AMERICAN INDUSTRIES.—No. 25.

THE MANUFACTURE OF SPOOL COTTON.

The manufacture of spool cotton requires machinery and processes so elaborate and so expensive, that the industry cannot be profitably conducted except on a very large scale. For this reason the making of the spool cotton used in this country is mainly confined to a few large factories, and we are informed that there is but a single company in America that makes all numbers of six-cord sewing cotton from the raw material. This is the Willimantic Linen Company, whose works we illustrate.

The company began business in the manufacture of linen; being deprived of flax by the breaking out of the Crimean war, they turned their attention exclusively to cotton thread, but the original style of the firm was retained.

The business offices of this company are located at Hartford, Conn.; the works are at Willimantic, on the river of the same name, about 125 miles from New York and 90 miles from Boston, on the New York and Boston Air Line Railroad. Two other railroads—the Hartford and Providence and the New London Northern—pass through the place, and hundreds of their passengers every day catch sight of the great, gray, six story mills of the thread company, built up of granite quarried out of the very ground on which they stand; and see, too, the rows of neat and comfortable tenements ranged along the streets. There are four large mills, picturesquely set upon the east bank of the river, and stretching, with their surrounding grounds, over a space of three quarters of a mile. The buildings and grounds are noticeably clean and orderly in appearance. By a series of dams, aided by a sharp natural fall, a force of fifteen hundred horse power is secured from the river for the factories. In these mills, as we learn from the elaborate description of them in *Scribner's Monthly*, to which we owe much of the information here given, more than a thousand workpeople—women and men, and girls and boys—are kept constantly busy at the various labors that combine to make thread.

The first operation in the preparation of the raw material for spinning is to run it through a machine called a "picker," which cleans about a thousand pounds a day.

The picker picks or beats out the dirt and seeds, and the cleaned cotton rolls out of the machine in laps, which are carried to the carding room, shown in one of the lower views in the engraving on the first page. The carding machine arranges the cleaned fibers parallel to each other, and delivers the cotton in a thin, narrow ribbon. After this operation the strand is run between sets of rollers, one set revolving faster than the other. This is called "drawing," and it is one of the most important parts of thread making. If one set of rollers, for instance, turns ten times as fast as the other, the strand that passes out between them is, of course, ten times lengthened and ten times as fine as the original. This is a "draught of ten," as it is called. The drawing may be in any ratio, and any number of strands may be run together into one at the same time that that is drawn. Five strands, for example, drawn with a draught of ten, would make a new strand half the size and ten times as long. This process of uniting strands is called doubling, and the doubling, running together, drawing down, and reuniting and redrawing are carefully watched, so that the size of the strand and the amount of work on it may be at any time known. The operation is repeated again and again; but all this doubling is not done without interruption. After the first few drawings, the long white ribbons of cotton which, in this condition, are called "slivers," are passed through another machine, which combs them again to remove all foreign substances; it also takes out all of the short fibers, leaving only the longer fibers to be worked into thread. The short fibers which are removed are sold for other manufactures. After combing, the sliver is doubled and again reduced in size, and then twisted for the first time in the roving frames and wound upon large spools, and it is afterward drawn and twisted in two separate machines before it is carried to the spinning mules.

The room in which the spinning is done is represented in the larger view in the engraving. In each of these machines there are several hundred spindles, which revolve very slowly as they are carried forward by the carriage in winding the thread on the spindle, but revolve with great speed as the carriage draws back in the operation of spinning. The spinning mule is entirely automatic in its action. The marvel of it all is the mathematical precision with which it begins, stops, and reverses, and the care with which it suitably varies its work each time to the needs of its case. The mule is all the while attended by a barefooted and lightly-dressed man or boy, whose business it is to unite such strands as accidentally part. On these mules the yarn is made of any size that is required. It is at Willimantic spun down to a fineness that rivals even the spider's web.

From the spinning mules the cops go to the cop winders, where two strands are wound together on a single spool. These two strands are twisted in a machine in which the bobbins revolve at a speed of about 5,000 revolutions per minute, and the thread is wound on the bobbins by a simple differential arrangement, which accommodates itself to the increasing diameter of the bobbin. Three of these double strands are twisted together, forming the well-known six cord spool cotton.

The spools from the twisting machines are conveyed to reeling machines, which form hanks suitable for bleaching, dyeing, etc.

