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COSMICAL CAUSES OF CHANGES OF CLIMATE.

In a former article, under the head of "Changes of Climate," we have given some of the arguments adduced in favor of the haeory that our planet is still undergoing the cooling process, which geology proves that she was undergoing millions of years ago. Another argument in favor of this theory, not founded on observation, is the *a priori* consideration that our earth possesses, interiorly, a temperature far above that of the surrounding planetary space, and that, therefore, according to the laws of distribution and radiation of caloric, a slow loss of heat must take place, tending ultimately to make the temperature of our whole globe equal to that of the space she moves in; that is, according to Pouillet, 240° below the zero of Fahrenheit.

The solar caloric radiation, enormous as it is, is without influence on the temperature of the earth's interior, it having been proved that the whole effect penetrates the surface to a limited number of feet only, and is as easily lost by radiation during the night and the winter as it is received during the day and the summer season. The incapability, of the apparently powerful solar radiation, to prevent a planet from losing its own heat, is forcibly illustrated by the present condition of those tops of our earth's mountain peaks which are elevated above the snow line, where, even under the tropics, a perpendicular midday sun is unable to raise the temperature above 32° Fah. The present condition of our moon is another case in point; we know now that this satellite has cooled down far below the freezing point; that practically it has no atmosphere, and that all its water, long ago, has been chemically combined with the lavas of its surface into hydrated rock, similar to those of our earth, which contain, in solid condition, a mass of water perhaps equal to half that of our oceans. The opinion, of some astronomers of the former century, that the side of the moon turned towards the sun should be subjected to great heat, is sufficiently refuted by the observation of the effects of the sun on our mountain tops above the snow line referred to.

These arguments serve to show the incapability of the sun to prevent the cooling down of the planets and satellites under its influence. In fact, our whole planetary system is an illustration of this simple law of caloric radiation: that the smallest bodies will require the shortest time to cool down, while inversely, the largest will remain hot the longest. The smallest planetary body, with whose physical condition we are acquainted, is the moon, and this has cooled down far below the freezing point. The next planetary body, the only one, in fact, with which we are intimately acquainted, is our earth, and this has cooled down, exactly so far as to allow the solar radiation to develop vegetable and animal life on its surface; and a similar condition may perhaps exist on the surface of the planets Mars and Venus, not differing much in size from our earth. When we, however, look at the larger bodies of our planetary system, say Jupiter, which surpasses our earth in size more than 12,000 times, we find a very different condition of affairs. In the first place, its density is only one third more than that of water; while the density of our earth surpasses that of water five times. This proves from the outset that matter is on Jupiter by no means in the same condition as on our earth; that probably it has a much higher temperature of its own, so high as to keep in a gaseous condition many substances which are liquid or solid on our earth. Very recent observations with the spectroscope and telescope combined have indeed proved this to be actually the fact, and that this planet, as well as Saturn, Uranus and Neptune, possesses so high a temperature as even to shine with, besides the reflected solar light, some luminosity of their own.

If, finally, we look at the central body of our planetary system, the sun, which surpasses Jupiter in the same ratio that Jupiter surpasses our earth, we find that the cooling process has advanced the least; in fact, the heat of the sun is still so great as to be entirely beyond our present means of estimating temperatures.

Human life and even the historical record is short, while the changes spoken of extend over such long periods of time as to be an eternity compared with them. No wonder, therefore, that the practical evidences are slight, so slight indeed that we should feel inclined to disbelieve such changes, and to accept a theory of perfect stability of condition. There are indeed some who adhere to this belief; but unfortunately for them, there looms up the geological record, proving stupendous changes from the time when the most excessive tropical climate prevailed at the poles; while, between the tropics, an excessive torrid zone and boiling ocean formed an unsurpassable barrier for the vegetable and animal life around the poles of each hemisphere. Before that time, there was a period that the earth's temperature was so high as to occupy four times its present bulk, and to be self-luminous. Then perhaps the moon was cooled to the temperature possessed now by the earth and she may have been inhabited; a condition similar to that of Jupiter at the present day, where the moons may have inhabitants, though the planet itself cannot.

