Health of Cities.

Longevity and premature decay are doubtless influenced by the food and general habits of the people, and by temperature and other local atmospheric conditions, although all these may be largely modified and brought under control by attention to sanitary laws and appliances. Artificial atmospheres are, in fact, created in large cities according to the character of the buildings, the air space allotted in them to each inmate, and the mode of ventilation and warming, as well as by the width of the streets, the sewerage, and other sanitary arrangements. Moreover, the hereditary constitutions of the citizens become in after generations affected by the condition of the cities in which they and their forefathers have lived.

The facts and figures before us point to many of the causes for so great a variation in the death rate as has been shown to exist in different cities. A high death rate will in most cases be found to be the companion of defective house accommodation, ventilation, water supply, sewerage, or scavenging. Thus, for instance, St. Petersburg, with a population of nearly a million, and the high death rate of 35·2 per 1,000, is without sewerage, and its water supply is taken from the river Neva, more or less contaminated by percolation from the subsoil. Cairo, with a death rate of 37 per 1,000, is supplied with water from the Nile, having no sewers, and the sewerage filtering through the subsoil into the Nile above the water intake. Vienna, with a death rate of 29·2 per 1,000, has an average of 60 people in each house, or twice as many as in Paris, while the ratable value of the houses in Vienna is only one sixth more than those in Paris. Pekin, with a death rate of 50 per 1,000, is without proper sewerage, water supply, street cleansing, or other proper sanitary arrangements.

Snake Bites and Hydrophobia.

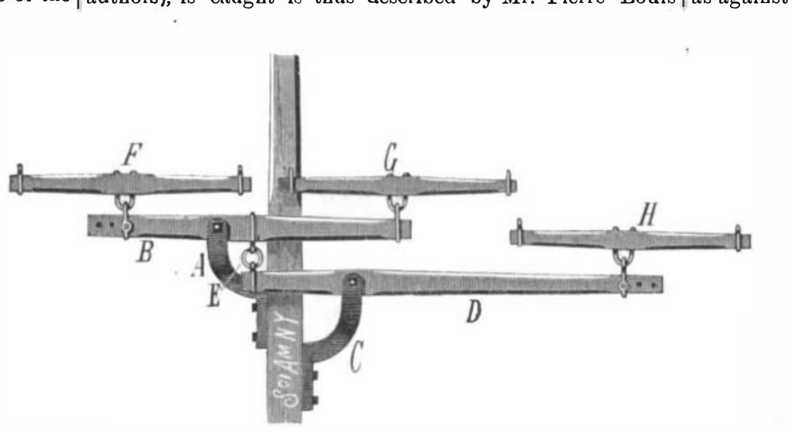
In a recent lecture in New York, Dr. Woodbridge said: "In case of a bite of a venomous serpent, the old historic method of sucking the wound with the lips is one of the first things to be resorted to. If the poison is in the circulation, the use of strong brandy or whisky, in quantities powerful enough to produce intoxication, must be resorted to. The bite of a mad dog should be cauterized at once, by a pencil of lunar caustic or by application of irons heated white. The peculiarity of hydrophobic poison is that it remains in the spot where the bite occurs for several days or weeks, and not until this poison ferments does it become dangerous. Dr. Hewett, a surgeon of London, allowed himself to be bitten no less than eighty times by rabid dogs, each time successfully cauterizing the wound. He fell a victim to his temerity, however, for one day he was found dead with a pistol shot from his own hand. A statement was left in his papers that he had neglected the cauterization too long, and feeling the first symptoms of hydrophobia, he preferred to die without the long agony."

IMPROVED DRAUGHT EQUALIZER.

The engraving represents a draught equalizer for three horses, so constructed that the draught is direct, and each horse exerts a like draught. The arms, A C, are fastened to opposite sides of the tongue, and the pivots in their ends are at equal distances from the tongue. To the free end of the arm, A, is pivoted a double tree, B, to one end of which a single tree, G, is held permanently, and to the opposite end a single tree, F, is held adjustably by a pin which is passed through a clip on the single tree and through one of a series of holes in the end of the double tree. The double tree is pivoted about two-fifths of its length from the outer end. To the free end of the arm, C, is pivoted a double tree, D, on the outer end of which a single tree, H, is held by a pin passing through a clip and one of a row of holes on the end of the tree, D. The inner end of this double tree is connected by loops, E, with the middle of the double tree, B. The double tree, D, is pivoted about one-third of its length from its inner end. The middle horse may have a leverage of two-thirds over the horse on the other side of the tongue, while the horse attached to the tree, H, will have a compound leverage over the middle horse.

