and the color. The light or figure is then softened by drawing the end of a flat hog-hair fitch, or a small thin mottler, across each figure, and slightly softening with the badger-hair softener. The figure is broken up a little with fine lines across it in parts, such as may be seen in the real wood; but previous to wiping out, the figure, streaks of light should be wiped out and softened on one side of the panel or across the stiles, in imitation of the reflective lights seen in oak. The color should also be partially wiped off the rails or stiles at their junction; this tends to define the joint. The color is is now let to dry hard, when it will be ready for over-combing—that is, combing or graining over the figure (hence its name), and this will have to be done somewhat differently to the ordinary combing. As thus: The color is rubbed in as before, and combed solely with the gutta-percha combs, but these are specially cut for the purpose; they are best about 2 in. wide. The first must be cut with teeth about three-sixteenths of an inch in width, the next one-eighth, and the third about one-sixteenth. The broad-toothed comb is first used, and must be drawn down the panel, with a wavy motion, in short or long curls; either will answer our purpose now. The next size of comb is then drawn straig it down—the straighter the better. This has the effect of breaking the wavy combing into short and long straight bits, similar to the pores or grain of the real wood. Both the first and second combing may be varied by holding the comb in a slanting direction, and may be fine or coarse, according to the width of the combs used; now take a soft rag folded, and with this partially clear off the grain which runs over the figure, leaving only a sufficient quantity crossing the light or figure, to be just distinguished, exactly as it appears upon the figure in real oak. The grain is also wiped off in parts on the plain spaces between the figure, in order to break it up and take away any formality. If this method be well and probably done, a thoroughly deceptive imitation may be produced; and except this end be kept in view, no really good work will result.

## KNOTS AND SPLICES.

[*See Engraving on First Page.*]

1. Turn used in making up ropes.

2. End tapered for the purpose of passing it readily thro gh a loop. To make this, we unlay the rope for the necessary length, reducing a rope diminishing in diameter towards the end, which is finished by interlacing the ends without cutting them, as it would weaken the work; it is lastly "whipped" with small twine.

3. Tapered end, covered with interlaced cordage for the purpose of making it stronger. This is done with very small twine attached at one end to the small eye, and at the other to the strands of the rope, thus making a strong "webbing" around the end.

4. Double turn used for making rope.

5. Eye splice. The strands of the cable are brought back over themselves, and interlaced with their original turns, as in a splice.

6. Tie for the end of a four-strand rope.

7. The same completed; the strands are tied together, forming loops, laying one over the other.

8. Commencement for making the end by interlacing the strands

9. Interlacing complete, but not fastened.

10 and 11. Shell in two views used in No. 65, showing the disposition of it at the throat. This joining is advantageous, as it does not strain the cords, and it prevents them from cutting each other; so that the rings pass one into the other, and are joined outside the intermediate shell.

12. Interlacing in two directions.

13. Mode of finishing the end by several turns of the twine continued over the cable.

14. Interlacing commenced, in one direction.

15. Interlacing finished, the ends being worked under the strands, as in a splice.

16. Pigtail commenced.

17. Interlacing fastened.

18. Pigtail with the strands taut.

19. Dead eye, shown in two views.

20. Pigtail finished. We pass the ends of the strands, one under the other, in the same way as if we were making a pudding splice: thus bringing it in a line with the rope, to which it is seized fast, and the ends cut off.

21. Scull pigtail; instead of holding the ends by a tie, we interlace them again, as in No. 16, the one under the other.

22. Pigtail, or "lark's nest." We make this to the "pennant" of a cable, which has several strands, by taking the requisite number of turns over the pudding, in such a manner that the strands shall lay under each other. This "pigtail" forms a knot at the end of the rope. It thus draws together two ropes, as shown in No. 32, forming a "shroud" knot. In these two pigtails, the strands are crossed before finishing the ends, so that the button, *a*, is made with the strands, *a*, and, *b*, with those of the rope, *b*.