During every step in the progress of the cotton, from the raw state to the finished thread, it is repeatedly examined by experts, and if at any stage it is not in all respects up to the standard it is rejected and never finished. Delicate instruments, which are used in testing the thread, are to be seen in all departments of this immense establishment. It is only by continually and closely watching the various steps in the manufacture of thread, that a uniformity in quality is secured.

It is established by all spinners that 7,000 grains shall be a pound in cotton, and that yarn of which 840 yards weigh this pound, shall be number "1." Every now and then, therefore, all through the mill, a very accurately gauged reel, or some similar instrument, is used to measure off an even fraction of 840 yards. The measurer may be careless in taking off his sample, but that makes no matter. At exactly the right point the reel breaks the strand and calls attention to the fact by ringing its signal bell. Then this sample, say 120 yards or one seventh of "a hank," is weighed on scales also gauged to show the most delicate variations. If the yarn or roving is number one, and weighs one-seventh of 7,000 grains, it is exactly correct; if 120 yards of No. "30," for instance, were being sampled, it should weigh one-thirtieth of one seventh of 7,000 grains. Every time a variation appears, the cotton is made to thicken up or thin out as is needed. This testing is done repeatedly, and the results are recorded in books kept for the purpose, so that the course of any of the cotton on its three weeks' cruise of three thousand miles through the factory, can always be traced and faults found and corrected at once. Nothing more impresses one with the wonderful accuracy of the process than to watch one of these testings, note the exact measurement of the sample, and rigidly careful weighing, and see the gravity with which the overseer marks down the pettiest variations to the 28,000th of a pound! It all tells upon the thread, and making it correct through all its processes guarantees it correct, of course, when finished.

After the thread is made the work on it is by no means finished. To prepare it for market it must be inspected, washed, bleached, dried, perhaps dyed, spooled, and boxed, and the spools and boxes are also made in the factory.

After the operations already described the hanks of thread are placed upon reels and transferred to large spools in the department represented in one of the upper views. The thread is then conveyed to the winding machines which take the spools, and, holding them between centers, revolve them, start the thread, wind it back and forth with the utmost precision, making allowance for the beveled ends, stop when the required 200 yards are wound, nick the spool, put in the thread, cut it off, and release the spool, all without attention. All that is required of the attendant is to see that thread is supplied, and to keep the hoppers full of spools.

One of the most interesting machines in this establishment is the machine for ticketing the spools. One girl supplies it with sheets of printed labels, and another feeds it with spools; it does the rest automatically. Provided with the labels, it cuts out, pastes, and fastens the proper mark for each end of the spool, and prepares a hundred spools a minute. The machine does the work of many girls, and it never tires.

The winding machine, the ticketing machine, and the automatic spool-making machine—inventions belonging to the Willimantic Company—are so essential to the thread business that the privilege of using them is rented by other manufacturers.

Everybody knows the sizes of thread. Every seamstress knows whether she wants No. 30 or 60 or 120, and knows, when she hears the number, about what is the size of the strand alluded to; but how the numbers happen to be what they are, and just what they mean, not one person in a thousand knows. It is a simple matter to explain. The standard of measurement is the same already recited. When 840 yards of yarn weigh 7,000 grains (a cotton pound), the yarn is No. 1; if 1,680 yards weigh a pound it will be No. 2 yarn. For No. 50 yarn it would take 50x840 yards to weigh a pound. This is the whole of the yarn measurement. Thread measurement rests on it. The early thread was three-cord, and the thread took its number from the number of the yarn it was made of. No. 60 yarn made No. 60 thread, though in point of fact the actual caliber of No. 60 thread would equal No. 20 yarn, being three 60 strands. When the sewing machine came into market as the great consumer, unreasoning in its work and inexorable in its demands for mechanical accuracy, six-cord cotton had to be made, as a smoother, rounder product. As thread numbers were already established, they were not altered for the new article, and No. 60 six-cord and No. 60 three-cord are identical in size as well as number. To effect this, the six-cord has to be made of a yarn twice as fine as the three-cord demands. The No. 60 six-cord would be six strands of No. 120 yarn. To summarize: yarn gets its number from the arbitrary formula that 840 yards weigh 7,000 grains. Three-cord spool cotton is the same number as the yarn it is made of. Six-cord spool cotton is made of yarn that is double its number.

As simple a thing as thread seems to be, the Willimantic Company makes 1,200 different kinds, and it takes 10,000 dozen spools to hold each day's product.

THE St. Gothard tunnel makes steady progress, no less than 3,000 workmen being engaged upon it. Nearly 10 tons of dynamite are used per month.

MISCELLANEOUS INVENTIONS.

