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- AGRICULTURE, ETC. With 2 engravings.—History of Long Horn Cattle, with engravings of Long Horn Steers and Cows.
- LESSONS IN MECHANICAL DRAWING, by PROFESSOR MACCORD, 8 figures.

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## A CENTENNIAL NUMBER.

In commemoration of the opening of the Centennial Exposition on the 10th of May, the next number of the SCIENTIFIC AMERICAN will appear in a new dress, and its pages will be devoted to illustrations of some of the various buildings, national, state, and those devoted to special industries, which together constitute the miniature city now almost completed in Fairmount Park. In the succeeding number we shall present a full account of the opening ceremonies, together with illustrations thereof, and interesting descriptions of matters and things connected with the event.

At the present time, beyond the brief report of progress which will be found in another column, it is an impossibility to afford any idea of the contents of the Exposition. Two sets of workmen, numbering many thousands, are working continuously, night and day, evolving order out of a chaos which appears to be continually augmented by fresh contributions pouring in at the rate of hundreds of car loads daily. As soon as affairs run smoothly, and the entries are in such condition as to admit of proper examination, our readers may look for complete accounts of all matters likely to prove of utility or interest.

## SILVER AND GOLD MONEY.

On February 12, 1873, Congress passed an act by which the gold dollar was made the unit of value, the trade dollar of silver, weighing 420 grains, established, and silver money rendered no longer a legal tender for sums exceeding five dollars. The effect of this measure is, it is claimed, practically to demonetize silver, and a bill to amend it, by making silver a legal tender up to sums of \$20, is now before the Senate. The chief supporter of the amendment is Senator Jones, of Nevada, who represents one of the greatest silver-producing districts in the world, and who has recently made an able speech in behalf of a silver currency. From a review of the mutations and quantities of the precious metals, from the earliest times to the present, it appears that any diminution of the stock of specie, whether resulting from failure of mines or from arbitrary legislation, is fraught with the greatest disasters that can befall society. England, said the Senator, by making gold the only standard of value, in 1816 was brought to serious financial straits, only relieved by the discovery of gold in California, and this, despite the fact that gold was a peculiarly British product. By existing laws, the United States is committed to resumption in specie, combined with a demonetization of silver, and Senator Jones believes this to be an impossibility, and that one or the other course must be abandoned. As no one, save those committed to the inflation heresy, will dispute the necessity of early resumption of specie payments, it follows that silver must be brought to the level of gold; and it is in support of this view that the Senator addresses a valuable array of facts and figures, some of the more striking of which we quote below:

From the discovery of America up to 1873, it is a remarkable fact that the relative values of gold and silver, 15½ lbs. of silver being equivalent to 1 lb. of gold, have scarcely varied, and it is probable that similar stability will be maintained in the future. The reason is that the nature and qualities of the two metals are so nearly alike that any improvement applicable to the extraction or recovery of the one must be applicable to the other; and further, their geological distribution is such that in many of the largest deposits they lie in the same matrix. At the present time, the world's store of specie is one half silver; the estimated figures in 1872 were: Gold, to the value of \$5,800,000,000, and silver, \$5,600,000,000. As a matter of curiosity, we have calculated, roughly, the volume of each metal, supposing each could be melted into a solid mass. The gold would form a cube only 27 feet in each dimension, and the silver, one of 177 feet. A medium-sized room, therefore, would hold all the gold in the world. The gold supply is, however, diminishing; the river beds of California and Australia, the Senator says, "have been washed, the surface gold has been secured, the water line has been worked, and below it are only those sulphurets which as yet have not been successfully treated." The annual production in gold in 1801 aggregated \$13,000,000 a year, in 1829 \$5,000,000, in 1852 \$182,000,000, in 1875 \$97,500,000. This shows, not only a falling off, but great fluctuation in production; and, moreover, in 1875 British possessions contributed \$60,000,000 against \$26,000,000 for the United States, so that gold is now a British product. The present gold product is insufficient to meet the demands of the world for that metal in use in the arts, and to keep good the loss and wear of coin. On the other hand, in marked contrast to the above, the annual supplies of silver, essentially an American product, have always been steady and are now but little above the average. In 1805 the average of coin per capita, throughout the world, was \$2 83; in 1862 it was \$4.75. Between these periods both the production and the per capita rate of coin have doubled; and this swelling of the measure of value lies in the increase of gold and not of silver. The production of the latter metal at the beginning of the century was \$35,000,000; in 1875 it had reached but \$72,000,000.

