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(Illustrated articles are marked with an asterisk.)

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Table listing sections I through IX, including Architectural, Electrical, Engineering, Marine Engineering, Miscellaneous, Medicine and Hygiene, Photography, Physics, and Technology, with their respective page numbers.

FIRES IN COTTON CARGOES.

According to the records of the British Board of Trade, there have been 171 fires on cotton-laden ships crossing the Atlantic from this country during the last ten years. The cause most frequently assigned for these fires is spontaneous combustion, but the various investigations which have been made have failed to furnish sufficient evidence to establish this as the true cause.

A very serious fire occurred on the Inman line steamer City of Richmond in June last when she was on a voyage from New York to Liverpool. Steam was turned on the burning cotton, and this kept it under control until the vessel reached Liverpool, and had commenced unloading, when the fire broke out again with great fury, insomuch that the space occupied by the cotton had to be filled with water.

This fire, taken in connection with the many which have preceded it, recently caused a spirited debate in the English Parliament. The debate was started by an inquiry as to whether the government intended taking any steps to prohibit the carrying of cotton on passenger ships. In replying to this question, Mr. Balfour said that, in regard to spontaneous combustion being a cause of fires in cotton cargoes, he thought that as the result of inquiries made not only by the Board of Trade, but by the underwriters, by Lloyds and by the shipping community themselves in England and in other countries, this idea was, if not discredited, at any rate much less generally held now than was the case a few years ago.

It is stated that, while there have been one hundred and seventy-one fires in cotton cargoes from this country to Europe during the last ten years, only four fires have taken place in cotton brought from India up to 1887, and since that date there has not been a single occurrence of that kind.

Edward Atkinson, the well known writer on economic subjects, has recently called attention to the alarming increase in the number of fires on ships loaded with American cotton. He says: "American cotton is treated more barbarously, more unsuitably, more wastefully and more dangerously than any other great staple of any kind or than any other kind of cotton in the world. From the time it passes the gin until the time it reaches the factory, the bale is abused. It is badly made; it is badly covered; it is badly cut; it is badly broken; it is rolled in the mud; it is exposed to the weather, and is always in a condition in which it may become most liable to the impregnation of cottonseed oil, and thereby become liable to spontaneous combustion."

In support of the statement that the persons who pack the cotton are guilty of great carelessness, it is shown that at cotton mills where each bale is carefully examined before it is used there have been found oily cotton, cartridges, broken pistols, matches, beer bottles, pieces of grindstones, old hammers and the like. A great deal of American cotton is packed in very coarse gunny cloth, the fibers of which are so far apart that the staple is left exposed. Tightly packed

and well covered cotton is much less likely to catch fire than that which is put together in a haphazard way, and the British Board of Trade reports that it was one of the difficulties encountered in their inquiries that if a spark fell upon cotton, it was often proved that the fire ran along the edges of the bales until it came upon some half packed bale, where it settled.

While persons interested in shipping claim that cotton is just as safe a cargo as anything else, it is seen that special precautions are taken to guard against fire. One of the officials of the Norddeutschen Lloyd line recently stated that when cotton is carried in one of the steamships of that company it is placed in a special apartment, where a fire can be flooded out speedily. A representative of the White Star line stated that great care was taken with cotton. No smoking was allowed while the men were stowing it, and it was placed away from the boilers. When it has to remain for any time on the wharf it is carefully covered and watched.

Some months ago a fire occurred on the Britannic while the vessel was at sea. The ship was stopped and a few bales were thrown overboard. The fire was believed to have been in the cotton, but it was not known exactly what started it. Within a month or so of this occurrence there was a small fire on the Britannic as she lay at her pier. It was supposed that oil had gotten into some cotton; since which time orders have been given not to accept oil, resin, and other inflammable goods as freight, no matter whether there is any cotton in the cargo or not.

