Rope-ma-chine'. Hemp is mentioned by Pliny as the favorite material for making ropes. *Spartium,* a variety of the broom growing on a tract of ground lying upon the sea line of the province of New Carthage, was used for common rope or cordage, and also for some other purposes. The outer portion of the papyrus was also used by the Egyptians for cordage.

In fact, most vegetable fibers of sufficient strength, as well as the hides and intestines of animals, are, or have been, used at different times and in various countries for this purpose.

The twisting of the fibers into strands, and *laying up* these into rope, was, from the earliest times until a comparatively recent period, almost entirely effected by manual labor; the simple means by which the process was effected hardly deserving to be called machines. A machine for this purpose was patented in England by Richard March in 1784, and another by Edward Cartwright in 1792. In 1805, Captain Huddard invented a series of machines, in which some of the features of the latter were introduced, by which hemp was successively combed, straightened, spun into yarns, tarred, twisted into strands, and finally laid up into rope. These were introduced into the dockyard at Chatham, England, and effected a great improvement in the manufacture of cables and cordage. See also English patents, — Sylvester, 1783; Seymour, 1784; Fothergill, 1793; Balfour, 1793, 1798; Chapman, 1797, 1799, 1807.

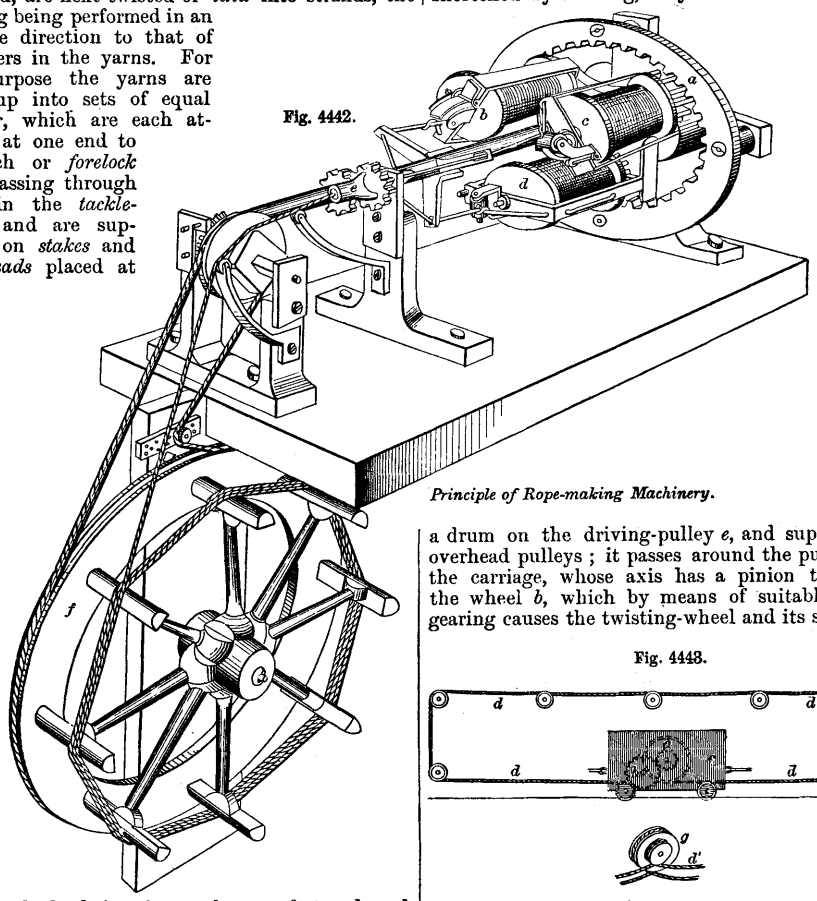
In the year 1820, machinery was introduced into the United States from England, for working the spun yarn into strands and ropes.

Mr. Treadwell introduced his rope-making machinery in 1834.