Senator Jones points out that it is the stock of precious metals in the possession of the world that measures prices; and as nearly one half of this stock is silver, to demonetize the latter would be to reduce all prices one half, and convulse every country in the world except those which may refuse to take part in such demonetization. Further more, he insists that we never can resume specie payments by gold alone. By continuing to exclude silver from equal participation with gold in the United States currency, and attempting to resume specie payments, we occasion a demand, say of 350,000,000, to pay off the greenbacks and furnish bank reserves and \$50,000,000 of silver in lieu of fractional notes. The quantity of precious metal needed to maintain prices at their present level in the occidental world is \$4,000,000,000; and of this, if the United States succeeds in resuming specie payments, it must hold \$350,000,000 in gold. It is impossible for the country to obtain this by 1879, with the present production of gold only at \$97,500,000; more than half of this yearly yield is needed in the arts, and 1½ per cent of the occidental stock of gold, \$2,600,000,000, is needed for the maintenance of money, to pay for the abrasion and loss. Deduct these sums, and there is a surplus of \$10,000,000 a year, whence to obtain our \$350,000,000, so that at least thirty-five years will be needed to amass the amount. But the increase of population will make an increased demand for gold exchanges and use in the arts, equal to at least \$6,000,000 annually; and the annual gold product is, besides, diminishing. When these elements of the circulation are all moderately provided for, there will remain perhaps \$500,000 a year surplus, and we shall be 700 years getting our \$350,000,000.

With these difficulties, the Senator contrasts the ease with which specie payments could be resumed on the basis of the double standard of gold and silver. The total coin in the world is \$5,700,000,000, and the annual supply of both metals

to draw upon is \$170,000,000. Instead of having to draw upon the accident alone, we should draw upon the whole world. Three hundred and fifty millions in gold forms one seventh of the entire stock of that metal; the same sum in both metals is less than one sixteenth. If a draft of one seventh would occasion a fall in prices of 15 per cent, a draft of less than one sixteenth would occasion a decline of less than 6 per cent; and while 15 per cent during two and a half years—equal to 6 per cent per annum—would sweep away all and more than all the profits of industry, which on the whole do not net more than 3 or 4 per cent, 6 per cent in two and a half years—equal to 2½ per cent per annum—would enable us to get back to a sound measure of values without the loss of more than a very small portion of our industrial profits.

## LA GRANDE CHARTREUSE.

Although modern society has generally concluded that the usefulness of the monastic life has long since passed away, there are many precious legacies in art and literature, which, born and nurtured in the cloisters of the middle ages, have descended to these times. When the outer world was given over to rapine, and the favorite amusement of men of wealth and high birth was highway robbery, it was surely a good thing that men desirous of cultivating the arts and sciences, and of keeping alight the sacred flame of literature, should find retreats which the wildest marauder respected, and which, moreover, were centers whence many streams of charity and benevolence took their course.

The ancient order of Carthusian monks was celebrated through many centuries. St. Bruno and six of his disciples repaired, about the year 1080, to the beautiful country watered by the Rhône and the Isère, in the southeast of France, and there founded the monastery called La Grande Chartreuse which is to this day the headquarters of the order. Another important organization occupied the site of the Charterhouse schools and asylum in London, the name of which is obviously derived from the monastery. The worthy ecclesiastics are now, however, appearing by their attorneys in our courts to defend their right to a trademark affixed to the bottles of a cordial of great delicacy called "chartreuse," for the manufacture of which the monks are justly celebrated. Some base imitators in this city, it appears, have adopted the trademark, and, by foisting a home-made article on the market, have brought discredit upon the old Carthusians. But Judge Shipman, after hearing argument in the case, at once directed an injunction to issue, and the bogus traffic will now be stopped.