The underwriters, who annually pay out in losses for fires in cotton cargoes many times the amount of premiums received from such risks, have naturally given considerable attention to tracing the causes of such fires. An officer of one of the largest companies in New York stated recently to the writer that the numerous fires which have occurred in cotton cargoes are, in large measure, due to lack of care in packing the staple in bales and stowing it in the holds of vessels.

The English Parliament has gone so far as to consider the question of prohibiting steamships which take passengers from carrying cotton. If such a law were enacted, a profitable line of business would be made unavailable for these vessels, whereas if the cause of the numerous fires is really due to careless handling of the cotton in this country, of which there seems to be very little doubt, the remedy should be promptly applied here, so that this menace of fires in cotton cargoes may be removed.

THE CONTAGION AND RAPID SPREAD OF LEPROSY.

In continuation of the article in the last SCIENTIFIC AMERICAN (Sept. 19), I desire to point out the most likely cause of the introduction of the taint into non-leprous blood, and to call attention to a danger which I believe is now becoming imminent. Agnes Lambert, whose recent epitomization of the literature of this subject has attracted much attention in England, has these pertinent words to say: "Is it not, then, a wonderful thing, not that a cure has not yet been discovered for leprosy, but that with men of science it is still an open question whether leprosy is communicable or incommunicable, contagious or hereditary; whether it is due to insufficient and bad food, or bad climate and dirt, or all combined; to a lack of meat or the absence of vegetable diet; to the use of salt fish or the want of salt? Such, however, is the case!" As Drs. Sir Morell Mackenzie, Vandyke Carter, Sir Erasmus Wilson, Munroe, Wynne, and Rev. Ignatius Grant have pointed out or tacitly admitted in their writings, this uncertainty and the rapid spread of the contagion in the last quarter of a century is very directly attributable to the unfortunate haste which led the Royal College of Physicians of London to issue their misleading and now famous report in 1867. The many data of a negative character, which came in to the college through the medium of the world-wide consular and colonial service of the English government, were allowed to outweigh the comparatively few of a positive nature, though the latter were of a most unmistakable kind. So they reported that it was not to be regarded as a contagious disease and that there was no pathological warrant for leprosy, segregation or any laws affecting the freedom of the leper. To again quote Mackenzie: "The leper houses throughout her Majesty's domain were thrown open. Each discharged its measure of pollution into the stream of healthy life near it. \* \* If leprosy slew its thousands before, it has slain its tens of thousands within the confines of the British empire since 1867."

Where Great Britain led, there nearly all of the Americas, save where French or German influence were more potent, followed; and the consequence has been the fearful strides which this disease has made. Since then the terrible fate of Damien and many of his followers; of Keanu, the Hawaiian convict, who was given the choice between inoculation with the leprous virus and death, and who, choosing the former in 1885, was in 1888 far advanced in the tortures of the disease; and scores of less famous cases, completely dis-

prove the stand then taken by the Royal College, and it is doubtful if to-day a single one of their committee of that time could be found to defend that position in the light of recent facts. That report, however, forever did away with any of the theories which had for so long done duty in attempting to account for the exciting cause of leprosy. That it thrives in frigid Norway and Upper Canada, along the torrid Amazons and in Ceylon; in interior India, where fish is rarely eaten, and in the West Indies, where it is the commonest animal food; in Oahu, where cleanliness is now reduced almost to perfection, quite as well as in Hayti, where the word clean must have become obsolete; as well among the pork-eschewing Jews of Jamaica as the pig-loving natives of Tahiti, proves that in climate, soil, and food we will hunt in vain for its origin.

Dr. Wynne, of the Robben Island leper farm, Cape Colony, sheds much light on this obscure subject, when he writes: "Until I came to Robben Island, I was not aware that this [communication of leprosy to animals] might be possible, for I had never even heard of its being probable. \* \* Two years ago I shot some two dozen pigeons. \* \* Among them I found two suffering from leprosy, with the bowed legs and incurved claws and with nodular or hypertrophied articulations. \* \* From time to time leper mice have been caught in the leper wards, presenting the usual characteristics of leprosy. \* \* I am indebted to Cæsar Africanus for calling my attention to some young pheasants suffering from the same affection. \* \* An old turkey cock may be seen to-day prowling about the doors of the leper wards affected with unmistakable leprosy. Several young turkeys limp about with him showing the same symptoms."

