motion, but the cylinder, H, will still move onward till the carrier is shifted to the other stop, when the cylinder, H, also is held from moving any further in that direction. Its motion may, however, be reversed till the carrier reaches the other pin, and is again shifted. Then the crank must be turned in the opposite direction again, and so by this arrangement, the cylinder, H, is made to move backwards and forwards to any desired distance, as regulated by the pins, and as the knitting proceeds, a flat web is knit with a perfect selvedge on each side.

Such a web may be knit from the outset, or in connection with the tube, as in forming the heel or the toe of a stocking. Let the reader suppose the leg of a stocking to have been narrowed (by a process hereafter to be described) down to the heel, and that it is required to knit a straight flat section, to be subsequently joined on to the beginning of the foot. The pins would then be set to limit the motion to the extent required to knit the flat strip desired. This strip can be closed on to the previous web by hand afterwards, or it can be knit on by slipping the loops of the selvedges over the other needles, previous to knitting all around again for the foot. This is not the exact process of knitting a heel—which is done in two ways hereafter to be described—but it illustrates the principle. Having thus seen how a straight tube or a flat web may be knit, we will now show how the work is set up, how various stitches may be performed, and how narrowing and widening are effected.

In setting up the work, the "set-up," O, and the looper, P are used. A length of thread is run off the bobbin, sufficient to form the first set of loops, the same as in setting up work on hand needles. This thread is put through an eye in the point of the looper. The "set-up" is taken in the left hand, put up and held in the cylinder, so that its hooks are nearly on a level with the tops of the needles. The looper is then passed about the hooks of the set-up and the tops of the needles, carrying the thread with it, and forming a series of loops, like those shown in the lower series, in Fig. 3. As soon as the needles are filled, the machine is given one turn, which completes the first set of stitches. The set-up is then drawn down, and the knitting proceeds until a length sufficient for the attachment of the buckle and weights is attained, when the latter are substituted for it, as shown in Fig. 1.

The stitches are made longer or shorter, so as to knit open or close, by the regulation of the upward and downward motion of the needles. This is done by the raising or lowering of the movable cam, K, Fig. 2. When this cam is raised, the stitches are made shorter, as the needles are not then drawn so far down into the grooves of the needle cylinder, and the loops do not then contain so much yarn as when the cam is set lower. This setting of the cam is done by the middle thumb-screw, K, Fig. 1, an indicator point, L, moving over a scale showing the proper degree of shortening or lengthening of the stitches.

In knitting flat webs, both the adjustable cams, M, Fig. 2, must be in the position shown. If they are both down, the machine will not knit either a cylindrical or a flat web, as there is nothing to raise the needles high enough to release the latches. In this position, the work cannot be run off, should the machine be turned in either direction. This may be done while setting up the work, or when it is left unfinished, as a security against accidental turning.

The needles are taken out, or inserted, by first removing the jointed ring clasp, J. This is provided with a rule joint and a spring catch, so that it can be removed or replaced in a moment of time. When it is taken off, the needles can be drawn up out of the needle cylinder. When they are inserted, they must be put in with the foot, R, Fig. 2, pointing outward. This must be borne in mind in reading the following method of knitting a stocking:

If the stocking is to be seamed at the top, every third or fourth needle is first taken out, as described above. The work is then set up, and the knitting proceeds three or four inches. Then the needles taken out are inserted, and three or four inches are knit plain. The stitch may be made loose over the calf of the leg, and gradually tightened to the ankle, shaping it nicely; or it may be narrowed down to the size desired by taking out needles. This is done by first taking out one exactly in front, putting the stitch over the next needle, and then knitting round six or seven times. Then the third needles on both sides of the one first taken out are removed. Then knit round six or seven times again, and take out two more; and so continue to knit and take out needles till the leg is narrowed to the size desired. The work is then ready for the heel. For a common sock, thirteen or fifteen needles will usually need to be taken out; the number of times knitting between the needles taken out may be determined by the length of the leg, which is about one hundred times round for a common sock.