It seems singular that so ancient and venerable a body should appear in the forefront of our modern civilization, claiming its rights like any manufacturer or inventor of our day. Much of the art, learning, and literature, so carefully nursed by the monks of bygone days, has passed away, and their science has long since gone, no one knows whither. Their houses and lands are, even in Italy itself, given over to secular purposes, their numbers are reduced, and there is little left of many of their orders but the names; but there still remains in all its force, protected by theegis of the United States Patent Office, their capability of producing potent liquids of exquisite flavor.

## WORRY AND ITS PHYSICAL EFFECTS.

To so every-day and common a state of mind as worry, ranging, as it may, from a passing "fit of the blues" up to the most poignant mental anxiety regarding life itself, little importance is popularly attached; and especially among so exceptionally nervous and rapid people as the Americans, the fact of a person succumbing under mental strain is of too ordinary occurrence to give rise to extended comment. To the list of the insane immured in asylums and brought thither through heredity or by their own excesses, thousands are added, suffering with broken minds induced by anxiety; but the great majority of people thus affected continue in their places in society, by no means lunatics, nor maniacs, nor idiots, but nevertheless of brain unsound in parts. The world sometimes dubs them "eccentric;" and, if they be distinguished, their odd habits, absence of mind, and like traits furnish rich material for the biographer; in other cases the eccentricities become crimes, and indiscriminating justice may declare the life forfeited because of the workings of hidden faculties, uncontrollable, because disorganized.

Worry, then, is dangerous, more so than the alcohol which kills the drunkard, for the latter involves a taste and a habit which may be put aside; the former is the creature of necessity, and creeps insidiously into every man's life. Its physiological effects, therefore, should be clearly and adequately realized. And the knowledge of the ills may, in some instance, prevent the existence of the cause.

During the early stages of dementia induced by mental anxiety, Dr. Richardson tells us in his "Diseases of Modern Life," there is nothing more than an increased tension of the minute vessels which supply the brain. In later stages, the substance of the nervous tissue itself undergoes a modification by which its activity is permanently lost. These are the physiological consequences, most briefly summed up. The first symptom is a want of full bodily vigor; then follows craving for more work, disturbed sleep, acute sensitiveness to external impressions, and, finally, strange figures and sounds are seen and heard. This condition may continue for years, and the sufferer in time may begin to accept abnormal creations as natural. Dr. Richardson cites a case of a merchant, who for weeks retained in his vision the spectra of three lights, oval in shape, of the size of an egg, and so clearly defined to the observer that he would watch them half consciously as they floated before him on the wall, the ceiling, or in space. In this stage of the disease lies the

foundation of all hypotheses of ghost-seeing, of ecstatic visions, and even of poetic frenzy. A curious instance directly in point, which came to our notice very recently, is that of a well known writer on the press, who, for some time past, has devoted attention to the subject of morbid mental conditions. This gentleman, in a letter to a daily journal, states himself to be the victim of the horrible spectacle of two men hanging from a gallows, a sight which he once beheld while acting as a city reporter. The suspended corpses are clearly brought before him by the sound of rain (the execution occurred during a rainstorm), and also by the sound of laughter, since, through some uncontrollable impulse during the hanging, he was induced to utter an untimely peal of merriment. That the writer's brain is injured, possibly by the excessive mental strain peculiar to his profession, seems probable; and the lesion is manifested, as already described, by the constant recurrence of the apparition.

It is a well known fact that we have two natures, one purely organic and emotional, the other subject to the reasoning powers. The organic nervous chain exists in the body as a link between emotional mental acts and vascular supply. An impression from without, made through the organs of the senses upon the emotional centers, is reflected directly from them to the vascular expanse. The part flushes or blanches, and the heart hesitates, palpitates, rebounds, or intermits; so that these centers, excited by anxiety, or grief, or joy, or sorrow, influence the waves of blood passing through the system, and the brain promptly feels the imperfect regulation of the supply. Under varying tensions of the vessels, there are flashes, chills, coldness of the extremities, and other oppressive symptoms, while in addition appear the distressing ringing or hammering sounds in the head. These sounds are arterial murmurs, vibrations of the blood which presses with each impulse of the heart on the bony surroundings of the relaxed carotid canal, situated at the base of the skull. The canal is in direct connection, by solid conducting substance, with the organs of hearing, and thus the faintest vibration is detected. The sound produced when it is sudden and unexpected, as in moments of fear, is occasionally mistaken for a sound proceeding from without with no obvious cause.