There is but one way in which pigeons, turkeys, mice, etc., could become thus tainted, *i. e.*, by eating food handled by lepers. And this should speak volumes to the people of the United States on this question. If the terrors of trichinosis can warrant our French and German cousins in closing their markets to our pork, what may we not claim as our right to legislate regarding the leper-handled products of the north torrid zone which is just south of us? Trichina kills one patient, and quickly; lepra, while it usually results in a living death that may last for a score of years, is too apt to leave its seed behind in the innocent progeny. I know it will at once be urged that we have been getting tropical fruits and other supplies from the West Indies in large quantities for over two decades and that no harm has yet resulted. To this I would reply that it is a well known characteristic of this disease that it may lurk in the system for many years before becoming apparent even to the victim.

Cases are on record where a wife has lived for ten years with a leprosy husband, before any indication of the taint was observable in her; or where children have almost reached maturity before its inherent effects became manifest. Father Damien was some years with the lepers of Oahu before he discovered his own impending doom by spilling scalding water on his foot and finding that it gave him no pain; a French creole, never suspected of nor suspecting the leprous taint, had a deep hole eaten into his thigh by rats during the night, and not until it was discovered did he realize that eight years before he must have contracted the contagion which had thus killed sensation; and, further, it may be replied to this claim that these cases prove not alone that the taint is long in manifesting itself, but that medical skill is often deceived for years by the symptoms of the disease. I myself have acquaintance with an American physician, a graduate of one of the leading medical schools of this country, and a licentiate of the Royal College of Physicians, who married into a leprous creole family in the West Indies, though the taint had maimed the bride's father, was very observable in a sister and had carried a brother to an early grave. Yet he was blinded to its nature and confidently announced his ability to cure the trouble, which he considered to be of a mild scrofulous nature. He has since that had dread cause to repent his very imperfect diagnosis. I mean no disrespect to American and English medical men when I emphatically state that I do not believe that there is one in one thousand of their number who is able to detect leprosy in its early stages; and perhaps not one in ten of that small number would know what it was best to do with a leprous patient.

Even to-day, the men in New York who have to deal with this problem in carrying out the laws affecting contagious diseases are not agreed as to whether a loathsome, pest-ridden Chinaman shall be isolated or allowed the same freedom as is given to the uncontaminated. In Jamaica, one member of the Royal College sends all patients coming under his notice to the Lepers' Hospital, at Spanishtown, while a local magistrate, acting under the results of the College's report for 1867, allows a woman whose fingers are fast disappearing to sell fruits and nuts to the passing school children. In St. Kitts the medical authorities allow a leper to teach school, and in Trinidad a medical board recommend entire segregation. A railroad in India leaves one terminus from a station where a leper punches the tickets and hands them back to the travel-

ing public, and at another station a leper, whose hands are so far gone as to compel him to wear gloves in the streets, cooks the food at the railway restaurant. Yet, between these stations there is a segregation settlement, where leprosy is sternly dealt with. These are from among many instances of the present total lack of agreement and knowledge on the part of the Anglo-Saxon medical profession in this respect.

In this country we consume over \$4,000,000 worth of bananas, over \$2,000,000 of oranges, over \$1,600,000 of minor tropical fruits, over \$15,000,000 of tobacco, and smaller quantities of other like products, which come from lands where leprosy is well known. I have frequently stood on wharves in Jamaica and noted pronounced cases of leprosy going by in ceaseless rounds carrying bananas from the store house to the loading vessel. I have stood in a South Cuban port and watched a leper, with but three fingers left on the right hand, and those badly eaten with leprosy, rolling cigarettes for exportation. The researches of Dr. Armauer Hansen, of Norway, the discoverer of the leprous germ, *Bacillus lepræ*, are quite sufficient to show that bananas or tobacco so handled are far from being safe articles of importation. Unless special precautions are taken to avoid eating the exposed parts of the banana, not completely covered with the skin, the risk, though it may be very, very slight, is nevertheless existent. The cigarettes should be entirely shunned. The American-made article is sufficiently injurious in its effects. If the smoker must tempt fate, let him content himself with the domestic product.