23. Slip clinch to sailors' knot.

24. Slip clinch, secured.

25. Ordinary knot upon a double rope.

26. Bowline knot for a man to sit in at his work.

27. Called a "short splice," as it is not of great length, and, besides, can be made quickly.

30. Long splice. This extends from *a* to *b*. We unlay the strands of each of the ropes we intend to join, for about half the length that the splice will be, putting each strand of the one between two strands of the other.

31. Simple fastening on a rope.

32. A "shroud" knot.

33. The ends of the rope are prepared for making the splice (No. 29) in the same manner as for the "shroud" knot in No. 32. When the strands are untwisted, we put the ends of two cords together as close as possible, and place the ends of the one between the strands of the other, above and below alternately, so as to interlace them as in No. 29. This splice is not, however, very strong, and is only used when there is not time to make a long splice, which is much the best.

34 and 35. Marline spikes. Tools made of wood or iron, used to open out a rope to pass the strands of another through it.

36. Shows strands arranged as described in No. 30.

37. Fastening when a lever is used, and is employed when hauling upon large ropes, where the strength of several men are necessary.

38. A "pudding splice." This is commenced, like the others, by placing the rope end to end, the turns of the one being passed between those of the other; having first swelled out the yarns by a "rat's-tail," we put them, two by two, one over the other, twisting them tightly, and opening a way for them with the marlinspike. The inconvenience of this splice is, that it is larger in diameter than the rope itself; but when made sufficiently long, by gradually reducing the size of the strands, it has great strength.

39. This shows two strands, *a* and *b*, of the ropes, A B, knotted together, being drawn as tight as possible; we unlay the strand, *a'*, of the rope, A, for half the length of the splice, and twist the strand, *b'*, of the rope, B, strongly in its place, tying *a'* and *b'* together tightly. The same process is again gone through on the rope, B, the strand, *a''*, of the rope, A, being knotted to the strand, *b''*, of the rope, B. When all the strands are thus knotted together, we interlace them with the strands of the cable. Thus the strands, *a a' a''*, are interlocked by being passed alternately above and below the turns of the cord, B, the ends being also sometimes "whipped." In the same manner the strands, *b b' b''*, pass alternately over and under the strands of the rope, A, and are in like manner "whipped." It is important that the several inte lacings and knots should not meet at one point; we reduce the size of the strands towards the end, so that they loose themselves in the body of the splice, cutting off such parts as may project. This splice is employed for joining the ends of a rope when a chafed part has been cut out, and is quite as strong as the rope itself.

40. Belaying-pin opened to serve as a button; these are used where it is necessary to stop or check velocity.

41. Chain knot, or fastening.

42. Variable or regulating lashing. By laying the piece, *a f*, horizontally, it can be slipped along the rope, *b*; by raising or lowering this, we shall raise or depress the weight, *c*, the cord, *b*, running over the two pulleys, *d*, from the piece, *a f*, in the direction shown in the figure. The friction of the cord, *b*, passing through the hole, *e*, sufficiently fixed the piece, *a f*, and holds the weight, *c*, securely.

43. Cleet, with three ties.

44. Cleet, showing the mode of belaying the cord.

45. The piece, *a f*, of No. 42.

46. Fair leader.

47. Cleet to be fixed to a stay.

48. Loop for slipping other lines.

49. A "bend" which is only used for fear of the stoppers snapping.

50. Bastard loop, made on the end of the rope, and whipped with yarns.

51. Tie to pins: *a*, the pin; *b*, small cords fixed by a cross tie.

52. Cleet, fixed to the "rail," either with screws or nails, to which the lines are belayed.

53. Waterman's knot.

54. Fair leader.

55. Tie, or l end to pier.

56. Simple fastening to tie.

57. Fastening by a loop. This can be tied or untied without loosening the loop itself. It is made by following, towards the longer loop, the direction as numbered 1, 2, 3, 4, 5, and is terminated by the loop, 6, 7, 6, finally passing it over the head of the post, A. This knot holds itself, the turns being in opposite directions. To unite it, we slack the turns of the cable sufficiently to again pass the loop, 6, 7, 6, over the post, A, and turn the ends in the contrary direction to that in which they were made (as 5, 4, 3, 2, 1).

