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(Illustrated articles are marked with an asterisk.)

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A BULL ON THE TRACK.

When George Stephenson was before a committee who were inquiring into the nature of his locomotive, one farmer committee man, after hearing that probably the unexampled speed of twelve miles an hour would be attained, and realizing that the machine could not leave its rails, sagely remarked: "But, Mr. Stephenson, supposing cows should get on your track, before your engine?" "Well," replied the inventor quietly, "it would be bad for the cows."

If the questioner had framed his query to refer to bovines of the masculine gender, subsequent experience has shown that Stephenson's reply might well have been otherwise; for while the average cow is not run over, as a rule, except involuntarily, bulls have over and over again scorned to fly from locomotives, and, while being killed themselves, have wrecked the aggressive train. A remarkable instance of this happened recently in Virginia, just as a heavy freight train was approaching a bridge. A bull, with mane and tail erect, placed himself in the middle of the track, breathing fierce defiance. The engineer put on the brakes and blew his whistle; but the brute lowered his head and refused to stir. It was impossible to stop, and the engine struck the animal just as it was passing on the bridge, left the rails, and was precipitated on the trestle work, which gave way. The locomotive, tender, and six freight cars went down into the abyss, the boiler exploded, and the bridge and cars in a few moments were in flames. The bridge, which was 120 feet long, was entirely consumed, the locomotive of course was ruined, and the engineer was mortally injured. The loss to the railroad company amounts to over \$8,000. What became of the bull is not stated.

Mr. Herbert Spencer, in discussing the subject of the distinction which brutes are capable of making between animate and inanimate objects, says that, where intelligence rises beyond the merely automatic, the motion implying life begins to be distinguished from other motion by spontaneity. That the spontaneity of motion serves as a test, he considers, is clearly shown "by the behavior of tame animals, and even of wild animals, in presence of railway trains. In the early days of railways, they showed great alarm; but after a time, familiarized with the roar and swift motion of this something, which, appearing in the distance, rushed by and disappeared in the distance, they became regardless of it." This implies that the knowledge acquired by cattle in the early days of the locomotive is hereditary, which is in accordance with Mr. Darwin's well known deductions from observation of other traits, transmitted from generation to generation, in hunting dogs and other trained animals. But in the case of brutes in which there exists great pugnacity, such as bulls, it would seem that the sentiment of anger is, as in the case of man, strong enough to overpower the knowledge which is analogous to reason. There can be traced in man, besides, the same tendency to think, in moments of rage, that objects, which he knows to be inanimate, are animate. Made angry by resistance to his efforts, he may in a fit of anger swear at some senseless thing, or dash it to the ground, or kick it. "But," to quote Mr. Spencer again, "the obvious interpretation is that anger, like every other strong emotion, tends to discharge itself in violent muscular actions, which must take some direction or other;" and the same author goes on to show that, as generally the object of wrath is a living object, to the injury of which the muscular exertions are directed, so this same muscular discharge is, by force of association, turned upon an inanimate thing. The similarity of behavior under such like peculiar conditions, between man and the brutes, seems to add another link to that connection between human beings and the lower orders which the evolution theory aims to establish.

DUAL LIFE.

We have already discussed in some detail the curious mental condition of persons who apparently possess two distinct mental lives. To such individuals the events of the abnormal life are a blank while existing in normal state, and vice versa. Dr. Brown-Séquard has advanced the hypothesis that this phenomenal condition is a consequence of our two brains, of which he believes we ordinarily use but one, leaving the other nearly unemployed.

The Greenlanders have a queer belief that the shadow, which by day accompanies us wherever we go, at night wanders away and has adventures. This odd superstition regards the quality of life from another standpoint than the almost purely physically one of Dr. Séquard; and Mr. Herbert Spencer, in his new work on "Synthetic Philosophy," devotes some close reasoning to the primitive idea of our possessing an alter ego, and to the question of whether we do not form a conception of a mental self through the incomprehensible experiences of dreams. Dreams, he says, cannot be interpreted as we interpret them, in the absence of the hypothesis of mind as a distinct entity; and this hypothesis cannot exist before the experiences suggesting it. There are dream experiences, which seem to imply two entities; and such a supposition involves the notion that the second entity differs from the first simply in being absent and active at night while the other is at rest. Only as this supposed duplicate, once thought of as like the original in all things, becomes gradually modified by the dropping of physical characters irreconcilable with the facts, does the hypothesis of a mental self become established.