Mr. A. Edward Barthel, of Detroit, Mich., has invented a hammerless self-cocking and rebounding firearm, the improvements being applicable to shotguns, rifles, or revolvers, either single-loaders or magazine arms.

Mr. Zebina M. Hibbard, of Brooklyu, N. Y., has patented a trace fastener provided with a screw stem that works in the threads of the ferrule, and is provided with a shoulder that fits within a rabbet of the ferrule.

Mr. Simeon Garratt, of Columbus, O., has patented a self-acting car coupling, which will couple high or low, which, when running, will only come apart by the use of the lever, but which will immediately separate should the cars run off the track.

An improved adjustable harness pad has been patented by Jacob Johnson, of Ashland, Neb. The object of this invention is to provide a harness pad which may be adjusted to the back of a horse of any shape or size.

An improved bale tie, patented by Mr. William H. Roane, of Pine Bluff, Ark., consists of a rectangular plate, having opposite edges bent over toward the outside, forming flanges or lips, through one of which is made a transverse rectangular slot in line with the outside of the plate, while the other is provided with a similar slot, and with an opening through from the edge of the lip or flange.

An improved spark arrester, patented by Messrs. Silas Byram, of Middletown, Ind., and William R. Hansford, of Hicksville, O., consists of two pipes set one within the other, with an annular space between them, the inner pipe being constructed in vertical sections, with lower edges inclined or drawn inward that are held apart by lugs or straps extending from one to the other, while fixed in the longitudinal axis of each section is a conical deflector, and encircling each section is an annular flange whose diameter is the same as the internal diameter of the outer pipe.

An improvement in candlesticks, patented by Mr. Andrew J. Smith, of Ukiah City, Cal., consists in providing a slitted match box rising up in the candle holder from the bottom of base.

Mr. John Henry Hettinger, of Bridgeton, N. J., has invented an improved can cover, which is simple, readily adjustable, and efficient, and may be used for cans and jars, paint cases, etc. It may also be applied to barrels, boxes, or cases of wood, as well as of metal, by only changing the material of which it is constructed.

An improvement in electric speaking telephones has been patented by Mr. Frank P. Mills, of Ishpeming, Mich. The object of this invention is to increase the sensitiveness of speaking telephones and the resulting effects by a new arrangement of the permanent magnet and the armatures thereof; and it consists, essentially, of a circular or cylindrical magnet surrounding the helix, the poles of which are brought close together, but insulated from each other by a peculiar arrangement and construction of armatures.

Mr. Oscar Kleinberger, of New York City, has patented a suspender having its ends formed of braid or cords which cross and overlap each other two or more times, and are fastened together at their junctions by threads or cords, thus forming a series of button holes or loops of like size.

Mr. Charles P. Blatt, of Elizabeth, N. J., has patented a simple and effective device for keeping beer and other liquids when "on tap" cold and supplied with common air or carbonic acid. It consists of a box or cabinet containing an air-tight chamber, an ice chamber, and a place for the barrel or other vessel containing the liquid.

Messrs. Hartwell A. Crosby and George F. Thompson, Jr. (administrator of Michael W. Thompson, deceased), of St. John, N. B., have patented an improved sash stop and lock. The object of this invention is to provide a more simple and durable sash stop and lock than those now in use. To close a window provided with this device, one has only to reach up and pull down on the thumb piece. If the window is partly open and it is desirable to raise it higher, it is only necessary to push it up, and the pawl will hold it at any point.

An improvement in riding plows, patented by Mr. Alfred Belchambers, of Ripley, Ohio, consists in a riding attachment composed of a frame mounted on wheels and drawn behind the mouldboard.

Commercial Enterprise.

Our English contemporaries seem to be awakening from their lethargy and to realize the cause for the depression in trade among their manufacturers.

Acute observers of the "spirit of the age," says one of the foremost trade journals of England, must have noticed the inborn love of conservatism, and the desire to follow in the footsteps of our fathers or predecessors that distinguishes us from our Continental neighbors and our American cousins. Progression in this country is usually the result of competition, or the force of circumstances, frequently impelling our ironmasters and our colliery owners to move with the times, and the steady-going British manufacturer to remodel his plant, improve his patterns, print his catalogues, and advertise his productions.

There can be no question that in many departments of trade the English name was at one time pre-eminently conspicuous, and our foreign rivals had to be content to follow the lead we were setting them. But, in too many cases now, the position is reversed, and "Jack is as good as his master."