In knitting a stocking or sock, either a square or round heel may be formed. The square heel is knit as follows:

After knitting the leg long enough, the machine is stopped with the carrier, D. at the back side. The needles in front or toward the operator, are then pulled up, being half of the entire number in the cylinder. These may be called the instep needles. They are drawn up till each loop passes into the notch, Y, Fig. 3, which holds them so that they will pass over the cams without knitting for the instep. Then the pins, N, are inserted on each side opposite the fourth needle of those drawn up. The object of the holes in the base of the machine is, as already explained, to insert the pins for the purpose of gaging the width of work knit; for example, in using thirty-six needles for knitting the heel, these pins are inserted far enough beyond the number of needles used to form each stitch perfectly on either side of the web. After the carrier, D, strikes the pins, the machine is turned until the sliding ring the carrier is attached to comes to a full stop. This places the carrier opposite the other cam in a position to knit the other way. The knitting is continued backwards and forwards until the heel is long enough, being thirty-six times for a common sock. Then the heel is run off and closed up; and, taking up the loose loops on the selvedge of the heel on the needles the heel was on, and pushing the instep needles down in place, we proceed to knit the foot the length required, being seventy times round for a common sock.

In knitting a round heel, one half the needles are put up, and the pins are placed as described for the flat heel. Then the machine is turned as far to the left as it will go, then back to the right, when the first needle on the left, next to those already drawn up, is raised; then to the left, pulling up the first needle on the right, next to those already drawn up; and so knitting across and pulling up needles, first on one side and then on the other, until one third of the needles are left down. Now, having narrowed the heel, we commence and widen out to the same size started from; to do this we knit across once, then push down the last needle raised up; knit across again and push down the last one raised up, on the other side; so continuing until all the heel needles are down. Then the instep needles are pushed down, and the foot is knit. There are also other modes of narrowing, which we have not space to describe.

The toe can be knit in the same manner as the heel; after it has been narrowed and widened, it is run off and the end loops are closed together. Or, one half of the needles can be raised, and one third narrowed on each side as before; the other half pushed down and narrowed in the same manner; then the whole is run off, and the open loops of the twe sides closed together. Either way is good, but the latter is preferable. To knit double heels and toes, two threads are used. Old heels and toes are quickly and nicely mended by knitting new ones on. The minute description of this process may give an impression that the manipulation is complicated. This is not the case, however; a single sitting of half an hour will enable any one of ordinary intelligence to knit a stocking perfectly.

The example given of the knitting of an entire stocking is sufficient, in connection with this description of the parts of the machine, to give an idea of its principle and operation. It fails, however, to give any adequate idea of its scope and capacity to perform a variety of work. Our space forbids a detailed exposition of the manipulations through which the various styles of stitches are effected, and we will content ourselves with an enumeration of some of them.

Children's socks, flat webs, seamed back and gored foot stockings, mittens, Balmoral work, ruching or tufted work, fringes, cords, scarfs, affghans, blankets and spreads, are some of the many articles which can be wrought in a beautiful and substantial manner with ease and rapidity. Among the stitches we may name the "diamond," "spiral," "zig-zag," "herringbone," "pineapple," and "honeycomb" stitches, all of which produce very fine ornamental effects, but which do not by any means exhaust the capabilities of the machine.

Different cylinders are supplied, containing different numbers of needles for coarse and fine work. Extra needles and pins are also furnished. A bobbin winder, Q, Fig. 1, also goes with the machine.

The machine is covered by seven patents, bearing dates from September 10, 1867, to July 6, 1869, and further applications are pending. Address for further information, or books of instruction and explanation, Dana Bickford, Vice-president and general agent, 689 Broadway, New York city.

A Barometer without Mercury.

Professor A. Heller, of Ofen, gives in Poggendorff's *Annalen* the description of an apparatus for determining the pressure of the atmosphere.

The apparatus consists of a scale beam, to the ends of which are screwed two bodies nearly equal in weight but greatly differing in volume,—a hollow sphere and a solid cylinder. On one end of the beam is a mirror which is approximately at right angles to the axis of the beam. At some distance from the apparatus is a telescope with a vertical scale, the image of which in the mirror is observed by means of a telescope. It is clear that when there is any change in the expansion of the air in the vicinity of the apparatus, the beam will indicate varying angles with the horizon, which angles may easily be read off in the mirror by means of the telescope.

The variations of the scale beam in consequence of alterations in the pressure will not amount to much, if the dimensions of the apparatus are moderate; but the use of Poggendorff and Gauss's method of reading affords such a degree of accuracy that, as a brief calculation shows, under assumptions which are easily realized, the changes in the position of the beam can be measured with far greater certainty and accuracy than the hight of the mercurial column in the ordinary barometer, provided the whole construction is light, and that its center of gravity is at a short distance from the knife edge of the beam.

Causes of Summer Diseases.