Thus the sufferer is likely to see visions and hear strange noises, impalpable so to speak, but as purely physical as the most common things in life. In some instances they are actual perceptions of real facts or objects, caught by an extremely susceptible and delicate nervous surface. In others they are an intensified recognition of movements within the body; but in the vast majority of instances they are actual impressions made at some time on the organism and now recalled and rendered more definite by constant recurrence.

At this point, if the mental powers be allowed rest and the fountains of care be closed, recovery may take place; but if the over strain continue, the disease assumes still graver form. There is a maddening desire for work, more work, coupled with the sad sensation that the physical powers are failing; and then there are lapses of memory. The man of business forgets important details, he is irritable, distrusts everybody and himself most, makes mistakes, and yet persists in accumulating more work on himself. The poet and novelist become over sentimental and morbid; the man troubled with remorse for guilt confesses his crime, or commits suicide. The downward course is rapid; in one case epilepsy occurs, in another paralysis, a third develops some hereditary malady like cancer, a fourth dies from nervous failure and local disease of some vital organ. The majority, escaping these special ends, become prematurely old, and sink helplessly into death. The brain becomes disorganized, the balance is broken, and anarchy succeeds to what once was order.

"In every brain, in fact, there is set up primitively a kingly force, to which all other forces bend. The king may be good or bad, he may be an hereditary king or a usurper, but he holds the balance; kill the king, and, in ninety-nine cases out of hundred, the kingdom is made chaos and dark night."

#### THE APPARENT SIZE OF THE MOON AT THE HORIZON.

A correspondent forwards us an article containing the views of Dr. Montucci, of Paris, on the above-named subject. As the learned doctor has expressed a wish that it be published in some widely circulated scientific journal in this country, we accede to his request, making, however, some comments on his theory.

"Everybody must have noticed the enormous size of the full moon when it rises at dusk, just when the sun has set. That it is owing to an illusion is notorious, first, because our satellite cannot undergo any real change in size during its short progress from the horizon to its culminating point, and secondly, because, whether observed at the former or the latter, the micrometric measurement of the visual angle under which it is seen is always the same. This curious circumstance has always been a puzzle to scientific men. La Place says that, since the celestial hemisphere above our heads appears to us depressed, the rays coming from the horizon must seem to us longer than those from the zenith. Other physicists, finding this explanation unsatisfactory, assert that our judgment is led astray at the horizon by the trees and houses bordering on it, and which, having a size known to us by habit, induce us to compare the moon to these objects, and so to think it larger than it is at the culminating point, where it is quite alone, without any type of comparison in the vicinity. To prove this explanation of theirs, they prick a hole through a card, and look through it at the moon on the horizon, thus covering all the terrestrial objects that might lead us astray; and in this way the moon's

disk is indeed reduced to a much smaller size. In an article published in the *Memorial Diplomatique*, Dr. Montucci expresses his astonishment at finding that atmospheric refraction, the only reasonable cause of the phenomenon in his opinion, is not only overlooked in this question, but actually rejected by all school book writers on natural philosophy, as well as by graver men. The demonstration by the pricked card he shows to be worthless: 'for,' says he, 'go about in the evening and look at the gas lamps through the card, and you will find them suddenly dwindle down to pins' heads, because you reduced the radiation of light by narrowing the field of vision. In the same way, if you look at the moon, it becomes less, just like the gas flame; but do not imagine that it is thereby reduced to its culminating size. No, you cannot have two sets of weights and measures; if you look at the moon through the hole when she is at the horizon, you must do exactly the same when she is at the zenith; and then you will see her smaller than you ever saw her.' The card being thus set aside for ever, Dr. Montucci proceeds to examine whether the illusion can be brought about by a type of comparison, and he enumerates several reasons why it cannot, among which is this: When the moon rises close to a large mass of houses or a mountain standing out in high relief above the real horizon, she loses her exaggerated diameter very quickly as she goes higher up; so that, by the time she has reached the top of the prominent object, she has diminished considerably. But that object is still there, it has not changed: then how comes it that, the type of comparison being the same, the object compared has diminished? Illusion from that source cannot therefore be pleaded here. Dr. Montucci next takes up refraction as the sole explanation possible. The misty atmosphere presents itself to the eye of the observer as a concave lens; the moon is outside, and forms with the atmosphere a divergent lens, which enlarges objects on a dark ground. Hence the moon, as well as all terrestrial objects, are increased in size on being projected by refraction through the atmosphere. This view of the case, the author confirms by various experiments with concave lenses."