It is unfortunate that such should be so, but a great deal of the present depression in trade is to be attributed to the

apathy of British traders. After being over-credulous for years they are now becoming over-cautious, and improvements or investments which show a good chance of being remunerative are either neglected altogether or postponed to an indefinite period.

The Wagon Hardware Trade.

Pittsburg seems to be a "head center" for the trade in wagon hardware. A recent article in these columns gave our readers an idea of the extent of the wagon and carriage building trade in the United States. A Pittsburg firm, Messrs. Lewis, Oliver & Phillips, employ about 700 men upon wrought iron wagon fittings. They control nearly 100 patents, covering the devices used and the processes for turning out the different parts by machinery. The firm make the necessary fittings for 90,000 wagons per annum, supplying the following wagon-making concerns: Studebaker, of South Bend, Ind.; Milburn, of Toledo, O.; Schuettler, of Chicago; Baine, of Kenosha, Wis.; Austin, Tomlinson & Webster Co., of Jackson, Mich., Moline Wagon Co., Moline, Ill.; Kansas Manufacturing Co., of Leavenworth, Kansas, and others.

ARTIFICIAL HAYMAKING.

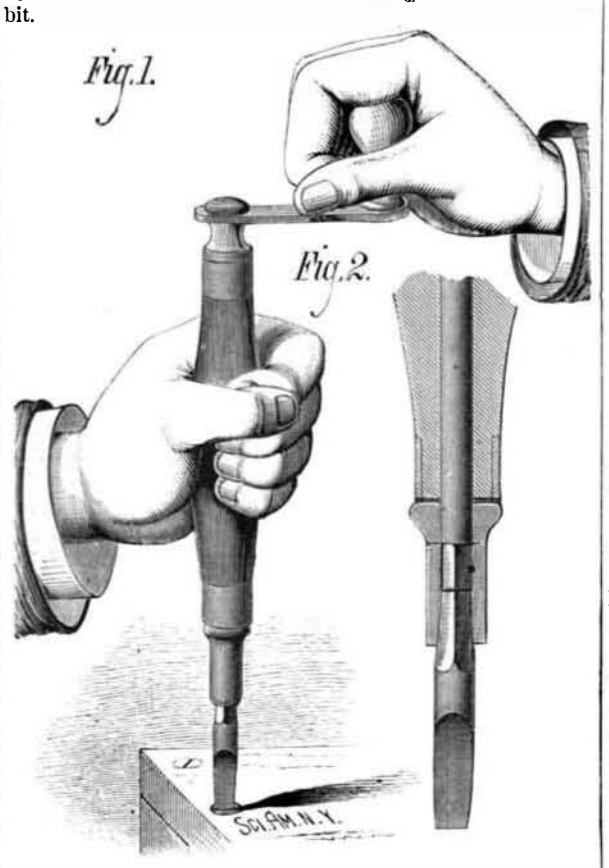
On these islands, says the London *Graphic*, where farmers suffer far more often from excess of moisture than from excess of sunshine, and where crops, which up to the last moment have promised well, are often seriously injured by wet during the process of gathering in, a successful method of artificial drying without the aid of the sun's rays would be an immense boon. For many years Mr. W. A. Gibbs, of Gillwell Park, Chingford, Essex, a gentleman engaged in mercantile pursuits in the city, and also, we may venture to observe, favorably known among the poets of the day, has also devoted much attention to this hay-saving problem. By slow degrees he invented a really practicable process, which is thus described:

"Streams of hot air from the mouth of a hot blast fan, connected with a portable engine, are directed upon masses of wet hay or grain laid in open troughs, and brought in turn, by occasional lifting of forks, under the direct action of the air. By increasing the temperature of the blast it was found that the drying process could be proportionately expedited. Eventually the scheme was perfected by bringing the hot blast fan to bear upon a shed divided into two compartments by an iron partition, and having a space between the iron floor and the ground. Hot air, supplied from the hot-blast fan by means of a duct from an underground furnace, communicates with thirty-two conical perforated tubes on the floor, on which are spiked the wet corn sheaves. These tubes of course are used only for grain. The crowning success of the whole process is an atmospheric hoist, worked by the same engine as the hot blast, which elevates and sends up to the top of a stack, 22 feet high, as many as 960 sheaves per hour."