In the ordinary process of manufacture, the hemp, having been heckled and formed into skeins, is spun into yarn by a number of men, each of whom wraps a bundle of hemp around his body, and attaches one end to one of a series of hooks rotated by band connection with a crank-wheel, and walking backward along the ropewalk draws out the fibers from the bundle with his left hand and compresses them between two fingers of the right, until he reaches the other end of the walk. The thickness and hardness of twist of the yarn is governed by the quantity of hemp fed out by the spinner, and the rapidity with which the hooks are revolved. The yarn is then detached from the hook, wound on a reel, and the spinner proceeds as before, working this time in the opposite direction. If the rope is to be tarred, this operation is next performed. 300 or 400 yarns are bundled together, forming a *haul,* which is dipped into a kettle of tar heated to about 212°, and drawn through a hole called a *grip, gage,* or *sliding-nipper,* which presses the tar into the fiber and squeezes out

the superfluous portion. The yarns, either tarred or untarred, are next twisted or *laid* into strands, the twisting being performed in an opposite direction to that of the fibers in the yarns. For this purpose the yarns are made up into sets of equal number, which are each attached at one end to a winch or *forelock hook*, passing through holes in the *tackle-board*, and are supported on *stakes* and *stake-heads* placed at intervals along the walk; when they have become shortened by twisting, they are detached from the

Fig. 4442.



Principle of Rope-making Machinery.

posts to which their other ends were fastened, and these are attached to a *sledge*, which is loaded with weights, so as to keep the strands taut, yet yield as they become farther shortened by twisting. When each strand has become *full hard*, they are detached from the tackle-board, and the three are placed in the three grooves of a conical wooden block termed a *top*, through which is passed a transverse stick forming the handles or *woolders;* one end of each is fastened to the center hook of the tackle-board, and the other to one of three hooks in the breast-board of the sledge; these are turned in one direction, while the tackle-board hook is turned in the other. The top, having been inserted between the strands as closely as possible to the tackle-board, is gradually forced along as the twisting proceeds, until it is brought up close to the sledge, the strands closing in behind it as it advances.

By another arrangement, a carriage *c*, which is caused to traverse from one end to the other of the walk, is substituted for the sledge. This carries a frame and wheel, having spindles on which the strands are wound, forming the equivalent of the breast-board. The wheel is caused to rotate in one direction and the spindles in another, by gearing driven from the ground-wheels of the carriage as it is moved along the walk by means of the ground-rope *d*.

In the illustration, this is shown as passing around a drum on the driving-pulley *e*, and supported by overhead pulleys; it passes around the pulley *a*, on the carriage, whose axis has a pinion that turns the wheel *b*, which by means of suitable interior gearing causes the twisting-wheel and its spindles to

Fig. 4443.

Ground-Rope.

revolve as described, and also gears with the ground-wheel of the carriage to give it a forward or backward motion.

The ground-rope may simply be employed to turn the twisting mechanism, the carriage being moved back and forth by ropes at each end; or, as shown at *g d'*, two ground-ropes may be used, by one of which *g* moves, as shown above, and imparts the traversing motion to the carriage, while the other, *d'*, passing around the smaller pulley, is fixed at each end, and causes rapid rotation of the operative machinery.

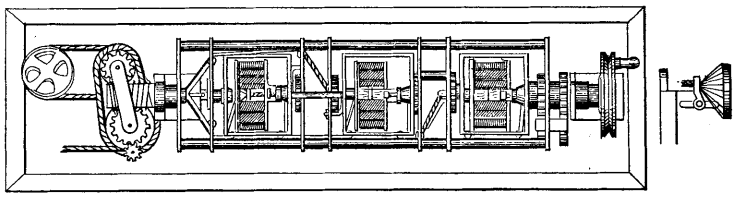
The principle on which the coarse fibers of hemp, coir, manilla, etc., are spun into rope-yarns is essentially the same as that by which yarns or threads for making fabrics are produced. For forming the first into the cords or strands which are twined together to constitute ropes, it is necessary that each of the spools on which the strands are reeled should rotate on its own axis, in order that the strands may freely unwind, and also that they should have a combined revolution around a common axis to twist the strands together.

In the machine (Fig. 4442), this is effected by the fixed sun-wheel *a*; the three spools *b c d* have planet-wheels at their ends, meshing with the teeth of the sun-wheel, and as they revolve on a common axis

concentric with its center, rotate independently on their own journals. The rope is conducted through the hollow rotating shaft *e* and wound upon the reel *f*, whose velocity is such as to take up the rope as fast as twisted and always maintain an equal tension.