We must confess that the statements, reasonings, and conclusions of the writer excite our surprise, as the fact is that this curious illusion has never been a puzzle to such scientific men as have taken the trouble to consider it carefully. They all agree with La Place that the celestial hemisphere appears depressed above us, and that objects near the horizon look much further off than those near the zenith; our judgment is not led astray at the horizon by the trees and houses bordering on it, but, on the contrary, these objects give us some faint idea of the great distance of the moon, for in this case alone it becomes perceptible that the moon is so much farther off than the largest distant objects, and the comparison allows some kind of appreciation of the moon's size; while when the moon is at the zenith, there is a total lack of objects of known size with which to compare her, and we are thus led astray by the impression of a smaller distance, and so underestimate her size. The fact is that experience trains us in our judgment of distances in a horizontal direction; but when we look upward, for lack of intervening objects for purposes of comparison, we always underrate the real distances. A six foot man, at 700 feet distance, when on the ground looks to be of natural size, notwithstanding that we see his whole figure under the small angle of less than a third of a degree; but let the man be raised to the top of a tower 200 feet in height, and let us go a little nearer, so as to see him at the same distance (700 feet) as before, and therefore under the same visual angle, or let us even increase the angle, and the man will look very small indeed. Almost every one has experienced the surprise with which we observe that the real size of any object, with which we have become familiar by seeing it always in an elevated position, is so much larger when placed on the ground than it appeared to us while elevated.

Pricking a hole in a card, and looking through it at the moon's disk near the horizon, is a very imperfect and clumsy way of effecting an otherwise good and conclusive experiment. A hole of exactly a quarter of an inch in diameter should be punched in a card, and this card placed at the end of a tube, of cardboard or other material, 28 inches long; then the hole will appear, to the eye placed at the other end of the tube, under an angle of half a degree, which is the angle under which the moon always appears to us, whether she be at the horizon or at the zenith, and when she is at her mean distance from the earth. If we look through the tube at the moon, when she is near the horizon and appears large, and also when she is near the zenith and appears small, we shall see that she is in both cases of exactly the same size, covering the hole nearly perfectly.

The only effect which atmospheric refraction can have is to lift objects, situated outside of our atmosphere, higher above the horizon than they really are, and this action increases as the objects come nearer to the horizon. At the horizon itself, it amounts to only about half a degree, the angle under which we usually see the sun and moon; so that when the sun or moon appears to touch the horizon with its lower edge, it is in fact below the same, and without the atmospheric refraction would show just a trace of the upper edge. As this refraction is greater at the horizon itself than half a degree above the same, the lower edge of the sun or moon is apparently lifted up higher than the upper edge. This has the effect of causing the luminary to appear with a diminished vertical diameter; so that it appears flattened, an appearance which has no doubt been observed by many of our readers; and this takes place to an exaggerated extent when the atmosphere was laden with vapors.

The explanation given by Dr. Montucci is by no means new, and is found in many elementary text books of astron-

omy. It appears in a little treatise for school use, published 40 years ago by Arago, and it has been frequently copied by other authors, as apparently the easiest mode of explaining the phenomenon; it cannot, however, stand the test of scrutiny, as the upper surface of our atmosphere, being parallel to the surface of the ocean, cannot be more curved than the ocean, but is actually less curved, having a somewhat longer radius. As, however, the surface of the ocean can be considered level for all practical purposes, the upper surface of our atmosphere may more reasonably be treated as a flat surface, owing to its larger circumference; but it can in no way be considered to act as a lens. This old theory has been so long since exploded that it is surprising to see it brought forward at the present day.