If these above conceptions are correct, worlds have their times of preparatory development, of youth, of manhood, and of decay. Jupiter is in its preparatory stage; our earth has passed its youth and is just entering into manhood; our moon has had its time of decay and is now a dead planet. This will continue, with the difference that, after millions of ages, these conditions will be shifted from one set of celestial bodies to another

THE NEW MANHATTAN MARKET.

One of the largest structures in the United States is the Manhattan market, situated between 34th and 35th streets and Eleventh and Twelfth avenues in this city. Its dimensions are 900 feet in length by 200 feet in breadth. Its foundations rest principally on piles driven to depths varying from 14 to 50 feet; on these, heavy beds of concrete are laid, above which, and level with the upper line of the foundation, the floor is placed. This is 160,000 square feet or over three acres and a half in extent. It consists of, first, a layer of concrete four inches, then two inches of asphalt, and finally a coating of Portland cement, one and a half inches in thickness. The latter is to be colored in various designs and all will be impervious to water. Drainways are provided on either side of the building, through which all refuse will be carried to the river as often as the water from the 1,000 Croton hydrants is allowed to play upon it. With such a flow, it is believed that the atmosphere and the market generally will be kept thoroughly pure and clean.

The walls are built of Philadelphia brick and light colored (Lockport) stone, the latter being used for trimming and for portions of the ornamentation. The architectural style of the building is what is known as the Lombard. The massive sides and roof are finely symmetrical, and it is claimed that they present some of the finest specimens of mason's and bricklayer's work in existence. On either front, the name of the structure and the date of the commencement of the work are inscribed.

From the walls rises the arch—of iron and slate—which forms the roof. The arch proper springs to an altitude of 135 feet, and extends to within 75 feet of either front. The ends of this archway are domelike in form, and the whole is covered with parti-colored slate, arranged in various figures and designs. The central tower of the building is 236 feet high, and will contain a clock, claimed to be the largest in the world, costing $37,000. The other towers are two on either of the façades, and two on the center line of the sides. All are to be of similar design, and to have dials small in size compared to that on the main tower. Eight elevations, constructed of iron and wood, and built along the crown of the arch, serve as ventilators. The windows are 1,500 in number and are on pivotal centers.

Between the walls and the inner line of pillars which sustain the roof and towers, there are to be ranged between ten and twelve hundred stalls, one half for wholesale and the other for retail dealers in meats and market produce generally, excepting only fish, for which another building is to be constructed. The larger of these stalls will be sixteen feet square, and the smaller, ten by eleven.

In addition to the main structure, which is to be opened to the public early in August, there are to be exterior roadways and a long dock constructed. A line of river steamers are building which, when completed, will be used for the delivery of orders to the shipping in the harbor, and to various predetermined points in Brooklyn and New Jersey, between which and the offices in the main building there will be telegraph lines. In addition to this, suitable positions are to be prepared for market gardeners and produce dealers from Long Island and New Jersey.

The cost of this great market enterprise, together with its docks and steamers, additional buildings, etc., is $2,000,000. Situated in a central position, it will be the great point of supply for the entire city. The structure forms one of the most conspicuous objects in New York, and is visible up and down the river at a distance of several miles.

SPONTANEOUS COMBUSTION.

During an investigation into the causes of a recent fire which broke out in a loaded warehouse in New York, the testimony showed that the fire originated in a case of silk twist, packed in a tight case, with two layers of thick paper and one layer of oilcloth between the inside of the case and the goods, thus wholly excluding the air from without. The goods had evidently been packed while damp, and, therefore, the heat of the weather favored the ignition in the manner supposed.

After the fire was extinguished, an effort was made to have the remainder of the goods removed from the premises, but it was not permitted. In the course of three days, fire was again discovered, and but for the promptitude and efficiency of the firemen, a heavy loss would have resulted. On investigation, it was discovered that this fire also originated in one of the same cases of silk twist, and was beyond question spontaneous.

The Fire Marshal is of opinion that goods packed like the above, no matter whether they be woolen, cotton, hemp or silk, are liable to ignite at any time when the atmosphere favors. In this case, it was shown that the goods had become valueless before the fire, as the process of combustion, which had been going on within the case, had made the silk so rotten that it could be broken with ease. It is believed that many vessels and places of business are destroyed by fire which originates in this manner.

CANAL BOAT TOWING BY ROAD STEAMERS.