It is a notable fact that this belief in the duality of self is constantly found among savages, and that they bring the same forward in explanation of the peculiar states known as swoon, catalepsy, etc., in which animation is suspended—as

well as for sleep. Insensibility following a blow or violent exertion, the Fijian believes, is due to the duplicate self wandering away from the body; and as the desertion is more determined than in the case of sleep, the return of the duplicate is followed by silence as to what has been seen or done in the interval. In our own common speech, we show the way in which syncope yields seeming verification of the primitive notion of duality. We speak of one who revives from a fainting fit as "coming back to himself;" we use the term "absent-minded" or "abstracted," literally meaning drawn away. "Wits gone wool-gathering" is an apt vulgarism in point. All of these terms clearly express the idea of something having departed from the present self, for a time.

In apoplexy, the patient suddenly falling betrays a "total loss of consciousness, of feeling, and of voluntary movement;" there is snoring as in deep sleep. Yet the sufferer cannot be "brought back to himself" by ordinary means, and the savage witnesses such effects, and, recalling his dream experiences, believes that the second self has gone away for a time beyond recall. Some time afterwards there is a like prolonged insensibility, and then revival, and another silence as to what has happened in the interval; on the third time, the absent something does not return.

Similar in the suddenness with which it commences, but otherwise dissimilar, is the state of insensibility called catalepsy. Instantaneous loss of consciousness is followed by a state in which the patient "presents the air of a statue rather than that of an animated being," and control of the members is lost. There is no recollection of occurrences during the attack; and interpreting the facts according to their primary meanings, the wandering other self will give no account of its adventures. The Chippewas, believing in the journeying of souls, think that those of persons in a trance, "being refused a passage, return to their bodies and reanimate them."

There is still another state of insensibility which has shown itself repeatedly of late among persons who have been profoundly impressed by the religious revivals. We refer to ecstasy, in which the subject shows that he is "not himself," and seems to have vivid perceptions of things elsewhere. During this state, in which the muscles are often rigid, and there is a total suspension of voluntary motion, visions of an extraordinary nature occasionally occur. These phenomena tend to strengthen the primitive belief that each man is double. All the various phases of coma, from a state of slight drowsiness up to permanent and profound stupor, are similarly interpretable.

It will be seen, from Mr. Spencer's reasoning before given, that the supposition peculiar to the savage is not without some justification; and if the prevalence of a hypothesis is any support, this is certainly one most widely extended. The Fijian may sometimes be heard to bawl out lustily to his own soul to return to him. Among the Karens, a man is constantly in fear lest his other self should leave him: sickness or languor being regarded as signs of its absence. Among the northern Asiatic tribes, disease is ascribed to the soul's departure. By the Algonquin Indians, a sick man is regarded as having his "shadow" "unsettled or detached from his body." Like interpretations are met with among the Australians and Tartars. A remarkable instance of the survival of the primitive idea that the soul leaves the body during sleep is instanced among certain Jewish sects: where the prayer on awakening is one of thanks for the return of the soul, and an immediate duty is the washing of hands and face to cleanse away the impurities of this minor death.

THE CENTENNIAL SURPLUS.

Congress, prior to the opening of the Centennial, appropriated \$1,500,000 toward defraying the expenses of the same, and provided that, after the debts of the Exhibition had been paid, the United States should be reimbursed before any profits should be distributed among the stockholders. After the Exposition was over, the Centennial Board of Finance declined to refund the above sum to the National Treasury out of the funds on hand, on the ground that the same could be reclaimed by the United States only after the accruing of profits, and that, as no profits had accrued, the Exhibition not having paid expenses, the United States was barred from taking any part of the balance in the hands of the Board, and that said balance was the property of the stockholders and was divisible only among them. Issues were framed, and the controversy put in action in the United States Circuit Court, which rendered decision in favor of the stockholders. The Government then appealed, and the judgment of the Supreme Court, delivered by the Chief Justice, reverses that of the court below, mainly on the ground that the act of 1876 "appropriated moneys to be paid back under certain circumstances, and the accepting of them only by the Board of Finance created a liability to repay it by the act of 1872." The assets of the corporation were to be divided among the stockholders only after the payment of all liabilities; and unless the contract entered into otherwise provides, it is clear the United States must be paid in full before the stockholders can claim distribution among themselves. The million and a half of dollars will therefore be paid into the United States Treasury.

This decision will, it is said, materially affect the interests of the permanent Exhibition in Philadelphia, as the subscription to that enterprise consisted in large part in Centennial stock worth some \$500,000 at par. It was expected that \$300,000 could be realized thereon; but now it seems that its value is but 30 cents on the dollar, so that the available capital, including \$130,000 in cash, amounts to but

about \$280,000. The preparations for opening will not be interrupted, and it is thought that the future income from admissions will be ample to insure the success of the undertaking.