58. Iron "shell," in two views.

59 and 60. "Wedding" knots; *a b*, eyelets; *c d*, the join; *e*, the fastening.

61. Lark's-head fastening to running knot.

62. A round turn; the cord, *a*, is passed through the bight of the cord, *b*, over the button, *c*, where it is secured by an ordinary knot.

63. Belaying-pin splice. The cord, *b*, "stops" the pin, *e*, its end being spliced upon itself, and "served" with yarn; this rope, with its pin, is passed through the spliced eye, *f* of the line, *g*.

64. Round button.

65. Joint by a spherical shell, each loop, *a* and *b*, being made by ties and splices, and surrounding the shell, *c*.

66. Belaying-pin, shown separately, before being stoppered.

67. Fastening to shears.

68. Square mooring. When the cable is round the post, A, and the piece, *c*, without being crossed, it lays in the section 1, 2, 3, 4, 5, 6, 7, and the end is fastened by tying.

69. Wooden shell in section.

70. Crossed fastening. The turns of the cable, passing in front of the post, B, are crossed at the back of C, in the direction 1, 2, 3, 4, 5, 6, 7, 8, the end, 8, being secured to the cable.

71. Wooden shell.

72. Double-chain fastening.

73. Lashing for "ram" block, or "dead-eye." The ram blocks, *a* and *b*, are strapped by the cords, *e*, which hold them; the small lanyards, *d*, pass through the holes to make the connection, and as they are tightened give the requisite tension to the cordage; the ends are fastened to the main rope. Usually one of these dead-eyes is held by an iron strap to the point where it is required to fix and strain the cordage, which is ordinarily a shroud.

74. Chain fastening.

1'. Simple band, showing the upper side.

2'. The same, showing the under side and the knot.

3'. Tie, with crossed ends, commenced; a turn is taken under the strands, to hold the ends of the cord.

4'. The same, completed.

5'. Bend with crossed strands, commenced, the one end being looped over the other.

6'. The same, completed.

7'. Necklace tie, seen on the upper side.

8'. The same, seen underneath. The greater the strain on the cords, the tighter the knot becomes.

9' and 10' are similar splices to 7' and 8' with slight modifications.

11' shows the commencement of 13', the legs in elevation; 12' being a front view. An ordinary band, made by several turns of a small rope, is lapped round them and hauled taut, and then interlaced at the ends. This done, the legs are shifted into the shape of a St. Andrew's cross. Thus the lashing is tightened, and, for further security, we pass the line several times over the tie and between the spars, knotting the ends.

13'. Portuguese knot. This is a lashing for shear legs and must be tight enough to prevent the spars slipping on each other; the crossing of the two legs gives a means of securing the knot.

14'. For binding timbers; *a*, knot commenced. Take several turns round the timbers, and fasten the ends by passing them under the turns; *b*, knot completed. The end of a round stick, *m n*, termed a packing stick, should be passed under the knob, the cord being slack enough to allow of this. By turning the stick, the turns can be tightened to any extent; when tight, we fasten the longer arm of the lever to some fixed point, by a rope, *p q*, so that it cannot fly back. Care must be taken not to turn the stick too far, or the rope may be broken. As the timber dries and shrinks, the lever may be used to make all taut again.

## The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in January, 1871:

During the month, there were 522 visits of inspection made, and 1,030 boilers examined—853 externally and 363 internally, while 106 have been tested by hydraulic pressure Number of defects in all discovered, 431, of which 163 were regarded as dangerous. These defects were as follows: Furnaces out of shape, 24—3 dangerous; fractures, 47—25 dangerous; burned plates, 29—14 dangerous; blistered plates, 54—10 dangerous; cases of sediment and deposit, 97—18 dangerous; cases of incrustation and scale, 70—24 dangerous. To show how little attention is paid to the internal condition of boilers by incompetent engineers, we copy the following from a letter of one of our inspectors:

"In one tubular boiler I found sediment in the back end, eight inches deep, and extending forward more than four feet. It seemed to be an accumulation of fine scale cemented together, so that it was necessary to break it up with a hammer and chisel before it could be removed. The engineer said *he had cleaned the boilers only three days before*, and objected to my making another examination. This is one of the many cases we find, where the proprietor trusts everything about his boilers to his engineer, supposing him to be reliable."