We learn from the Troy *Whig* that a trial of Williamson's road engine "Enterprise" was recently made on the tow path of the Erie Canal between Albany and Port Schuyler. The machine is thirteen feet in length by seven feet wide, with an upright boiler. There is a double horizontal engine with two cylinders, each, with a ten inch stroke, enclosed in a box.

There are two driving wheels five feet in diameter, the tires of which are fifteen inches wide, covered with stout india rubber and protected by iron shoes about five inches wide and set about three feet apart. The steering wheel is three feet in diameter, with a tire twelve inches in width. The seat for the engineer is directly in front of the engine, which is managed by a double crank. On either side of this seat are water tanks, and in the rear are two coal bunkers. The machine can be turned on its own ground and works much the same as a velocipede. In hight, the engine is eight feet from the groudd to the top of the boiler. The smoke stack is hinged, so as to be lowered when passing under bridges. The engine is twenty-four horse power. Four boats, three loaded and one light, were hitched to the steamer and were propelled at the rate of about four and a quarter miles an hour. The first mile was made in thirteen minutes. The "Enterprise" is valued at $5,000, and was built about three years ago. It has worked successfully on roads, and the owners are confident of its success in canal boat towing.

The New York *Sun* remarks: "It is said that all who witnessed the trial were fully satisfied of the practicability of this plan of steam towage, and it appears that its economical advantages are very great. The pressure of steam required to enable the engine to draw three barges is ten pounds to the square inch, and that pressure can kept up with a consumption of one hundred and fifty pounds of coal per hour. By a careful comparison of the cost of towing three boats by the road steamer and one boat by horse power from Albany to Buffalo, in which interest, wear and tear, and all contingencies are taken into consideration, it is estimated that by the use of the road steamer the expense of towage would be $133.86 less for each boat than by horse power, while there would be a gain of four days in time. The usual time consumed in a trip between Buffalo and Albany is ten days; the road steamer would easily make it in six.

It may be that some system of water traction may be devised that will give even better results than these; but if not, it seems to have been fully demonstrated that the land tractor will do more than has generally been deemed possible Should it come into general use there can be little doubt that many improvements in its construction will be suggested by experience, and it is also probable that improvements will be introduced in the construction of boats which will reduce the resistance of the water and lessen the wash of the banks. At all events it is safe to assume that horse power on the large canals will eventually be generally superseded by steam, whether land or water traction is adopted as the substitute for the present system."

The steamer alluded to is known as Thompson's patent, in England where it has been brought into very extensive use, and has been subjected to the severest tests. Mr. Williamson is the owner of the patent for this country. An excellent engraving of the invention with full description will be found on page 319, Vol. XXI of the SCIENTIFIC AMERICAN. The capabilities of the engine for canal boat traction are there set forth. That it is well adapted to such a purpose, there can be no question.

LOOK OUT FOR THE METEORS.

On the 10th of August, unless the calculations of our astronomical *savans* fail us, the earth will pass through a ring of meteors—the remains of the comet of 1862—on which date those of our readers who are wide awake may expect a meteoric display of greater or less brilliancy. We give in another column a very interesting summary of Dr. Schellen's statements concerning meteors and the annual shower in August.

BECAUSE I AM SO LAZY.

An esteemed correspondent, who is a good writer, a good investigator, and who knows just what is useful and interesting for readers of the SCIENTIFIC AMERICAN, says that the only reason why he does not more frequently contribute to our columns is "because I am so lazy." This unfortunate condition besets thousands of the most useful people in the

world, and in fact greatly hinders the mental and material progress of the human race. But it can be readily overcome, in every individual case, by a determined exercise of the will. We hope that our correspondent will turn over a new leaf, let us hear from him more frequently, and so set a good example to his fellow men in general and to other correspondents of our paper in particular, who are afflicted in the manner he describes.

STEAMSHIP NOTES.