ALLEGED MAGNETO-PHOTOGRAPHY.

Mr. William Brooks has recently communicated to the South London Photographic Society some astonishing statements (which we find in both the *Photographic News* and the *British Journal of Photography*) regarding impressions which he claims to have obtained in a sensitive plate exposed in total darkness to the influence of a magnet—said impressions being analogous to those due to light. The probabilities are that the investigator has overlooked conditions in his experiments which would give another and more likely cause for his results; and certainly no one will accept the latter according to his interpretation, in the absence of proof of the most convincing and conclusive nature.

Mr. Brooks places a horseshoe magnet, about 8 inches in length, poles uppermost, in a dark box. Over the poles, and about three eighths of an inch distant, he suspends a card blackened with Indian ink on both sides, and pierced with certain letters and geometrical figures. One eighth inch above the card, he places his sensitized plate, so that the latter is thus half an inch distant from the magnet. The exposure lasts from three to fifteen minutes, after which the plate is removed and developed. Where the perforated parts of the card have not intercepted the magnetic *aura*, or influence, or mode of motion, or vibration (the reader may choose his own term), sometimes a negative and sometimes a positive image is developed, as if ordinary daylight had had access to the plate. It will doubtless astonish many to find that a card is capable of intercepting magnetism, as it is currently believed that that natural force acts through all interposed bodies—as would be inventors of magnetic cut-offs have discovered to their confusion. But this is not ordinary magnetism—it is *aura*—the imponderable agent which Reichenbach conceived and supposed to emanate from most substances, and to affect people as well as sensitive plates. Mr. Brooks wisely offers no opinion on the matter; but not content with the remarkable statements already made, he adds that upon his plate appeared a portion of a word, which was not in perforated letters on his card screen. After examining the latter with great care, he discovered that the word was printed on the card, but was illegible except when the card was held at an angle, and then only very faintly, being thickly covered with Indian ink. This spoils a good story by making it too strong. If the card intercepted the magnetic *aura* so that the same could only act through the perforations in the first case, how could the same influence, acting on another part of the card at the same time, go through that card where the printed letters were impressed? And why did it not reproduce all the printing on the card instead of selecting a portion of a word? There is a mysterious discrepancy about it all, which makes us think that Mr. Brooks is a "medium."

REMARKABLE RESULTS OF EVAPORATION AND RAINFALL.

The general belief that all dry land on the earth's surface must necessarily be above the ocean level is erroneous. Land is above the level of the sea only where there is a direct water communication, by the drainage streams of the district, with the ocean. But there are many instances where such a communication does not exist; and in such cases the drained surface may as well be below as above the general ocean level, where there are depressions in the soil. Large regions that are below the ocean level will not necessarily be entirely filled with water, because as a rule the amount of evaporation far surpasses the amount of rainfall. To realize this fact, we have only to consider that one quarter of the terrestrial surface is land and the rest is water; and it is certain that the evaporation from the land cannot amount to much, compared with that from the aqueous surface. It is true that vegetation throws some watery vapor into the air; but on the other hand vegetation consumes a great deal of water, the elements of which are fixed in the plants. We may assume, therefore, that the evaporation from three quarters of the earth's surface, occupied by ocean and lakes, provides all the water falling on the whole; therefore, as a rule, the evaporation from a given surface of land surpasses the amount of rainfall. The former differs for every climate, but is for each special belt of latitude a much more constant quantity than the amount of rainfall, which, by peculiar local circumstances, such as mountain chains, air currents ascending from arid plains, etc., is often so much interfered with as to leave in some places rainless regions: such districts are the southern extremity of California, and New Mexico, near the mouth of the Colorado river, and there is another in the center of the Mexican Republic, and still another in a very elongated strip of land with its neighboring sea extending along the western coast of South America, from Peru to Chili. A larger surface of this kind is found in Central Asia, in and around the great desert of Gobi or Shamo, situated in Mongolia and Chinese Tartary. But the largest rainless surface is that which extends in Northern Africa, beginning some 300 miles inland from the western extremity, over a width of not less than 1,000 miles in an east by north direction. It covers a large part of Egypt and the surrounding lands, including Arabia, and a narrow belt of it passes through Asia and Persia. In the last named country, a long strip of country, extending some 200 miles on each side of the 70th meridian of longitude east of Greenwich

separates it from the next largest rainless region of Central Asia, mentioned above.