The *Journal of Health* for June, under a different heading, states the following facts concerning the causes of disease:

The mistletoe bough, like the Spanish moss, which drapes the trees of Southern swamps in such sad funereal garb, is a growth outside of the natural condition of the tree; it is a parasite, a fungus; a very low form of life, exceedingly slow in development in some cases, in others so inconceivably rapid as to be reproduced in millions in a few hours, as in the toadstool and mushroom. The common yeast, with which we make our bread, is a mass of living things, a dozen of them generating myriads more in a night. These fungi, sporules, or germs, are not only the pests of living plants, eating out the entire life in the course of time, but they infest animals and man, carrying with them, sometimes, the most dreadful deaths. The mushroom, the morel, and the truffle, among the greatest delicacies of the table with some, are fungi. In some cases they kill, or cause disease, or poison. Ergot, blight, mildew, rust, brand, dry rot, are all the diseased results of fungous growth.

There are similar growths or products in the animal world, called "cell" life. Vegetables come from seed, animals from eggs by cell development, and these cells or eggs are as amazing in their fecundity as fungous growth. A man swallows a few mouthfuls of raw pork in which are a few trichinæ. In a very few days, living things are found burrowing in the fles by millions, causing the most agonizing pains and a dreadful death.

Between the effects of fungi and cell products, the vegetable germ and the animal egg, men perish in millions every year. Asiatic cholera seems to be, by the latest researches, the product of a thing of life, but whether vegetable or animal admits of question thus far.

Whooping cough is apparently of vegetable growth; for when the expectoration of a child suffering from it is examined, it is crowded with germs; on one occasion a small amount of it was introduced into the windpipe of a healthy young rabbit; in a few days it had a troublesome cough, and on examination a countless number of these same germs were found all along the throat, windpipe, and lungs.

Plague and pestilence, and all those diseases, called epidemic, which suddenly fall upon a whole community, such as fever and ague, chill and fever, bilious fever, yellow fever, diarrhœa, and dysentery, are caused by marsh miasm.

In the worst time of yellow fever and cholera in New Orleans, the evening and the morning air was so cool and delicious and balmy that many a time we have breathed it by the hour in perfect delight; and yet the resident knew that it was but the sure intimation that the disease would be more fearful in a day or two. But if this air be bottled and taken a thousand miles away, put into a close room where a healthy man is sleeping, he will have the ordinary symptoms of chill and fever in a day or two, and myriads of these pestiferous things will be found about his tongue, his throat and windpipe, and his lungs and stomach.

The newspapers announced recently that the Asiatic cholera had made its appearance in India; its progress has been always westward along the most prominent lines of travel, until it reaches America, crosses to the coast of California, and is lost in the boundless Pacific.

Thomas' Process for Preserving Wood.

In a previous number of our paper, we gave an account of this process, which consists, substantially, in treating the wood with oil of resin, applied either hot or cold. The New Orleans *Times*, in a recent notice, speaks very highly of the improvement, and remarks as follows:

"We look upon this as the great discovery of the present age, something that has long been sought after, particularly by ship builders and wharf builders. It is particularly valuable because it is cheap, plentiful, and easily applied. By using this process the timbers or bottoms of all ships or vessels going into warm climates will be thoroughly protected without the great expense of coppering them, their bottoms will not only be protected from salt water worms, but also from decay, as when timber is once prepared the material never evaporates nor passes off or out of the wood, but remains permanently as a part and parcel of the wood, excluding both air and water. Crossties for railroads can be prepared at a cost of about five and a half cents each, all that is necessary is to take off the bark. Other timbers can be prepared in this ratio: all fence posts and telegraph posts should be prepared before putting in the ground; also, the sills of houses. It is particularly good for paving purposes and for building bridges." The patentee's address is N. H. Thomas, 32 Carondelet St., New Orleans, La.

A New Danger to Ocean Cables

A recent announcement of the Superintendent of the International Telegraph Company between Punta Rosa and Key West, has placed a new item upon he list of dangers to which ocean cables may be subjected.

The cable in question had, during the past year, been so frequently injured or broken, that a careful examination was decided upon, the result of which was to the effect that the damage was to be ascribed to the loggerhead turtles, which are abundant in those waters. In many places, the cable presented the appearance of having been bitten through; and in others of having been crushed from both sides until it had become so much flattened as to destroy its conductivity. The conclusion of Colonel Heiss, the superintendent, is further confirmed by the fact that at the depths where the breaks and injuries occur, there the loggerheads most abound. The Company has sent an order for a much larger and stronger cable, and when it is laid, the assailants will have something more substantial than the present steel-wound cable, upon which to whet their teeth.