Among the multitudinous shipping of New York harbor there is always occurring more or less of current interest from an industrial or technical standpoint. We cannot afford room for extended mention of all or even much of this, but some of the items are worthy of note, either as indices to commercial or engineering progress or as illustrations of the way things mechanical are sometimes managed. Of the kind last indicated is an incident that recently occurred to the *Great Western*, an English bluff bowed iron freight steamer on her first trip from Bristol to New York, laden with railroad iron. She had a four bladed propeller, but broke three blades on the voyage, and steamed into Gowanus with rather dilapidated propelling machinery. She carried the usual spare propeller, and on her arrival here was taken to the Erie docks to have it put on in the place of the old one. The usual method of removing a screw from its shaft is to drill a line of holes in the boss and then split it open. But in the present instance, the plan was adopted of removing the keys, taking off the nuts, and driving it off. While doing this, the other propeller was being hoisted out of the after hold. While being swung aft, the lashings broke and the ponderous apparatus fell, one blade going through the dock and another breaking off. This left the parties with a one bladed screw on the shaft and a three bladed one in the mud. All things considered, it was thought best to cut off the one blade of the former to correspond with the diminished length of the broken ones thereof, and so the vessel has started back with her jury screw. Had the affair been under Yankee management, possibly the spare screw would not have been broken, but if it had, there would have been ingenuity enough somewhere about the shop to have lengthened the broken blade with a wrought iron plate.

Nevertheless, however much we may justly claim superiority for inventive skill and adaptiveness, we have to make painful mention of British energy, shewn in the progress of iron shipbuilding in England, a branch of industry which we hope to see returning to our own shores. For example, the Anchor line, hitherto almost wholly devoted to freight between New York and Glasgow, is about to increase their previously limited passenger traffic by the addition of new and superior steamers. The company is now building, on the Clyde, seven new vessels which, with those now running, will aggregate forty-three.

While upon the subject of steamers, we may speak of a pair of what may be termed historic marine engines, one of which is lying dismantled at the Continental Iron Works, while the other is doing duty in the *James Adger*. These engines were splendid examples of marine steam engineering, and drove the paddlewheels of Commodore Vanderbilt's famous steam yacht the *North Star*, in which he voyaged along the coasts of Europe a score of years ago, and which, if we remember rightly, so alarmed the officials of the port of Civita Vecchia that they ordered her off. These engines were of the vertical beam variety, of about 1,000 horse power each, with sixty inch cylinders and ten feet stroke. The one at the Continental Iron Works has some of the smaller portions missing; the bright parts are painted over, and it will doubtless some time find an obscure use as a stationary motor. The *James Adger*, in which the other was placed when removed from the steam yacht, will be remembered as the vessel employed in laying the first cable between Newfoundland and the mainland.

The Erie Railway is having built at Chester, Pa., a new iron ferry boat, said to be the first ever designed to cross the North river. The following are the dimensions: length between perpendiculars 180 feet, over all 190 feet. Beam over hull, 36 feet. The depth of the hold 13 feet 6 inches. The power will be furnished by a beam engine with a forty six inch cylinder and eleven feet stroke. The diameter of the paddlewheels is 22 feet and their faces 8 feet, 4 inches. The keel instead of being brought up inside the rudder to form a stern, as in the usual method of construction, is extended beyond the ends of the hull and made to form a rudder guard at each of the ends. The plates at the water line have a thickness of nine sixteenths of an inch, increased at the bows to ten sixteenths. The vessel is to have watertight bulkheads up to the main deck, and is to have iron paddle beams, that is, those supporting the guards at the ends of the paddle boxes. The spring beams which support the outboard bearings or ends of the paddle shaft are also of iron. The keelsons are box keelsons of heavy plate iron, arranged to distribute the weight of the engine upon the bottom. The carriage ways on deck are eleven feet in width. The bows are to be protected by extra framing as well as by the increase herein before referred to in the thickness of the plates. A drop return flue boiler will be put in, as is the case with nearly all or every ferry boat in New York waters.

BRIGHT'S DISEASE.

The medical profession generally divide this terrible disease of the kidneys into two forms, the acute and the chronic. The acute form is a simple congestion of the filtering tubes through which the kidneys perform their organic duty. The chronic form occurs when, through neglect or repeated attacks of congestion, granular degeneration, bringing with it structural alteration of the organ, has supervened. The first is curable; the second, though it may be temporarily alleviated, is fatal.

The New York Times publishes some valuable statistics, extending over a period of three years, which show that the disease is more rife in certain sections of this than in other countries, especially in New York city. During the first year covered by these statistics, the ratio of deaths from Bright's disease to the total number of deaths taking place in that period was as 1 to 66, the following year as 1 to 55, and the third year as 1 to 42. Comparing these figures with the ratios in other cities, we find that in Boston it is as 1 to 93, Rochester as 1 to 73; and in the old world, in London as 1 to 89, in Glasgow as 1 to 142, in Paris as 1 to 266.