On the other hand, there are a few regions of perpetual rain. These appear to be, as far as they are known, Cape Horn, at the southern extremity of South America, and the neighborhood of Sitka, at the southern part of Alaska Territory, which formerly belonged to Russia, but which now forms part of the United States. It follows, therefore, that over the rest of the earth the fall of rain must be very unequally distributed; and we have compiled a series of observations as follows, which gives the average rainfall per year in inches for several localities.

No. of inches falling per year	Locality.
13	Erfurt, Germany.
16	Cambray, France. Upsala, Sweden.
17	St. Petersburg, Russia. Copenhagen, Denmark. Toulon, France.
18	Brussels, Belgium. Francke, Holland.
19	Stockholm, Sweden.
20	Marseilles, France. Coblenz, Germany. Glasgow, Scotland.
25	Rotterdam, Holland. Strasburg, Germany. Lisbon, Portugal.
30	Funchal, Madeira. Rome, Italy.
35	Liverpool and the Isle of Man, England.
40	Mafra, Portugal. Florence, Italy.
45	Dover, England. Genoa, Italy.
80	Bergen, Norway.
110	Coimbra, Portugal.

At the western limit of the rainless region of Central Asia are situated several lakes, receiving their water supply from rivers; these lakes are without communication with the ocean, but they are all situate on a table land, some of them many hundred feet above the ocean level. But they all dispose of their supply of water by evaporation.

Every such locality forms a water system by itself, surrounded as it is on all sides by mountain ranges, without any local depression to permit the exit of the water; thus all the rain received must necessarily be disposed of by simple evaporation.

When we proceed westward from these lakes of Central Asia, the elevation becomes less and less until we reach the Sea of Aral, which is the largest of these inland seas, covering about 10,000 square miles; its surface has been found to be only 21 feet above the level of the ocean, while our Great Salt Lake in Utah is not less than 4,220 feet above the sea. Proceeding further west, the ground is still more depressed, and gives evidence that a gradual sinking has taken place towards the shores of the Caspian Sea, which at its nearest point is scarcely 100 miles west of the Sea of Aral, but of which the surface is 112 feet below that of Aral, and 86 feet below the level of the ocean. It is the largest body of water in existence which has no communication with the ocean. It separates the southeastern extremity of European Russia from Asia, and it covers a surface of about 100,000 square miles; it is separated by a high mountain chain from Persia, a great portion of which empire is situated in the largest of the four or five rainless belts. This belt extends through the whole of Central Africa and Southwestern Asia, as far as the sources of the river Indus. This sea, therefore, receives no supply of water of any importance from the south; and on its eastern side only one river of any importance empties itself into it. This river is the Attruck, which has its source in the Persian mountain chain mentioned. The western shore receives the waters of several rivers, among which are the Kooma, the Terek, the Koor, the Avan, etc.; but the northern side receives an enormous amount of water from two large rivers, the Volga and the Ural. The first is the largest river of Europe, having a length of 2,300 miles; it drains a surface of not less than 640,000 square miles, more than half the area drained by the Mississippi and the Missouri, and more than the whole of the watershed of the mighty St. Lawrence, which with its chain of large lakes drains a surface of 600,000 square miles. The latter river, the Ural, which belongs as much to Asia as to Europe, forming as it does a part of the southern boundary between the two continents, has a length of some 1,050 miles, and drains a surface estimated to be nearly equal to that of the Caspian Sea. East of the Ural, several other considerable rivers, each about as large as our Hudson, Delaware, or Susquehanna, pour their waters also in the northern extremity of the Caspian Sea; and it is no wonder, therefore, that old geographers, who did not know that its level was below that of the ocean, and who had no idea of the results of powerful evaporation, were unable to account for the disposal of all this mass of water, and so they imagined that there was a subterranean outlet toward the Black Sea or the Persian Gulf. Kircher, in his book on the subterranean world, gives a picture of this supposed channel, traversing at great depth the bases of mountain barriers and passing under the beds of rivers, etc.

These suppositions were definitely set at rest by the discovery that the surface of the Caspian Sea, as before stated, is 86 feet below the surface of the ocean; while the surrounding shores, especially in the north and northeast, extend for many miles as an alluvium, also below the ocean level. These data were ascertained many years ago by the surveys for canals constructed with the intention of establishing water communication between the Caspian and Black Seas by means of a canal uniting the Volga and the Don. At one point these rivers are close together; but the Don flows into the Black Sea, and the Volga, as we have stated, into the Caspian.