By means of the holes in the ends of the two double trees the leverage can be varied to suit conditions. The direct draught of the tongue is in the center of the two draught points. To turn, the horse at F eases up while the horse at H pulls, and the turning in this direction is accomplished without the aid of the neck yoke. The device is simple in construction, and can be quickly and easily adjusted to varying conditions.

This invention has been patented by Mr. John Bowers, of Brookville, Illinois.



BOWERS' DRAUGHT EQUALIZER

Paint for Iron.

The *Neueste Erfinderung* describes an anti-corrosion paint for iron. It states that if 10 per cent of burnt magnesia (or even baryta or strontia) is mixed cold with ordinary linseed-oil paint, and then enough mineral oil to envelop the alkaline earth, the free acid of the paint will be neutralized, while the iron will be protected by the permanent alkaline action of the paint. Iron to be buried in damp earth may be painted with a mixture of 100 parts of resin (colophony), 25 parts of gutta-percha, and 50 parts of paraffin, to which 20 parts of magnesia and some mineral oil have been added.

IMPROVED TRUSS.

The principal feature of the improved truss, hereby illustrated, is the insertion of a "universal joint" into the back pad. This gives an *even, self-adjusting* pressure upon the back of the wearer, thus enabling him to wear the truss for long periods of time without discomfort.

While applicable to all kinds of trusses, it is especially valuable in connection with a direct acting, one side, single rupture truss, as distinguished from a truss which reaches

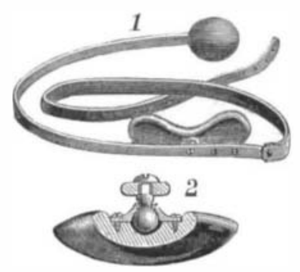


Fig. 1.—BACK PAD.

across and around the body. Such one side, single trusses have heretofore never had any back pad, and the pressure and pain produced upon the muscles of the hips have often obliged the patient to cease wearing his truss when he, perhaps, needed it most. With this device all pressure upon the hips is avoided.

No. 1 shows the back pad attached to the ordinary truss, and No. 2 the universal joint inserted in the back pad.

An improvement in front pads is shown in the accompanying engraving, Fig. 2. This pad gives an inward and upward pressure, similar to that produced by holding one's fingers over the rupture. It also furnishes a gradual resistance to all motions of the abdomen; following the abdomen inward at a mild pressure, when it is drawn in, and

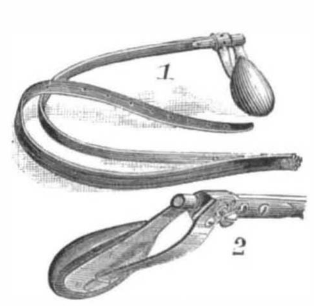


Fig. 2.—FRONT PAD.

giving a very strong resistance when the abdomen, through any variation in the position of the body, is pressed outward. This pad can, therefore, be depended upon to hold a rupture securely under almost any circumstances, and with comfort.

The pad is retained in the same place on the abdomen, and throws any change of bearing from any possible movement of the body upon the variable motions of the spring.

This spring is attached to the end of the hoop over a slanting plate, which gives it a forward direction, and is held in place and guided by a guard on the back of the pad. In the upper end of the pad is a ring fitting loosely on to the end of the hoop, thus allowing the spring to throw the pad easily forward and backward, according to the pressure applied.

No. 1 is a rear view and No. 2 a front view of the device.

These improvements are covered by two patents, and are, therefore, separately applicable to different kinds of trusses. The inventors are Messrs. Darling & Schulz, care of H. A. Schulz, corner De Kalb and Central Avenues, Brooklyn, N. Y.

Catching the "Ai."

The peculiar manner in which this celebrated Japanese fish, which belongs to the Salmonidæ (the Salmo altivelis of authors), is caught is thus described by Mr. Pierre Louis Jouy: After whipping the stream with flies, as for trout, and securing a fish, a fine gut line is passed through the nostrils and fastened to a line held in the hand; trailing behind the fish thus fastened, which is simply a decoy, are several bright hooks which flash in the sunlight and attract other fish. The decoy is now gently led up stream, and the fish, in darting after it, get snagged on the hooks. Horse hoof parings, used as lures, are said to be successful with "ai"; they are also caught with weirs.

Objections to Light Draught for Vessels.