It is considered that the prevalence of the disease in this country is due to two leading causes, climate and intemperance. The experiments of scientific men have shown that alcohol is partly cast off from the system, unchanged, through the kidneys. When alcohol is taken to excess, the circulation in the kidneys is disturbed and irritation and congestion ensue. Wine and beer, although exercising no beneficial effect on these organs, do not tend invariably to injure them, but rather to induce gout. Few are aware of the immense quantity of alcoholic liquors yearly consumed in New York. From the 1st of May 1870 to the 30th of April 1871, 7,440 licenses were issued for the sale of intoxicating liquors, the annual fees on which amounted to $340,141.91. Estimating the population of the city at 1,000,000, there is one liquor saloon for every 134 inhabitants, men, women, and children. If all the liquor saloons in the city could be placed side by side they would extend a distance of 26 miles; or if situated on Broadway, they would reach the whole length of the street from the Battery to the end of the island, covering both sides of the way. Deducting the women and children who do not drink, an enormous quantity of liquor must be annually consumed by the remaining men in order to support 7,440 saloons. Whisky is the ordinary beverage drunk, and its effect on the kidneys is shown above. The records of the New York Hospital show that over fifty per cent of the cases yearly admitted for treatment were caused by intemperance in the use of alcoholic beverages.

The trying nature of our climate is another prolific cause of this disease. It has been demonstrated that the malady is confined to that part of the earth in which the change of seasons is most marked, and where the annual mean temperature of the air ranges between 46° and 57°. In the extreme northern part of this continent, where cold is the normal condition of the atmosphere, and in the Southern States, where heat is the normal condition, the disease is but little known. In Bombay, the proportion of deaths is 1 in 2,800; in New Orleans it is 1 in 329, and in Providence, where cold is more prevalent than in New York, 1 in 173.

The acute form of Bright's disease may be produced by any sudden chill of the system, undue exposure, or rapid change of temperature. Unseasonable changes of garments and rapid checking of perspiration both tend to bring it on. It is also induced to a certain degree by gout or disease of the heart; one or two trades are particularly liable to it, especially those who work in lead.

A careful study of the causes of the disease, together with the consideration by the facts advanced above, show plainly that vast numbers of persons who now suffer and die under it need never have known such an affliction. Care in keeping themselves warmly clad, avoidance of sudden chills and reckless exposure, and the observance of the simple rules of temperance, would have saved hundreds from premature graves.

THE BLACK ROCK BRIDGE OVER THE NIAGARA RIVER.

For three years past, both American and English engineers have worked to lay the foundations for the international bridge for the Grand Trunk and Great Western Railroads, at Black Rock, 4 miles below Buffalo, across the Niagara River, to Canada. The entire length of the structure is to be 1,400 feet, consisting of iron spans resting on eight abutments. The tremendous current in the river which rushes toward the falls has rendered the work one of unexampled difficulty. Caissons and foundations have been sunk and immediately swept away by the torrent, while the river banks below are strewn with the *débris* of wrecks, showing a loss of millions of dollars.

The entire past year has been unsuccessfully devoted to attempts to erect the three middle piers in a depth of from thirty-five to forty feet of water. Mr. Otto Meyer, of New York, who last winter was engaged to prepare and sink coffer dams, has finally, however, succeeded in sinking one dam so that the work on its enclosed pier has been commenced. The length of this dam is 125 feet, width 32 feet, and depth, to suit the river, 36 feet. It is sharp on both ends, has double sides, closing at the bottom, forming a space three feet wide around the sides for depositing stones, leaving the center of the dam open for the caisson in which the pier is afterwards built. Eight of the largest anchors and chains from New York and Montreal being secured, one the 13th instant the "ship without a bottom" lay formerly moored six feet above the position of the pier to be built.

Preparations were then made for sinking several hundred tuns of stones, which were thrown in the apertures on the sides of the coffer dam until it had sunk to within eighteen inches of the river bed. A number of barrels had been arranged previously under water and fastened on the woodwork, their buoyancy lifting the structure about two feet; these were all held by one rope, which being cut, caused the barrels to float and submerge the coffer dam deep enough to strike the bottom. Six very heavy iron-pointed posts or "spods," running through sheaths or sockets, three on each side, were hoisted and ready to drop.

