PHOTOCHRONOGRAPHY IN THE MEDICAL SCIENCES.

In a preceding article we gave a description of a new photochronographic apparatus designed more especially for medical studies. The numerous researches that we have had to make, the many experiments that we have performed, and finally, the financial question, it is very necessary to say, have retarded us. It is for these different reasons that our apparatus, begun nearly three years ago, has been but recently completed. This apparatus is designed to operate in the service of our regretted master, Professor Charcot, at the Salpetriere. We shall describe further along the annex of the laboratory of photography that has been created to utilize it.

In consequence of the special work that we have to do from a medical standpoint, we have had to get up an apparatus entirely different from those used at the present time in photochronography. It is not a question, in fact, of the physician obtaining in a very short time the largest number of photographs possible, but rather, in the study of any phenomenon whatever, of getting a sufficient number of them to seize on the one hand the attitudes that may escape direct observation, and, on the other, to know the general nature of the motion analyzed.

It is necessary, moreover, that the photographs obtained shall have sufficient dimensions and a model complete enough to allow them to be easily studied.

We lay it down as a principle that a number of photographs amounting to twelve is practically sufficient in most cases to seize the different phases of a motion. Consequently our apparatus has been established for giving twelve successive photographs. The problem that we have proposed to ourself, then, consists in distributing these twelve photographs, in a uniform manner, over the duration of the motion observed, whatever be the duration of the latter, from a fraction of a second up to one or more seconds. There is nothing even to prevent operating at more distant intervals, at one or more minutes apart, although at first sight one scarcely feels the necessity of taking photographs at so distant intervals. Yet, from a medical standpoint, in order to observe certain slow-moving phenomena, such as the transfers of contractions or of attitudes during the period of catalepsy, this mode of operation of our apparatus will possess indisputable advantages for noting the position of the patient at accurately determined intervals.

We have consequently had to devise a special arrangement that should permit us to free the shutters one after the other and at variable intervals, according to the velocity of the motion observed. Lastly, it may be useful in the study of certain difficult cases (for seizing, for example, the so movable and varied phases of an attack of hysteria or epilepsy), to take a certain number of photographs in quite a short space of time. Here it will no longer be a question of making a photochronographic analysis of a motion, but rather of noting attitudes that appear unexpectedly and that the physician wishes to preserve.

With an ordinary apparatus one is powerless, since after each exposure it is necessary to remove the frame and to replace it. With ours, on causing each of the shutters to operate isolatedly, it is possible to take a dozen photographs at any intervals whatever and according to the necessities of the experiment.

In both cases the physician has only to maneuver an electric bulb. In the first case, the twelve photographs will be taken in an interval that has been fixed beforehand; in the second, at every contact, we shall obtain a single photograph.

Let us now pass on to a description of our *materiel*, which consists of a camera, or receiver, a transmitter and a distributer.

(1) *The Camera* (Fig. 2).—This is provided with twelve objectives arranged in three parallel rows so as to give the twelve images upon a 9 × 12 plate. Each objective is provided with a shutter of the Londe & Dessoudix system. We have adopted this type of shuutter because it has always given us excellent results in practice and because it is of variable velocity. Here again is one of the characteristics of our apparatus, for it permits, independently of the variability of the intervals between each photograph, of modifying the velocity of the different shutters. This condition is most important as regards the quality of the images. We know, in fact, that the obtaining of instantaneous photographs with great speed easily leads to a hardness of the image or its insufficiency as regards details and intensity. Despite the sensitiveness of the present gelatino-bromide of silver preparations, the very existence of the image becomes more and more problematical in measure as the time of exposure is reduced. It therefore may be laid down as a principle that such time of exposure must be reduced only just the length desired to obtain sharpness, under penalty of having insufficient and incomplete negatives.

On another hand, we know that the closer together it is desired to have objects, the more it is necessary to increase the length of exposure. This still further shows the advantage that will accrue from the possibility of reducing the velocity of the shutters at will.

The freeing of the shutters is done electrically. Fig. 2 well shows the electro-magnets and their armatures placed near each objective. The connection of the various wires is effected at a single stroke by means of the piece, B, which is put in communication with the distributer by means of a flexible 13-wire cable, twelve of the wires being in communication with the twelve electro-magnets, and the thirteenth serving as a common return wire.

The apparatus is mounted upon a laboratory stand or a field stand, permitting of transporting it with sufficient facility.