This year, owing to the unprecedented wet summer, Mr. Gibbs' invention has come to the front and been recognized by practical men as one of extreme value. He says, in a letter to the *Field:* "On Tuesday in last week I lent one of my hay driers to Mr. Ashcombe, of Sewardstone, a practical farmer of long experience and large 'holding.' He started it at 9 A.M., and in ten hours had dried and stacked the produce of ten acres, estimated at one and a half loads per acre. The total cost was £5 10*s.* for the ten acres, rather less than it would have cost to make the hay in the field, had that been possible. The hay was made from unripe, rank, weedy grass which had been perpetually rained upon; Mr. Ashcombe and his men were inexperienced in the use of the machine, and had no help from me; the hay drier was wholly uncovered, and heavy showers fell on the hay while it was being dried" Yet, in spite of these unfavorable conditions, the result was a complete success. Already several leading agriculturists, among whom is the Duke of Sutherland, have purchased these machines. The price of the large size is £350, but cheaper forms for small holdings, ranging from £50 to £90, are in use, and have done good service.

AN IMPROVED SCREW DRIVER.

The engraving given herewith represents an improved screw driver recently patented by Mr. George Abrams, of Philadelphia, Pa. It consists of a handle through which extends a shaft, having on the upper end a crank and upon the lower end a socket for receiving the screw driver bit.



ABRAMS' CRANK SCREW DRIVER.

With this tool screws may be inserted and removed with much greater facility than with the ordinary form of screw driver, as the motion is a continuous rotary one instead of intermittent.

If desired the screw driver bit may be removed and a drill or boring tool inserted in its place.

MECHANICAL INVENTIONS.

Messrs. Jacob W. Cagle and Joshua W. Nichols, of Greenville, S. C., have patented an improved press for baling cotton, hay, straw, rags, bagging, hemp, etc. It is simple in construction, convenient, rapid, and powerful in operation. It consists of certain novel features which cannot be fully described without an engraving.

An improvement in skiving machines has been patented by Mr. Charles E. Langmaid, of Stoneham, Mass. It consists in a vibrating knife that is hung upon the bed and used in connection with the usual clamps or rolls for feeding the material, and operated by mechanism, whereby the cutting is done with greater facility than heretofore, and the machine may be used for the finest work.

Mr. William H. Silsby, of Chico, Cal., has patented an improved grain separator of that class in which the grain is thrashed and immediately separated from the straw by endless belts. It consists in a peculiar arrangement of parts which cannot be readily described without an engraving.

Mr John M. Whitney, of Mount Pulaski, Ill., has invented an improved windmill and pump for use in supplying water for stock and other purposes. It is so constructed that the wind wheel may be in operation so long as the wind blows with sufficient force, while the pump will operate intermittently, or only at such times as the tank or trough is empty, or nearly so.

Mr William F. Rundell, of Genoa, N. Y., has patented an improvement in mowers, which consists, first, in the construction and arrangement of a clutch for connecting the main shaft with the driving gear; second, in the peculiar arrangement of the gauge wheel for the inner end of the cutter bar with respect to the cutter bar and carrying frame; third, in the peculiar form of joint connecting the outer end of the pitman to the cutter bar; and fourth, in the peculiar construction and arrangement of the draught attachment.