Having stated a few of the apparent advantages of light draught, it is but reasonable to give consideration to the objections as well which may be urged against such a mode of construction.

One is, that such a craft will not hold her wind; she takes such slight hold of the water that when close hauled she will slide off to leeward and lose more than she makes, and in fact with a wind any way but dead aft she will go nobody knows where. For a sailing vessel this would be a fatal difficulty, and even for a steamer one not to be disregarded. But it is surely one easily surmounted. A movable keel is entirely within power of management. Our vessel of 160 feet, drawing five feet loaded with 2,500 tons, can readily add five feet to that draught when in free water. That keel may be, for ease of action, in three or more divisions, each corresponding to our present center board.

The small height of free board, and the consequent liability to be swept by the seas in rough weather were incidentally mentioned in our former article. We have no idea that in working against such a sea as we must expect to encounter at times, especially if we are driving a steamer with speed, dead to windward, we can carry dry decks. We cannot do it with our present models, high out of the water as they are built. But what we contend is this: that the greatly increased buoyancy which we have secured will more than compensate us for the diminution of height. That which causes a sea to break on board is the resistance which it encounters. An air filled globe, like a balloon, could never ship a sea; it would rise instantly over it. That, in its degree, is our full belief concerning the model we have ventured to propose.

Rushing down from a sea, and striking the next one ahead of her, she will from her breadth and lightness begin to rise with the instant, instead of cutting in and down, deeper and deeper, as is now the case. Her bow is buried, as we plan that it should be, but as it buoys itself quickly it shakes off the load and goes over the wave which it has struck, while the real deck, commencing fifty feet aft, even with its slight elevation, sees less salt water than at present.

But the greatest objection which can be urged against the form which is to give us such light draught is the extent of surface which we present to the water for friction, and its consequent resistance. It cannot be denied that the proportion of "skin area" to amount of tonnage capacity is largely increased. It is safe to say that the increase is at least sixty per cent as compared with vessels of a present average model. And if by means of this we have lost speed in the same degree, our plan can expect to find but little favor. We must "make time" at whatever cost. But it is by no means certain that we are going to lose any time. Two important points demand our consideration.

The degree of friction encountered by one of our present deep draught ships is to be measured in part by the amount of her "skin area," but only in part. For a chief factor is the amount of pressure under which that surface acts. The water which she displaces in her progress offers resistance according to the depth at which she acts upon it. That which she is crowding away, fifteen to twenty-five feet down, cannot yield as that does at her water line. Here is where we have in our new form a very great advantage; we are floating, so to speak, on the very surface of the water. We go over the seas, and not through them. The problem involves so many complex factors and relations that no exact results can be worked out except by actual trial. But it is certainly reasonable to consider it.

The second point is this: It is now very well settled as a law of hydrodynamics that a large part of the resistance to a ship's progress is due to the production of waves, from the difference in pressure at the bow and stern as compared with the sides. At a high rate of speed this is reckoned at 30 to 40 per cent of the total amount. Now, as this element resistance becomes necessarily much less in our "skimming dish," we have made a gain which may fairly pass to our credit as against the increase of friction. And it is our own belief that not only equal, but actually superior, speed can be obtained by the surface floating craft. This, however, can be determined only by trials faithfully and patiently made. We hope to see this done. A.

Bridge Receipts for Two Months.

The gross receipts of the Brooklyn Bridge were $76,420 for December and January. Upon the last Wednesday of January, a day of dense fog, the receipts were as follows:

Cars, $1,476; roadways, $286; promenade, $147; total, $1,909. On Thursday they were: Total, $1,697; cars, $1,367; roadways, $218; promenade, $112. On Friday they were: Total, $1,624; cars, $1,294; roadways, $228; promenade, $102. The receipts for the same three days of the previous week were as follows: Wednesday, $1,432; Thursday, $1,207; Friday, $1,385—making a total for the three days of $4,024. The total receipts for the three busy days of last week were $5,230, an increase of $1,206 over the same days of the previous week.

The receipts for December and January were as follows: December—cars, $30,022; roadways, $4,545; promenade, $2,506; total, $37,073. January—cars, $33,192; roadways, $4,246; promenade, $1,909. The increase for cars in January over December was $3,170; decrease for roadways, $299; for promenade, $597; total increase for January, $2,274.

Greek Fire.