With such accumulation of sediment and deposit, is it any wonder that sheets are burned? A careful engineer will understand, if the feed water be impure, that he must blow down two or three inches every day, or oftener, that the sediment may be removed as it accumulates, and then an internal examination once in two weeks, or once a month, will insure a clean boiler.

Cases of external corrosion, 26—10 dangerous; cases of internal corrosion, 17—5 dangerous; cases of internal grooving, 28—11 dangerous; water gages out of order, 50; blow-out apparatus out of order, 15—7 dangerous; safety valves overloaded, 40—12 dangerous; pressure gages out of order, 54—6 dangerous, varying from —15 to +8 pounds. (We have found several gages entirely ruined from being frozen). Boilers without gages, 4; cases of deficiency of water, 5—1 dangerous; broken braces and stays, 31—7 dangerous; boilers condemned, 2—both dangerous.

Two engineers were found drunk on duty, and promptly discharged. There were 9 serious explosions during the month, by which 99 persons were killed, and 6 wounded. Eighty-seven of the killed were passengers on the ill-fated steamer *H. R. Arthur*, on the Mississippi River. Many were drowned, and some burned, but the origin of the calamity was the bad quality of the boilers, which a careless manage ment was unable to detect. The upper and fore part of the boat was blown away by the exploded boilers, and, to add to the horror, what remained took fire.

None of these exploded boilers were under the care of this company.

FIVE ore-roasting furnaces are in full blast in Nevada

### Improved Compound Spiral Car Spring for Railway Carriages.

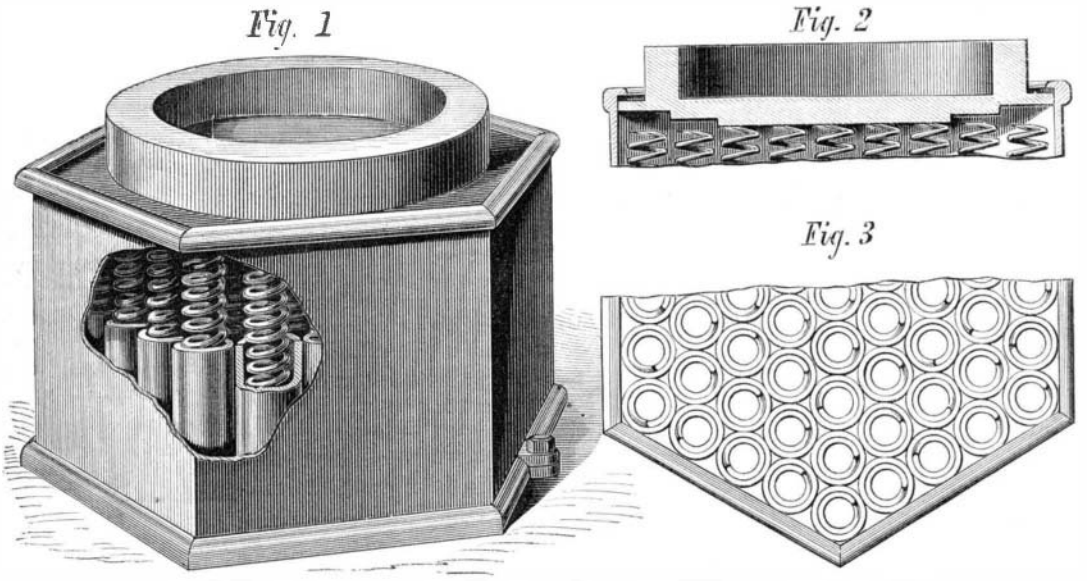
Our engravings illustrate an improved compound car-spring, which appears to possess all the requisites of a first-class spring, combining in its construction extreme simplicity with great strength, and a feature whereby the power of the spring increases with increase of the load, and *vice versâ*, so that its flexibility remains nearly constant for all loads.