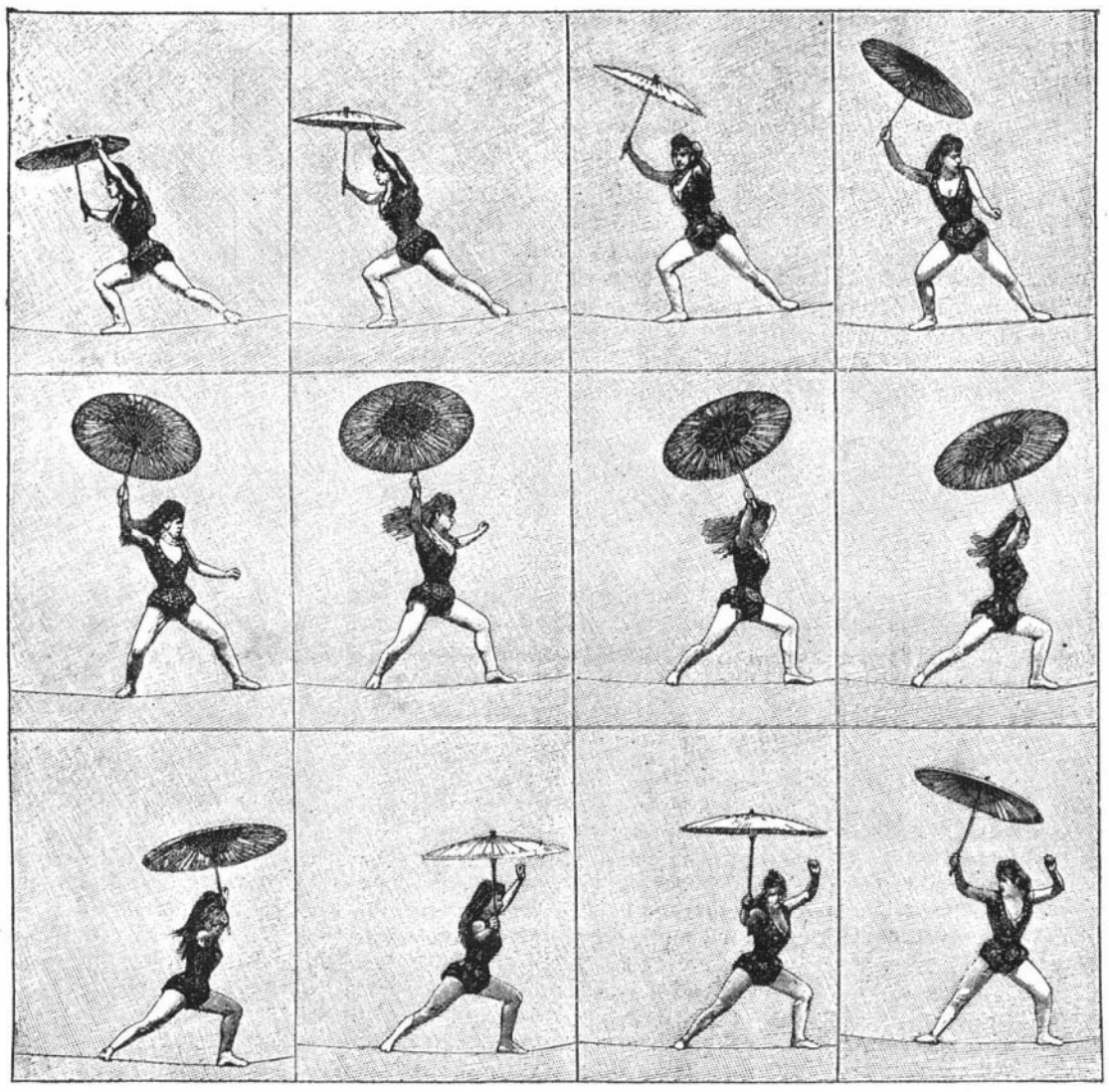


Fig. 1.—FACSIMILE OF A PHOTOGRAPH TAKEN BY MR. LONDE'S PHOTOCHRONOGRAPHIC METHOD.

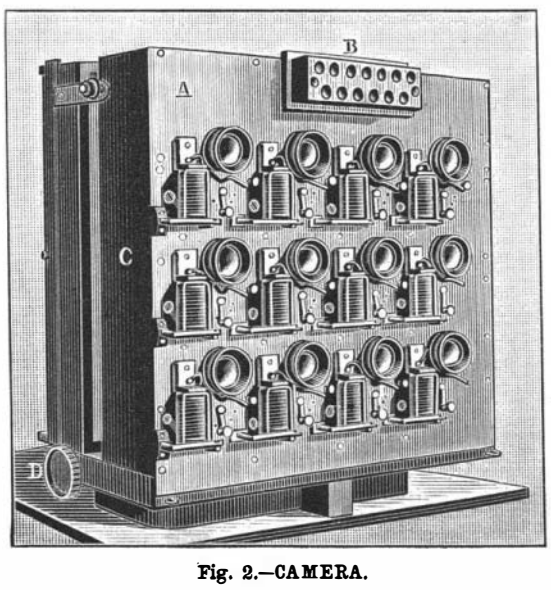


Fig. 2.—CAMERA.