The Caspian Sea is a forcible illustration of the fact that the evaporation on a given surface may far surpass the rain-

fall. It receives the drainage of a surface more than ten times its own size; and if we suppose that three fourths of the water falling in rain is utilized by vegetation, and so never reaches the streams, there is still the watershed from two and a half times the Caspian's area, besides the rain which falls in that sea itself, which must be disposed of by evaporation; and such is undoubtedly the case. It is scarcely necessary to go into calculation of the million of tons of water which the Volga and the Ural supply annually—a calculation which offers no difficulty when we consider that the average rainfall on the ground drained by those rivers is nearly 12 inches, making 1 foot of water over a surface of about 1,000,000 square miles; we leave this calculation to our readers, merely drawing attention to the enormous amount of saline matter washed out by this water from the soil through which and over which it flows. This salt is all carried to the Caspian Sea; and as only pure water is removed by evaporation, the salt remains behind, and that body of water must necessarily become more and more salt, up to the point of saturation, which is now nearly reached, the Caspian Sea being already much saltier than the ocean. The rivers continuing to pour in water, of course of less purity than that which evaporates, the process goes on; and this consideration solves not only the question in regard to the salting of this particular lake, but of all lakes having no outlet, and also the question, so often asked: Where does the salt of the ocean come from? The ocean is, in fact, nothing but a huge lake without an outlet, into which all the rivers of the earth continue to pour their impure waters, while nothing but pure distilled water is taken out by evaporation. Even the ocean, therefore, must steadily increase in its saltiness, and only its immense size retards the change which will take several thousand years to become appreciable to man.

A Time Ball in New York City.

An arrangement has been concluded between the Superintendent of the United States Naval Observatory at Washington and the Western Union Telegraph Company, for the purpose of disseminating the standard time, as determined daily by the Naval Observatory, to shipowners and masters, business men in general, railways, chronometer makers, and others, and to the public generally. In pursuance of this agreement, a time ball of large size is to be dropped daily from the tower of the Western Union Telegraph Company's main building at New York city; and arrangements will be made for controlling public clocks in New York and other places, and also for distributing the noon signal of the United States Naval Observatory to various cities in the United States having more than 20,000 inhabitants. In New York, at 11h. 55m., a time ball will be hoisted halfway up the iron flagstaff on the tower of the Western Union building at the corner of Broadway and Dey street. This ball is 3 feet 6 inches in diameter, and can be seen by all the shipping lying at the New York and Brooklyn docks and on the New Jersey shore, as well as by all vessels lying in the bay, even beyond quarantine. For long distances an ordinary ship's glass will be needed. It can also be seen on Broadway from Tenth street nearly to the Battery and from suitable positions it can be seen by a large majority of the citizens of New York, Brooklyn, Hoboken, Jersey City, etc.

The ball will remain at half mast from 11h. 55m. to 11h. 58m. At 11h. 58m. it will be hoisted to its highest point, about halfway up the main staff—that is, over 250 feet above the street. It will be dropped by an electric signal at exactly noon by New York time. The longitude of New York being assumed to be that determined by the United States Coast Survey for the City Hall. 12h. 0m. 0s.00 New York time=11h. 47m. 49s.53 Washington time. 12h. 0m. 0s.00 New York time=4h. 56m. 1s.65 Greenwich time.

If, on account of high winds, etc., the ball fails to fall at 12h. 0m. 0s., it will be kept at the mast head till 12h. 5m., and then dropped at 12h. 5m. 0s. In such cases, a small red flag will be hoisted at 12h. 1m. and kept flying till 12h. 10m.

The time of falling of the ball will record itself automatically, by electricity, near the standard clock of the Western Union Company (which is regulated by signals from the Washington Observatory); and if by any cause it does not fall precisely at noon, its error will be known. In the evening papers of the day, and in the papers of the next morning, a notice will be regularly inserted, stating whether the ball fell at the correct time, and if not, then its error fast or slow. In this way, even signals which high winds or other causes have prevented from being given precisely will still be available for the regulation of clocks and chronometers.

This ball will therefore serve to regulate the clocks of New York city to standard New York time, and will also serve to correct chronometers of ships lying in the harbor.

Business Stagnation in Germany.

Herr Krupp, of Essen, Germany, the great gun maker, has issued a memorandum to his workmen, dilating on the present stagnation of business, and the short hours necessitated by the restriction of the market. Herr Krupp exhorts his men to submit with patience to the passing slackness and reduced wages, and points to the conduct of the laboring classes in England, under like circumstances, as an example not to be followed. England has had its period of industrial activity and prosperity. "England has grown great and powerful by her industry. Then her working men have formed trades' unions, and struck work for the purpose of enforcing higher wages. The consequence has been that the work of England has, to a great extent, been carried abroad. That ought to be a warning to us."