If this is a danger—and I believe I have greatly understated it—have we no right to notify such countries as Trinidad, Demerara, Barbados, Haiti, Jamaica, Cuba, Mexico, and others whence we desire a constantly increasing supply of food products, that the time has come for them to deal with this problem in a firm and enlightened manner, if they would retain our trade? It is bad enough to visit a presumably enlightened land, such as Jamaica, for instance, and find a partner in whom the taint is becoming evident facing you for the dance at a governor's ball; from that the panic-stricken dancer may flee, though with hands on which the skin is unbroken, he probably runs no risk if his ablutions be thorough afterward. But how shall we be protected against the employment of lepers in the handling and manufacturing of our food products? That surely calls for attention from our State Department. H. P.

POSITION OF THE PLANETS IN OCTOBER.

JUPITER

is evening star, and, though losing a little of the prestige that marked his course in August and September, still retains his position as monarch of the starlit October nights. Observers will notice a change in the time of his appearance. He is high above the horizon when it is dark enough for the stars to come out, and sets in the small hours of the morning. He is on the meridian at 8 o'clock, and sets about half past 1 o'clock on the 31st. His diameter has decreased about 5".0 since opposition, but it makes no perceptible difference in the brilliancy of his light. The prince of planets is leaving us, and traveling toward the sun; the earlier rising and setting and the lessening diameter are the tangible proofs of his obedience to the great central orb, who sways his course as irresistibly as he does that of the tiny atoms of a meteor swarm.

The moon is in conjunction with Jupiter three days before the full, on the 14th, at 6 h. 46 m. A. M., being 3° 57' south.

The right ascension of Jupiter on the 1st is 22 h. 48 m., his declination is 9° 14' south, his diameter is 46".2, and he is in the constellation Aquarius.

Jupiter sets on the 1st at 3 h. 29 m. A. M. On the 31st, he sets at 1 h. 22 m. A. M.

URANUS

is evening star until the 25th, and then morning star. He is in conjunction with the sun on the 25th, at 6 h. A. M., when he makes his appearance on the sun's western side and commences his role of morning star. The synodic period of Uranus, or the time it takes him to travel from conjunction to conjunction, is 369 days, while his sidereal period is 84 years. It will be noticed that the more distant a major planet is from the sun, the shorter is its synodic period, for, the slower the planet moves, the less space will the earth, after completing a revolution, have to travel to come into line with the planet and the sun. In the case of Jupiter, the synodic period is 1 y. 34 d.; for Saturn, it is 1 y. 13 d.; for Uranus, it is 1 y. 4 d.

Uranus while evening star is in conjunction with Venus on the 17th at 1 h. 40 m. A. M., being 21' south. He is in conjunction with Mercury on the 26th, the day after he becomes morning star, at 7 h. 31 m. A. M., being 10' south.

The right ascension of Uranus on the 1st is 13 h. 53 m., his declination is 11° 7' south, his diameter is 3".4, and he is the constellation Virgo.

Uranus sets on the 1st at 6 h. 30 m. P. M. On the 31st, he rises at 5 h. 57 m. A. M.

MARS

is morning star and is slowly making his way toward the earth. Saturn overtakes and passes him on the 12th, when the planets are in conjunction, at 10 h. 25 m. P. M., Mars being 52' south.

The right ascension of Mars on the 1st is 11 h. 14 m., his declination is 6° 11' north, his diameter is 4".0 and he is in the constellation Leo.