At what period the ancient Greek fire was invented has never been certainly determined. There are many writers who place the invention in a far antiquity. Historical details have been adduced pointing to the period of the earlier wars between the Greeks and Romans as the true era of the discovery. But we do not find any certain evidence of the use of Greek fire until the sieges of Constantinople, in the seventh and eighth centuries, though a Father of the Christian Church, writing in the fifth century, gave receipts for making a combustible substance of similar qualities from the compounds resin, sulphur, pitch, pigeons' dung, turpentine, and the juice of the herb "allheal."

It is related that the true Greek fire was invented by a certain Callinicus, an architect of Heliopolis, in Syria (Baalbec) in 678. The secret of the composition of this artificial flame, and the art of directing its action, were imparted by Callinicus—who had deserted from the Caliph—to the Emperor of Constantinople. From this period until the year 1291 the use of Greek fire was an important element in the military power of the Byzantine empire. The progress of the Saracens was, more than once, decisively checked by the destructive action of this powerful and terrible flame. The important art of compounding the fire "was preserved at Constantinople," says Gibbon, "as the palladium of the State; the galleys and artillery might occasionally be lent to the allies of Rome; but the composition of the Greek fire was concealed with the most zealous scruple, and the terror of the enemy was increased and prolonged by their ignorance and surprise."

The accounts which have reached us respecting the properties of the Greek fire are such as to justify the high value attached by the Byzantine emperors to the secret of its composition. It was a liquid, which was propelled by various methods against the ships or engines of the enemy. So long as it was kept from the air, or remained in large masses, the liquid appears to have been perfectly safe from combustion; but as soon as it was poured forth it burned with an intense flame which consumed everything around—not merely burning upward, but with equal fury downward and laterally. Water not only failed to quench it, but made it burn with new ardor. To subdue the flames it was necessary to employ, in large quantities, either sand or vinegar. Various methods were employed for propelling the liquid fire toward the enemy. Sometimes it was inclosed in vessels made of some brittle substance, and these were flung at the enemy by means of suitable projectile machines. "It was either," says Gibbon, "poured from the rampart in large boilers, or launched in red hot balls of stone and iron, or darted in arrows and javelins, twisted round with flax and tow, which had deeply imbibed the inflammable oil." But the effectual use of the destructive compound seems to have been best secured by means of a species of fire ships specially constructed for the purpose. Copper and iron machines were placed in the fore part of these ships. Long tubes, fantastically shaped, so as to resemble the mouth and jaws of savage animals, formed the outlet for a stream of liquid fire, which the engine—literally a fire engine—propelled to a great distance. Hand engines were also constructed by which the destructive compound could be spurted by the soldiers, Beckman tells us.

The secret, as we have said, was carefully kept by the Byzantines. The Emperor Constantine suggested the answers which in his opinion were best fitted to elude the pertinacious questioning of the barbarians. "They should be told that the mystery of the Greek fire had been revealed by an angel to the first and greatest of the Constantines, with the sacred injunction that this gift of Heaven—this peculiar blessing of the Romans—should never be communicated to any foreign nation; that the prince and subject were alike bound to religious silence under the temporal and spiritual penalties of treason and sacrilege; and that the infamous attempt would provoke the sudden and supernatural vengeance of the God of the Christians." Gibbon adds that the secret thus religiously guarded was "confined for above 400 years to the Romans of the East; and at the end of the eleventh century the Pisans, to whom every sea and every art were familiar, suffered the effects without understanding the composition of Greek fire."

This, however, is not wholly true. The secret was preserved, indeed, from the Romans of the West, but the Saracens managed to possess themselves of it very much earlier than Gibbon's account would imply. For, at the siege of Thessalonica, in the year 904, the Saracens, we are told by John Comeniata—threw liquid fire, by means of tubes, upon the wooden defenses of the besieged, and by this means principally succeeded in capturing the town.

In the Holy Wars the Mohammedans freely availed themselves of the use of Greek fire. Gallant knights, who feared little the swords or lances of the Saracen host, were terrified by the uncouth aspect and the hideous noises of machines which belched forth upon them a torrent of liquid fire. Joinville tells us that "it came flying through the air like a winged long tailed dragon, about the thickness of a hogshead, with the report of thunder and the velocity of lightning; and the darkness of the night was dispelled by this deadly illumination."

It does not by any means follow, because the invention of gunpowder rendered the ancient Greek fire no longer a very useful military weapon, that the knowledge of the secret of its composition would be of little value. We must remember that the use of firearms rendered the old fashioned engines, by means of which the liquid was propelled, no longer available, since those who worked the engines could no longer venture near enough to the enemy. It was to this cause, we suspect, rather than to any want of efficiency in the compound itself, that the discontinuance of the use of Greek fire should be ascribed. The time had not yet come for making gunpowder itself a useful adjunct to the employment of liquid flame.