Fig. 1 is a perspective view of this spring, with a portion of the side of the case broken out to show the interior arrangement of the spiral springs. Fig. 2 is a section of the compressing plate. Fig. 3 is a plan view, showing the arrangement of the tubes which enclose the springs.

The case is cast in two pieces. Its vertical wall is cast in a single piece, and has at the top a flange or bead extending inwardly, against which the compressing plate abuts when the spring is not compressed, as shown in Fig. 2. A bottom plate completes the case.

The spiral components of the spring are inclosed in tubes, as shown in Figs. 1 and 3. It is not deemed essential that these tubes should be seamless, or that their edges, brought together in bending, should be soldered, brazed, or welded. They act merely as guides to compel the component springs to expand or contract in vertical lines, and need only be strong enough for that purpose.

The compressing plate is formed with concentric steps or ledges, as shown in Fig. 2, so that with light loads, only a portion of the component spirals act. With a heavier load a new series of spirals is brought into action, and so on, till the spring is loaded to its full capacity. This feature is novel, and as important as novel, as it gives the spring a far more easy and flexible carriage, with light loads, than would be the case if all the spirals were permitted to act.



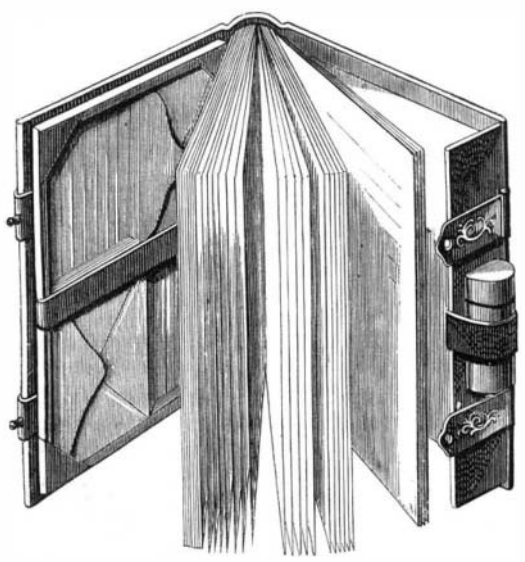

POTT'S' SPIRAL CAR SPRING FOR RAILWAY CARRIAGES.

In putting the spring together, the vertical part of the case is inverted. The compressing plate is then placed within the case, resting upon the inner flange of the case above described. The tubes with their inclosed springs are then arranged in position, as shown in the plan view, Fig. 3. The bottom plate of the case is then placed in position, and held to its place by lugs and rivets, as shown in Fig. 1; the spring is then ready for use.

The employment of tubes in the manner described, enables springs of the greatest practical length to be used, without the sectional or division plates met with in other spiral car springs. A greater and easier movement is therefore obtained. These springs can, it is claimed, compete in price with any spring in market, and are guaranteed by the manufacturers. Patented through the Scientific American Patent Agency, December 27, 1870, by Albert Potts, whom address for further information, No. 490 North Third street, Philadelphia, Pa.

### PORTABLE WRITING AND COPYING CASE.

This device is the invention of A. G. Buzby, of Philadelphia, Pa. It is a combined writing and copying case. Besides the usual recesses or chambers for pen, ink, paper, etc., it is provided with a book of copying paper, in which copies



of important letters may be made, by damping the letters in the usual way, and pressing them between the leaves of the copying book; or the transfer paper may be used, so that the letter will be copied as it is written, if preferred.