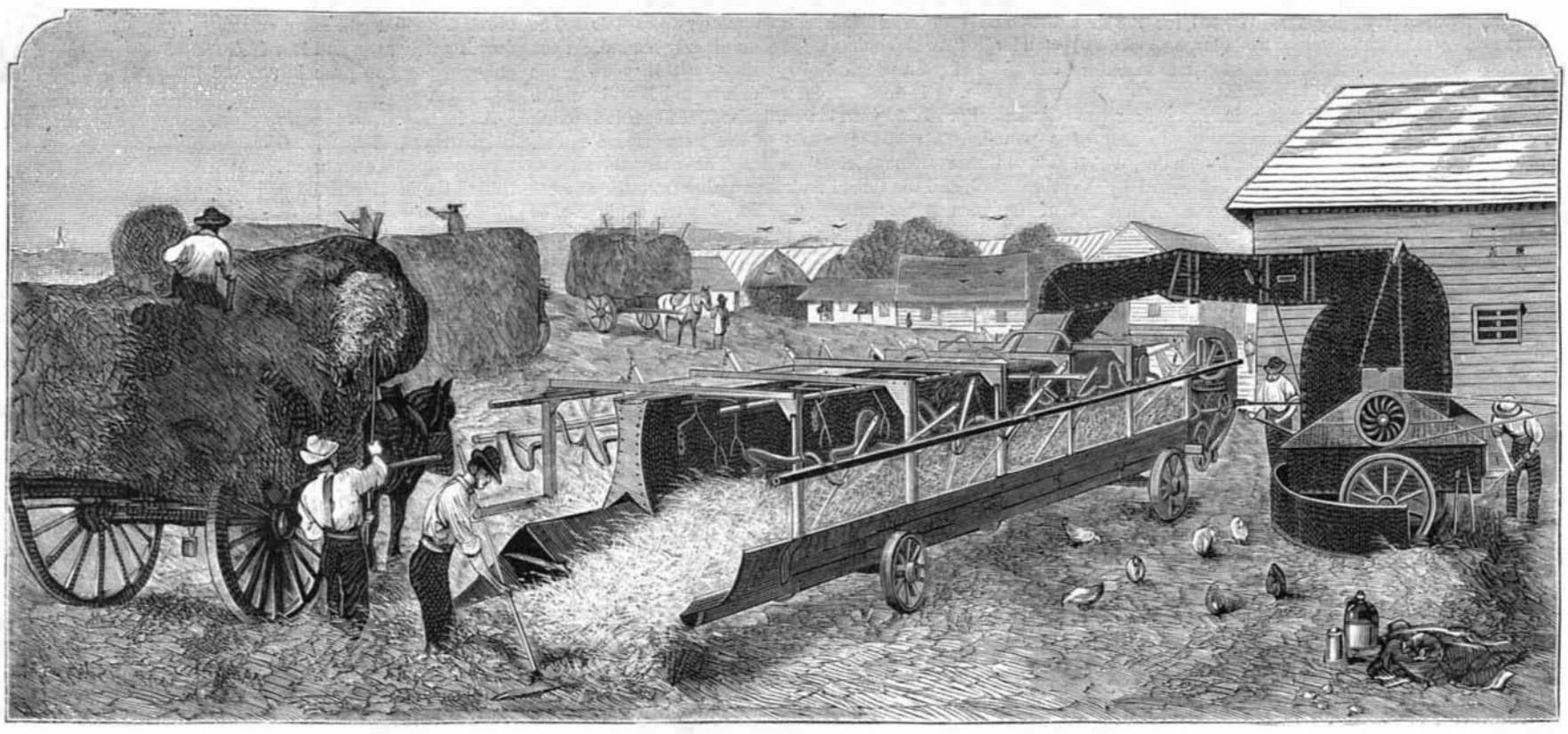
The New Cunard Steamer.

Mr. John Burns, one of the proprietors of the Cunard Steamship Company, writes to the London *Times:*

"It may interest the public to know that my partners and I have just concluded a contract with Messrs. James and George Thomson by which that firm is to build on the Clyde, for our fleet, a screw steamship the size of which will be exceeded only by that of the Great Eastern, while the speed will be greater than that of any ocean steamer afloat. This new vessel will be of 7,500 tons and 10,000 horse power, her dimensions being 500 feet in length, 50 feet in breadth and 41 feet in depth, propelled by inverted direct acting compound engines, with three cylinders and seven oval tubular boilers, having thirty-eight furnaces and 1,000 feet of effective fire grate surface. She will have an extra promenade deck, and will practically be a five decker, being fitted for 450 first class and 600 steerage passengers, with accommodation for a crew of 200 officers and men. Her cargo capacity will be equal to 6,500 tons, with 1,700 tons of coal and 1,000 tons of water ballast, having a double bottom on what is called the 'longitudinal and bracket system.'

"This vessel has been designed, after lengthened consideration, to meet the requirements of our traditional service, and we have adopted in every detail of the ship and engines the most advanced scientific improvements compatible with the safe working of so great a vessel. Among the important matters into which we have crucially inquired has been that of the employment of steel instead of iron, and after a practical and thorough examination into the merits of both materials we have adopted steel for the hull and boilers, but under a provision so stringent that every plate, before acceptance, will undergo a severe and rigid test by a qualified surveyor appointed and stationed at the steel manufactory for that special purpose, and that the manipulation of the steel by the builders shall be subject to an equally careful supervision by qualified engineers of our own appointment. The steel is to be made on the Siemens-Martin process, and all rivets as well as plates throughout the ship are to be of steel. The name of the new vessel is to be the Sahara, and she is to be ready for sea in March, 1881."

THE prize of $100 offered by Stillman B. Allen, of Boston, to the boy of York county, Maine, who should raise the greatest amount of corn on one-eighth of an acre this year has been awarded to Joseph Milliken, Jr., of Biddeford, who raised 1,404 pounds



CURING HAY IN WET WEATHER BY AID OF ARTIFICIAL HEAT.