It is not so clear, however, that the ancient Greek fire was much more efficient than that which has recently come into use. Still, the inquiry into the nature of its composition is not without interest.

The Princess Anna Comnena states that Greek fire was compounded of sulphur, resin, and oil. It may be well to dwell on this point, since many writers have been disposed to consider naphtha, or liquid bitumen, to have been the principal ingredient of the Greek fire. Possibly, however, the oil mentioned by Anna Comnena may have been naphtha, and not, as one would be disposed to infer, any of the ordinary vegetable or mineral oils; for the use of naphtha in lamps is of great antiquity.

Gibbon writes: "Naphtha was mingled, I know not in what proportions, with sulphur and with the pitch that is extracted from evergreen firs—that is, resin—in forming Greek fire."

It is a moot point whether Friar Bacon ever discovered the true composition of the liquid fire. Many supposed that he concealed a real ignorance on the subject, when he supplied an apparently unmeaning answer to the questions addressed to him. Others, however, assert that two of the components of Greek fire were, as Bacon said, sulphur and saltpeter, and that the third is to be detected in the logogriph—"Luru vopo vir Can utriet." We leave this anagram to the ingenuity of our readers, mentioning, in passing, that it contains the apropos words, "urit voraciter," but that the extraction of these words leaves us only the combination "lupovun," from which it will not be found easy to form a word. Possibly there is a mistake in transcription to add to the anagrammatic difficulty.

Many others have tried to elucidate the question. Friar Bungay, Charles du Frene, Ducange, and Joinville—a host, in fact, of commentators, historians, and antiquarians—have all had something to say more or less to the purpose. But the satisfactory solution of the problem has not yet been obtained, nor perhaps is it likely to be.

It has been well remarked by a writer on the subject, that "gunpowder blew the ancient Greek fire out of the field." But during the American war of 1860-65, it was shown that gunpowder might be used to blow modern Greek fire into cities. Whether the example will ever become a recognized military precedent is uncertain. But it has been shown that Greek fire may be flung into a city by means of a suitably prepared shell, and that its destructive properties may thus be made available when the besieging force is four miles or more from the central parts of the city. Charleston was certainly not destroyed by General Gillmore's fire shells; in fact, there are difficulties connected with the construction of such shells, which, though far from being insuperable, were not wholly mastered by the artillerists under Gillmore. But that an immense amount of damage was effected is shown by the fact that General Beauregard hurled from the mouth of his cannon denunciations against Gillmore for employing "the most villainous compound ever used in war."

That Greek fire will one day be employed as a fearfully destructive agent in warfare seems scarcely probable. Yet, so far from looking forward with dismay to the prospect of such an application for its properties, we may rather, perhaps, consider that prospect as favorable to the interests of peace. We may apply to this case the remarks applied by Fuller to the use of cannon—"Though some may say that the finding of such appliances hath been the losing of many men's lives, yet it will appear that wars are now fought with more expedition, and that Victory standeth not so long a neuter, before she express herself on one side or the other." —*Knowledge.*

Minnesota Sorghum Amber Cane.

The Minnesota sorghum cane growers have just held their fourth annual meeting at the State University in Minneapolis. The perseverance of the association is remarkable, considering the disastrous results of the past two years. It seems to be agreed that, for a successful crop either of corn or of cane, there must be an average temperature of 70° for 90 successive days. The average for the summer of 1883, in the latitude of Minnesota, was but 67°.

But a new and experimental industry ought not to be discouraged because of such a calamity of climate, by which all crops not harvested before the exceptionally early September frost suffered as well as the cane crop. The problem demanding first attention is that of securing a mature crop; in regard to which the perfection of seed, thoroughness of culture, and elimination of suckers from the mature stems may be considered the most important factors. Hybrids should be sought that are earlier and more hardy even than the celebrated "early amber cane."