Mars rises on the 1st at 4 h. 7 m. A. M. On the 31st, he rises at 3 h. 44 m. A. M.

SATURN

is morning star. The noteworthy event in his October course is the reappearance of his ring on the 30th. The plane of the ring then passes through the sun, its northern surface comes into the light, and the southern surface enters into shadow. The ring continues to open until in about seven years it is open to its widest extent, then gradually closing, it becomes again invisible about 1906. Saturn rises at the close of the month three hours and a half before the sun, and may be found north of the star Beta Virginis.

The moon is in conjunction with Saturn on the 1st, the day before her change, at 7 h. 26 m. A. M., being 2° 59' north.

The right ascension of Saturn on the 1st is 11 h. 36 m., his declination is 4° 41' north, his diameter is 15".0, and he is in the constellation Virgo.

Saturn rises on the 1st at 4 h. 32 m. A. M. On the 31st, he rises at 2 h. 52 m. A. M.

VENUS

is evening star. There is little to be said of her as she makes her slow progress eastward from the sun, keeping so close to him that there is only an interval of twenty-seven minutes between sunset and the time of her disappearance below the horizon.

The new moon of the 2d is in conjunction with Venus on the 3d, at 2 h. 18 m. A. M., being 2° 36' north.

The right ascension of Venus on the 1st is 12 h. 45 m., her declination is 3° 30' south, her diameter is 10", and she is in the constellation Virgo.

Venus sets on the 1st at 5 h. 47 m. P. M. On the 31st, she sets at 5 h. 21 m. P. M.

MERCURY

is morning star until the 27th, and then evening star. He is in superior conjunction with the sun on the 27th at 9 h. 35 m. P. M., when he completes his synodic revolution of 116 days, and comes into line with the earth and sun, being beyond the sun and at his greatest distance from the earth.

The moon is in conjunction with Mercury on the 1st at 2 h. 12 m. A. M., being 3° 31' north.

The right ascension of Mercury on the 1st is 11 h. 34 m., his declination is 4° 41' north, his diameter is 6".2, and he is in the constellation Leo.

Mercury rises on the 1st at 4 h. 29 m. A. M. On the 31st, he rises at 6 h. 47 m. A. M.

NEPTUNE

is morning star. His right ascension on the 1st is 4 h. 30 m., his declination is 20° 6' north, his diameter is 2".5, and he is in the constellation Taurus.

Neptune rises on the first at 8 h. 27 m. P. M. On the 31st, he rises at 6 h. 29 m. P. M.

Mars, Saturn, Uranus, and Neptune are morning stars at the close of the month. Jupiter, Venus, and Mercury are evening stars.

Railway Conductors' Exhibit and Fair.

A unique sort of an exhibition and entertainment is to be held at New Haven, Conn., during the week commencing October 12, for the benefit of a society of railway conductors and the members of their families. It will be an exhibit and fair under the management of officials of different railway divisions in Connecticut, including the New York, Hartford, Shore Line, Air Line, Northampton, Naugatuck Valley, Housatonic, Danby and Norwalk, and New Haven and Derby, and others. Inventors and manufacturers of railway appliances and supplies of all kinds are invited to exhibit their productions, applications for space to be made to Mr. John McCarthy, 63 Church Street, New Haven.

A Bow Propeller.

An exhibition of a method of propulsion devised by Mr. Thomas Mills, of Queensland, was recently given in Glasgow. Mr. Mills' invention consists in the placing of the propeller at the bow instead of the stern of the ship. He states that he has made the change for two reasons—first, that the revolution of the screw propeller in its ordinary position at the stern of the vessel produces a vacuum, which must be filled by the inrushing water ere the ship obeys the forward impulse; and second, that the water at the bow of a ship offers resistance to its movement. Mr. Mills thus places his propeller at the bow. The shaft is carried through the bow, and carries a conical propeller with a diameter nearly as great as the beam of the ship. The outside of the cone consists of webs projecting at right angles to the surface, and arranged in a spiral. The action is thus a boring action.