### How Walking Sticks are made.

Sticks are manufactured both from large timber of from two to six feet girth, and from small underwood of about the thickness of a man's thumb. The timber, which is chiefly beech, is first sawed into battens of about three feet in length and as many inches in width; and from each of these battens two square sticks, with square heads are afterwards cut in opposite directions, so that the middle portion is waste wood. The corners of each are afterwards rounded off by a planing process called "trapping," and the square head is reduced, by a small saw, to a curve or rectangular bend, so as to form a handle. When the sticks are brought in this way to the exact size and pattern, they are polished with great care, are finely varnished, and packed in boxes or bundles for the market. Many sawn sticks, however, are supplied with bone and horn handles, which are fastened on with glue; and then of course there is less wood waste, as a larger number of them may be cut from one batten.

A very different process takes place in the manufacture of sticks from small underwood, in which there is no sawing required. The rough unfashioned sticks, which are generally of hazel, ash, oak and thorn, are cut with a bill in the same way as kidney bean sticks, and are brought to the factory in large bavins or bundles, piled on a timber tug. There must of course, be some little care in their selection, yet it is evident that the woodmen are not very particular on this score, for they have in general an ungainly appearance; and many are so crooked and rough, that no drover or country boy would think it worth while to polish the like of them with his knife. Having arrived at this place, however, their numerous excrescences are soon pruned away, and their ugliness converted into elegance. When sufficiently seasoned and fit for working, they are first laid to soak in wet sand, and rendered more tough and pliable; a workman then takes them one by one, and securing them with an iron stock, bends them skillfully this way and that, so as to bring out their natural crooks, and render them at last all straight even rods. If they are not required to be knotted, they next go to the "trapper," who puts them through a kind of circular plane, which takes off knots, and renders them uniformly smooth and round. The most important process of all is that of giving them their elegantly curved handles, for which purpose they are passed over to the "crooker." Every child knows that if we bend a tough stick moderately when the pressure is discontinued, it will soon fly back, more or less, to its former position; and if we bend it very much, it will break. Now the crooker professes to accomplish the miracle of bending a stick as it might be an iron wire, so that it shall neither break nor "backen." To prevent the breaking, the wood is rendered pliant by further soaking in wet sand; and a flexible band of metal is clamped down firmly to that portion of the stick that will form the outside of the curve; the top end is then fitted into a grooved iron shoulder which determines the size of the crook, the other end being brought round so as to point in the opposite direction; the metal band during this process binding with increasing tightness against the stretching fibers of the wood, so that they cannot snap or give way under the strain. The crook having been made, the next thing is to fix it, or remove from the fibers the reaction of elasticity, which would otherwise, on the cessation of the bending force, cause it to backen more or less, and undo the work. In the old process of crooking by steam, as timber bending is effected, the stick was merely left till it was cold to acquire a permanent set; but in the new process, a more permanent set is given by turning the handle about briskly over a jet of gas. The sticks being now fashioned, it only remains to polish and stain or varnish them; and they are sometimes scorched or burned brown, and carved with foliage, animal heads and other devices.—*Chambers' Journal.*

FLOWERING OF THE VICTORIA REGIA IN THE OPEN AIR.—Joseph Mager, Esq., has succeeded in flowering the Victoria lily, in his pond in England. The pond is perfectly open, but the water is heated by hot water pipes coming from a boiler near the pond, carefully concealed. The seeds of the Victoria were planted in May last, and the first flower was produced Sept. 10th. Afterwards seven other flowers opened. The plant has eight leaves, of which the largest is five feet two inches in diameter. Mr. Mager has also succeeded in flowering a large number of other tropical lilies in his pond.