The principle is farther illustrated in Fig. 4444, in which the main frame revolves in one direction and the inner frames with their reels revolve in the opposite direction: the threads and cords are respectively and successively associated and entwined to form a complete rope.

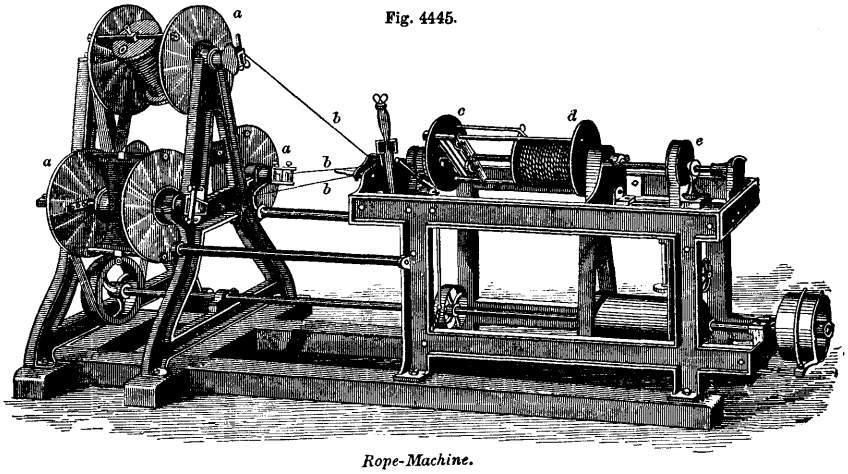
Fig. 4444.



Blackie's Rope-Machine.

The machine (Fig. 4445) is particularly designed for making small rope. The bobbin-holders *a a a* are rotated in a vertical plane by bands, and the bobbins are turned by the unwinding of the strands

Fig. 4445.

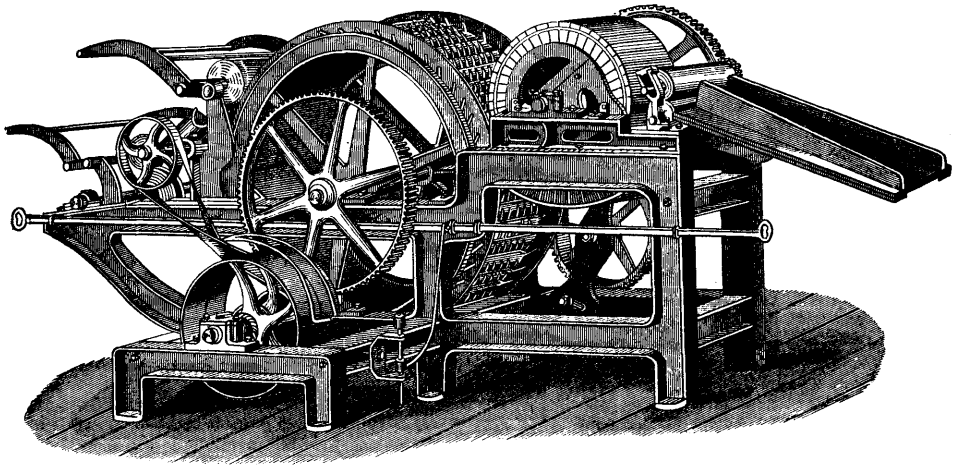


Rope-Machine.

b b b; these are laid together and twisted by the revolution of the reel *c d*, on which the completed rope is wound. This is driven by a pulley *e*, receiving its motion by belting from a drum on the same shaft by which the bobbin-carriers are actuated.

Fig. 4446 is a preparing machine for opening and

Fig. 4446.



Preparing Machine for Rope-Stock.

straightening such fibers as manilla, hemp, etc., and forming them into slivers suitable for the drawing-machine, preparatory to being spun into rope. The material, direct from the bale, is fed from the rack on the left of the machine to the large-toothed cylinder, by which it is combed out, and, being taken off by the smaller slatted cylinder, is transferred to two rollers by which it is compressed into a sliver and delivered into the trough at the right.