Everything being ready on shore and on board, the craft was quietly let "down stream" by her anchors until the engineer on shore signalled "in position." The flag was raised "all right," and with the order "cut away," the barrels floated up, the iron spods dropped, burying themselves in the river bed, and with a light shock the coffer dam rested securely on the bottom of the Niagara, on a deposit of gravel and stones. The gravel and stones have to be removed by a dredge, there ready for the purpose. Below the gravel the solid rock is found on which the piers are to rest.

Three divers from the new Blackfriars Bridge, London, are clearing away the obstructions around the shoeing. They now and then come in contact with pieces of wreck and sunken logs. Until the bridge is finished, the large steam ferry, near Buffalo, continues taking the trains across Lake Erie to the Canada landing.

THE AMANIANS.

The Amania Society is the name of a very flourishing community in Iowa, consisting of fifteen hundred members. They own everything in common, and present an admirable example of the success of the co-operative plan when intelligently administered. These people were formerly known as *Ebenezers*, and lived near Buffalo, N. Y., where they possessed six thousand acres of land. They sold out some fifteen years ago for the sum of five millions of dollars, and moved to Iowa. They are located near Homestead station on the Rock Island and Pacific Railroad, where they own thirty thousand acres of the choicest lands. They have seven distinct settlements, and their affairs are managed by fifteen trustees or fathers. The society is incorporated under State laws. At convenient distances in the settlements they have restaurants, to which the various families resort for food.

The Amanians cling to their good old German ways in dress and general habits, and are not in bondage to the outside world. All have an equal interest in the property; individuals are not allowed anything for their services, or furnished with money for their private use. Each settlement has a store, and all are allowed to draw a certain amount yearly from it for their private wants. A man with a family is allowed from $50 to $70, with $20 for his wife and $10 for each child. This is expected to keep them in clothing and household furniture and supply all their little personal needs. When persons find that the amount appropriated is not sufficient for their actual expenses, the matter can be laid before the Board of Trustees, who will exercise their judgment about making an additional appropriation.

They are a temperate, industrious, religious people, but it is difficult to define their theological views.

A leading principle of the society is that all will get along well together if every one will do right; and in this spirit, everything is managed harmoniously. There is no better theology than this, after all.

It is their custom to meet every day in small companies, about the settlement and in rooms provided for the purpose, to devote half an hour to religious exercises; on Wednesday they meet in the middle of the day; Sundays they all come together in their meeting house for religious services. They do not appear to specially favor marriage, and many of them are living single. When young people wish to marry, they generally receive the consent of the society if they have a reputation for good behavior. If the parties have not succeeded in commending themselves, they are not allowed to marry.

The society owns the whole settlement, and carries on all the business, including that of the lumber yard, store, hotel, etc. They hire considerably on their farm and in their factories, and claim that even in Iowa, with their 30,000 acres of choice land, farming operations do not pay. About three miles from Homestead, on the Des Moines river, they have a fine water power, flouring and woolen mills, and manufacture an extra quality of yarns and fine flannels in colors. The latter goods stand high in market, and are mostly bought up by a few first class retailers in the large cities. The Amanians have a high reputation for uprightness in all their dealings with the outside world, and are much respected.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

PITTSBURGH, Pa., July 2nd, 1872.

Construction of Iron Bridges. Works of the Keystone Bridge Company. Manufacture of glass ware. New iron works. The coal and iron fields. The Siemens furnace.

At the upper part of the city and near the bank of the Allegheny, are the works of the Keystone Bridge Company, where are made a large number of the finest bridges in the country, and where is now in progress the superstructure of the great St. Louis bridge over the Mississippi. About three hundred men are employed here, and an immense amount of bridge work is turned out. The character of the work done at this factory has secured for the firm a reputation that can hardly be affected by anything that we may say; they are everywhere known as the builders of one of the best forms of bridges in use, and as giving the best possible work.

Many tools in use here were designed especially for their work, and are remarkable both for their ingenuity of design and for their simplicity and effectiveness.

In all the bridges built by this company from their own designs, the bolts and links are "upset" at their ends to take the thread or to form the eye; and this work being done