Among interesting facts brought out was that, as a sirup making plant, the amber cane may now be considered as nearly perfect. As a sugar making plant, however, it is to be noticed that it yields two sorts of sugars. The crystallizable variety is what we desire, as there is hardly any demand in market for the uncrystallizable. Experiments excite the hope that amber cane may yet be made to yield 10 per cent of the best sugar and but 2 per cent of the inferior sort. It well known that when the sugar beet was first experimented with, about a century ago, six per cent of sugar was the most that it was thought possible to get, whereas under modern methods the yield is from 12 to 15 per cent. This development has been made in the face of difficulties far more formidable than those confronting the champions of amber cane. It should not be forgotten that the seed alone will always pay the cost of the crop, as it yields at the rate of 150 pounds to the ton, and is worth as much as corn. It resembles buckwheat in taste, appearance, and properties.

Prof. Wiley, Chemist of the Agricultural Department at Washington, was present, and gave an address, on the second day, on "The Northern Cane Industry." He began with the statement that foreign sugar is being now imported at the rate of 1,250,000 tons annually, and that, if the home production does not soon increase, the importation will rise to 2,000,000 tons. At present there are four large sorghum sugar factories in the United States, that produced last year an aggregate of 1,000,000 pounds. The speaker averred that the best sirups and molasses in the world are now made out of sorghum canes, the value of which is steadily rising, so that the whole crop of last year sold at an average of fifty cents per gallon. The lingering prejudice against sorghum sirup is due to imperfect defecation; an evil that may be remedied by filtration, heat, and chemical agents. These were minutely described, and the gratifying conclusion reached that amber cane sirup, when properly treated, cannot be made to ferment under any ordinary conditions of temperature and exposure.

It may be added that, while sorghum was introduced into America from China about thirty years ago, it is only about fifteen years since that Mr. E. Y. Teas, while experimenting on some cane seed purchased in Paris, noticed a single head of the canes raised from it, that differed from the rest. The next spring he planted this seed by itself and found that the result was a very early cane, and the sirup made from it was of a fine amber color. In consideration of these qualities it was called "The Early Amber." This new variety was introduced into Minnesota in 1874, by Mr. C. F. Miller, who, together with Mr. S. H. Kinney, has brought the northern culture of cane to its present hopeful condition.

The officers chosen by the association for 1884 are: President, Capt. R. Blakely, of St. Paul; Vice President, Mr. Wyman Elliot, of Minneapolis; Secretary and Treasurer, Prof. E. H. Porter, of the State University.

H. C. H.

Aboriginal Dwellings in Arizona.

An interesting discovery has been made by Mr. James Stevenson, of the United States Geological Survey in Arizona, where explorations have been carried on for some time. It will be remembered that some extensive villages of caves and houses built in the sides of cliffs were found in the same district a year or two ago, and more recent investigations have shown the existence of several others, differing in certain ways from those first observed.

The most curious of the newly discovered towns formed a group of pits, about sixty-five in number, sunk in the volcanic foot hills of the San Juan Mountains. Each dwelling consisted of a central cavity, oval in shape, and about twenty feet in its shortest diameter, with arched roof, and surrounded by three of four smaller apartments communicating with the central hall by passages, but entirely isolated from the adjoining habitations. Access to each of these groups of rooms was obtained through a square shaft, which had holes cut in its walls to serve as steps, and a groove in one side which answered for a chimney flue. The shaft entered at one side of the main hall, and the upper end was surrounded by a fence of loose stones, to guard against the entrance of unwelcome guests.

About fifteen miles from this singular town was found another, consisting of a large number of huts, built of stone, in a sort of horizontal crevice in the perpendicular wall of a deep canon. The houses stood in a single row, with the back against the rocky wall, the fronts and sides only being constructed of large stones laid in clay. A narrow path extended along the front of the houses, and the deserted groups formed almost a continuous line of houses for about five miles along the side of the canon. Many simple utensils of wood and stone were found in the huts, but no inscriptions or other indications of high civilization.

Iron in New South Wales.

In our advertising columns will be found a remarkable invitation addressed to the iron masters of Europe and America by the Government of New South Wales. This prosperous colony is very rich in iron and coal of excellent quality. The Government has within a few years constructed over 1,200 miles of railroad, and more than 500 miles are in course of construction, all the materials for which, except the sleepers, have been imported at a heavy charge in the way of freight, etc., from England. These charges should operate as a large "protection," and afford great inducements to enterprising men to embark in the manufacture of iron and steel in the colony. It is stated that 1,250,000 tons of iron and steel, inclusive of permanent way material, have been imported into New South Wales and Victoria within the last ten years. The Government has determined to make a bold experiment to naturalize the iron industry in the colony, and has, in the terms of the notice which we publish to-day, called for tenders for 150,000 tons of steel rails (or any portion thereof) to be manufactured in the colony from New South Wales ores.