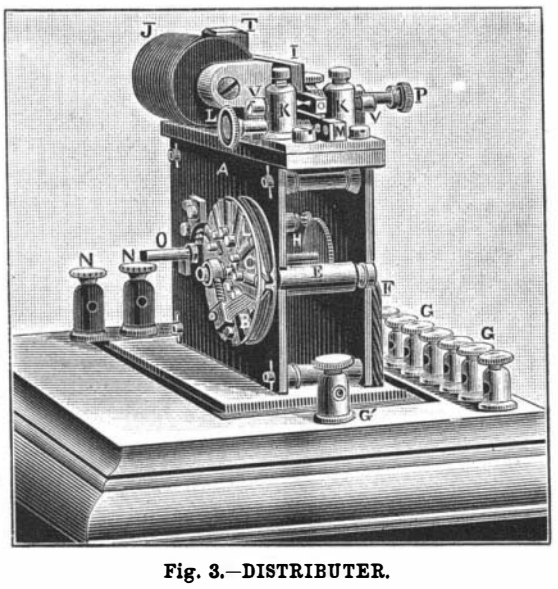


Fig. 3.—DISTRIBUTER.

FIG. 2.—A, covering plate carrying the objectives, shutters and electric gearing; B, thirteen-wire contact; C, camera; D, focusing rack.
FIG. 3.—A, clockwork case; B, brush; C, ivory disk; D, one of the twelve contacts; E, insulating tube; F, the twelve wires connected with the terminals G, G; G¹, return wire; H, escapement; I, armature; J, electro-magnet; L, regulation of the counter spring; N, terminals for the current of the transmitter.

(2) *The Transmitter.*—Granting that the shutters are actuated electrically, it will suffice, in order to assure the operation of the apparatus, to send a current successively into each of the electro-magnets, such emissions of current, moreover, being made at perfectly equal intervals. The realization of such synchronism is a delicate matter. Nevertheless, certain apparatus, such as a well constructed metronome or the Foucault regulator, are capable of giving excellent results, for the reason that the work to be effected, and which will consist in raising a light lever that establishes the desired contacts, could in no wise interfere with the regular operation of these apparatus.

Nevertheless, the metronome can be utilized only for a relatively slow succession of photographs. As for the Foucault regulator, that must be so modified as to give contacts at intervals variable within certain limits.

We have had the good fortune to meet in commerce an apparatus constructed upon such principles by Mr. Trouve and called an interrupter. This instrument, which is designed for medical uses, gives more or less frequent interruptions in a unit of time. By means of a very simple modification, it has been able to serve us for giving emissions of current at intervals regulated in advance.

A metallic cylinder is set in action by means of a clockwork movement provided with a regulator, so as to assure its uniform operation. Upon this cylinder are arranged, in parallel circles, pins whose number increases from one extremity of the cylinder to the other—one for the first, two for the second, and so on up to twenty-five for the last. The object of these pins is to lift a very light lever designed to close the electric circuit. Every time the lever is lifted an emission of the current occurs. The lever and its support are capable of moving parallel with the cylinder, so as to appear before such or such a concentric circle, thus permitting of a determinate number of contacts being easily obtained at will.

As regards our special studies, this apparatus, therefore, constitutes a very practical transmitter. Nevertheless, as the emissions of current always take place in the same direction, it is necessary to employ another apparatus in order to send the current by turns into each of the electro-magnets. This apparatus is the

(3) *Distributer.*—This apparatus, which was constructed according to our directions by Mr. L. Leroy, is represented in Fig. 3. A clockwork movement is inclosed between the pillar plates, A. Upon the last axle is mounted at right angles a rod, carrying at its extremity a platinum brush, B, which is capable of moving over a series of twelve platinum contacts regularly arranged upon an ivory disk, C. Each of these contacts is connected with one of the twelve terminals

represented at G G, these latter being put in communication with the twelve electro-magnets by means of the flexible cable of multiple conductors that we have already spoken of. In the interior, at H, may be seen an escapement wheel, which is controlled by the armature, I, which is attracted every time a current is sent by the transmitter into the bobbin, J. At every attraction, the brush advances by a twelfth of the circumference, and sends the current arriving through the terminal, G', into the corresponding shutter. On taking care, before any operation, to place the brush in the position that corresponds to zero, one will consequently free all the shutters in the order that has been fixed in advance. Such order will depend solely upon the arrangement of the wires of the various electro-magnets in such or such a terminal.