#### PROGRESS OF THE CENTENNIAL.

Imagine over a hundred carloads of every conceivable product of art and industry arriving daily, and an immense army of workmen working as if for dear life, early and late, and some idea of the present condition of affairs at the Centennial will be realized. That the American exhibition will be far from complete at the opening day is certain; but fortunately the same is not the case with the foreign contributions, and hence a reasonably good display may be looked for on the 10th of May.

Three new bridges are being built over the tracks of the Pennsylvania Railroad in order to complete the approaches to the Centennial grounds. One is constructed on the rigid suspension principle, another on the stiffened triangular truss system, and the third is an iron truss structure. The last is one of the largest street bridges in the country, and will cost \$300,000.

A new building has been erected near the west end of the main building for a general reception room for all visitors. It contains parlors, baggage rooms, toilet apartments, writing conveniences, and telegraph and mail stations, and is the headquarters of the corps of Centennial guides.

The interior decoration of Horticultural Hall is now nearly completed, and the main hall presents a magnificent display of tropical plants. All of the garden beds have been laid out, and a large quantity of flowers are in full bloom.

The Japanese building is complete, and exquisitely furnished in a style corresponding with the better residences in Japan. The walls are elegantly papered, and the windows are furnished with a peculiar style of paper in lieu of glass.

The Chilean exhibit has arrived by steamer at Aspinwall, and will shortly reach Philadelphia. It includes a magnificent collection of precious ores, and native wines, besides a large quantity of machinery. Some of the small South American republics, not distinct exhibitors, occupy part of the Chilean space. Among these, Guayaquil has sent samples of a straw hat made from the delicate young palm leaf. It takes several months to make one hat, as it can only be worked upon by night in order to escape the action of the sun and heat. No seam or joint is visible, and each hat is valued at several hundred dollars.

The Granger's encampment at Elm Station, on the Pennsylvania Railroad, is now so nearly completed that the buildings will be ready by the opening day of the Centennial. The terms are only \$1 per day for room rent and 50 cents per meal. A branch railroad line will run to the Centennial grounds, and a nominal fare will be charged. The Grangers have the preference in securing quarters, but the general public is accommodated on the above terms. Working men will probably find these accommodations very convenient.

The great 100-ton Krupp cannon has safely arrived. The principal display of war material will be found in the United States section. A very interesting feature in that portion of the exhibition is a small working model of a Hitchock forge, which will be so arranged that at stated periods miniature guns will be actually constructed, built up from iron sections. The Gatling gun will be shown in all its modifications, and there will be a complete set of small-arm-making machinery in practical operation.

The carriage building is about finished. It is of wood sheathed with corrugated iron, and of very ornamental design. The exhibits consist entirely of pleasure carriages, as all carts, farm wagons, omnibuses, etc., will be displayed in the Agricultural Building. Palace and street cars will, however, be exhibited, together with all improved carriage appliances.

The Art Gallery is rapidly progressing, and in parts of it the hanging committee have already begun arranging the pictures. The judges' pavilion and the Massachusetts building are finished, and present a beautiful appearance. The Pennsylvania building, begun very recently, will not be completed for several days.

The London Artisans' Institution and several French working men's associations are making preparations to send delegations of workmen to the Centennial. We have as yet heard of no similar action on the part of trade associations and large manufacturing concerns in this country. We have already pointed out at some length the advantages to be gained by affording every possible facility for workmen to visit the exhibition, and certainly no other such opportunity for observation and study will be afforded our mechanics during the present generation. This country will never be able to compete with Europe in the matter of artistic workmanship until our workmen have the same advantages, in the shape of galleries and collections of industrial art, that are possessed by their European brethren. In respect to art productions, the Centennial will be especially rich; and with proper opportunity for study, American operatives can gain a fund of information and ideas which will be not only valuable to them, but directly beneficial to all our industries.