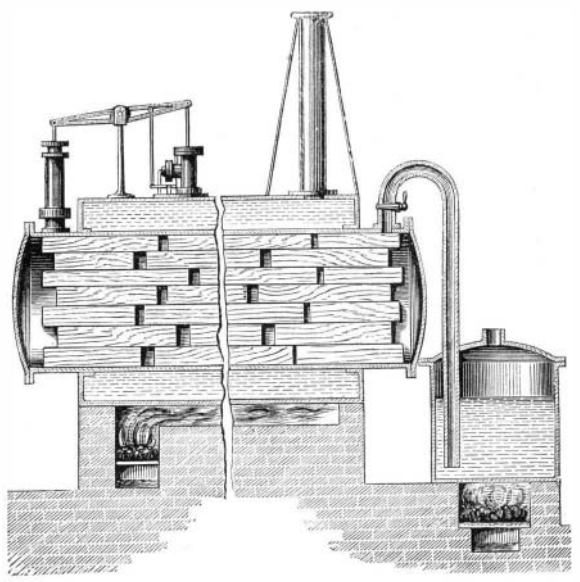
JUTE, a material largely used in combination with hemp, for making cordage, sacking, mats, and carpets, is produced in India to the extent of 300,000 tuns per annum. The scarcity of fuel prevents its manufacture on the spot, except by the rudest and most primitive means, so that the bulk of the growth is sent to Great Britain.

### Ventilation of the Liverpool Tunnel.

This tunnel, which forms an ascending incline of a mile and a quarter length from the terminal station in Lime-street, London and N. W. Railroad, was worked until recently by a rope and stationary engine, to avoid fouling the air of the tunnel by the passage of locomotives; but the increase of the traffic having necessitated the abandonment of the rope, and the substitution of locomotives for bringing the trains up through the tunnel, it became requisite to provide some efficient means of ventilation for clearing the tunnel speedily of the smoke and steam after the passage of each train. A large exhausting fan has been designed by Mr. John Ramsbottom for this purpose, which works in a chamber situated near the middle of the length of the tunnel, and draws the air in from the tunnel, through a cross drift, discharging it up a tapering chimney that extends to a considerable hight above the surface of the ground over the tunnel. The fan is about thirty feet diameter, and is made with straight radial vanes; it revolves on a horizontal shaft at a speed of about forty-five revolutions per minute, within a brick casing, built concentric with the fan for the first half of the circumference, and afterwards expanding gradually for discharging into the base of the chimney, the air from the tunnel being drawn in at the center of the fan at each side, and discharged from the circumference of the fan by the revolution of the vanes. The engine driving the fan is started by telegraph signal at each departure of a train from the terminal station, and the fan is kept running until the discharge from it becomes quite clear, showing that no steam or smoke remains in the tunnel; this is usually the case in about eight minutes after the time of the train entering the lower end of the tunnel, the passage of the train through the tunnel occupying about three minutes. The fan draws air in at both ends of the tunnel simultaneously, and begins to clear the lower end immediately upon the train entering; the clearing of the u per end commences as soon as the train has passed out of the tunnel, and as the fan is situated nearer the upper end of the tunnel than the lower, the clearing of both lengths is completed almost simultaneously. The fan is so constructed as to allow an uninterrupted passage through it, for the air, whilst the fan is standing still; and the natural ventilation thus obtained by means of the large chimney is found sufficient for clearing the tunnel during the night and some portion of the day, without the fan being worked at those times. This natural ventilation is aided by the engine exhaust and the boiler discharging into the chimney. The fan has now been in regular operation for three-quarters of a year, and has been found completely successful.

### IMPREGNATING WOOD WITH TAR OR OTHER PRESERVING MATERIAL.

The preservation of wood is a problem which is attracting increased attention, as year by year diminishes the material supply of timber, and consequently gradually increases its price. Among other methods employed, the impregnation



of wood by the vapors of tar, creosote, petroleum, etc., has been tried, and one of the practical difficulties met with has been the obtaining of suitable apparatus for the purpose.

The engraving annexed is an invention intended to supply this want. The wood is inclosed, in a tank kept hot by a steam jacket which surrounds it, as shown. A boiler at one end is used to heat the substance with which it is desired to impregnate the wood. An air pump is also employed to remove the steam, generated in the heated timber, and the air from the tank. The pores of the wood being thus rendered vacuous, the hot liquid or vapors from the heating tank readily penetrate the entire substance, and thoroughly impregnate it. This apparatus is the invention of George Pustkuchen, of Hoboken, N. J.