One can thus easily change the order of succession of the photographs according to the direction of the motion, and this is very advantageous for the reading of the results.

The apparatus employs the current of a battery of six bichromate piles, two to actuate the distributer, and four for freeing the shutters.

Operation of the Apparatus.—The focusing having been effected, the shutters are set and their velocity is regulated by means of the lower handle, which moves in five notches corresponding to five different velocities. The Trouve transmitter is so regulated as to have desired number of contacts for the reproduction of the motion that it is desired to photograph. The cylinder is then set in motion, and, after it has been ascertained whether the brush is really in its starting position, the piles are lowered. The operator then holds in his hand an electric bulb, and, when the moment has arrived for operating, he has only to press the latter and maintain a contact during the time of the experiment. The brush of the distributer frees the shutters one after the other, and the photochronographic series is obtained at the intervals that have been fixed in advance. In case it was desired to obtain a discontinuous series, that is to say, the twelve photographs at any intervals whatever, it would suffice to suppress the transmitter. Upon sending the current directly into the distributer, a photograph will be obtained every time the electric bulb is compressed.

In studies concerning locomotion, either in man or animals, a very simple arrangement will permit of making the apparatus operate automatically when the subject arrives in the field of the objectives. Across the path that the subject is to follow is placed a weak thread that keeps separated from each other two metallic plates at which end the conductors that previously led the current into the electric bulb. The current will not be able to pass until, the thread being broken by the passage of the subject, the plates have come close together. The apparatus will operate then at the velocity that has been fixed in advance by the operator, and in this way will be avoided many failures, and will be suppressed the lost time that is inevitable between the moment at which the subject is seen to arrive in the field of the apparatus and that in which the apparatus is set free.

Fig. 4 shows perfectly the arrangement as a whole at the moment at which the operator is about to catch the motion of a subject who is forging a piece of metal. This figure, moreover, represents the new open air laboratory that has just been installed at the Salpetriere, thanks to a subsidy generously granted by the Municipal Council of Paris. A large screen, 20 feet in length by 10 in width, permits the subject to stand out in relief from a plain background. Parallel with the latter there is a horizontal track for the study of motions seen from the side. A second track at right angles with the other permits of catching face or back motions. In the prolongation of this latter track are placed rails that carry the car upon which the apparatus is mounted. In this way, the latter can be displaced with great facility.

The piles, transmitter, and distributer are placed upon a table. The box containing the transmitter is represented open in order to allow the latter to be seen. There is also shown the flexible cable that connects the distributer with the photographic apparatus and the conductor terminating in an electric bulb that the operator holds in his hand. A finder situated above the camera permits of following the subject and of photographing him at the most favorable moment.

This installation will permit us to enter upon studies that it was impossible to pursue with the usual *materiel* and in a laboratory with a glass roof. On another hand, the apparatus is transportable, and this permits us to obtain a certain number of series, either in the country or at the seaside. On the present occasion, just as an example, we give in Fig. 1 a facsimile of one of our negatives representing an equilibrist upon a wire. Mlle. Barenco, of the New Circus, who was kind enough to come and pose for the special benefit of our readers, is, in these photographs, executing a volt from right to left—a motion that she repeats several times in succession, her limbs remaining extended. The series is complete in ten photographs, the eleventh and twelfth representing the beginning of the same motion, but in an opposite direction. The twelve photographs were taken in $\frac{1}{5}$ second. Each of them measures $2\frac{3}{4}$ by $2\frac{3}{4}$ inches.

In conclusion, we believe it our duty to thank all those who have been our true fellow-laborers, and who have been instrumental in causing our ideas to pass from the domain of theory to that of practice: Messrs. Dessoudix and Bazin for the mechanical part, the Messrs. Mors Brothers for the electrical arrangement, and Mr. Lucien Leroy for his distributer. Nor can we forget our venerated master, Mr. Charcot, who has always encouraged our researches in the so interesting field of medical photography, and whom we saw for the last time when he did us the honor to come to witness the operation of the new laboratory installed under our direction in his service of the Salpetriere.—*A. Londe, in La Nature.*

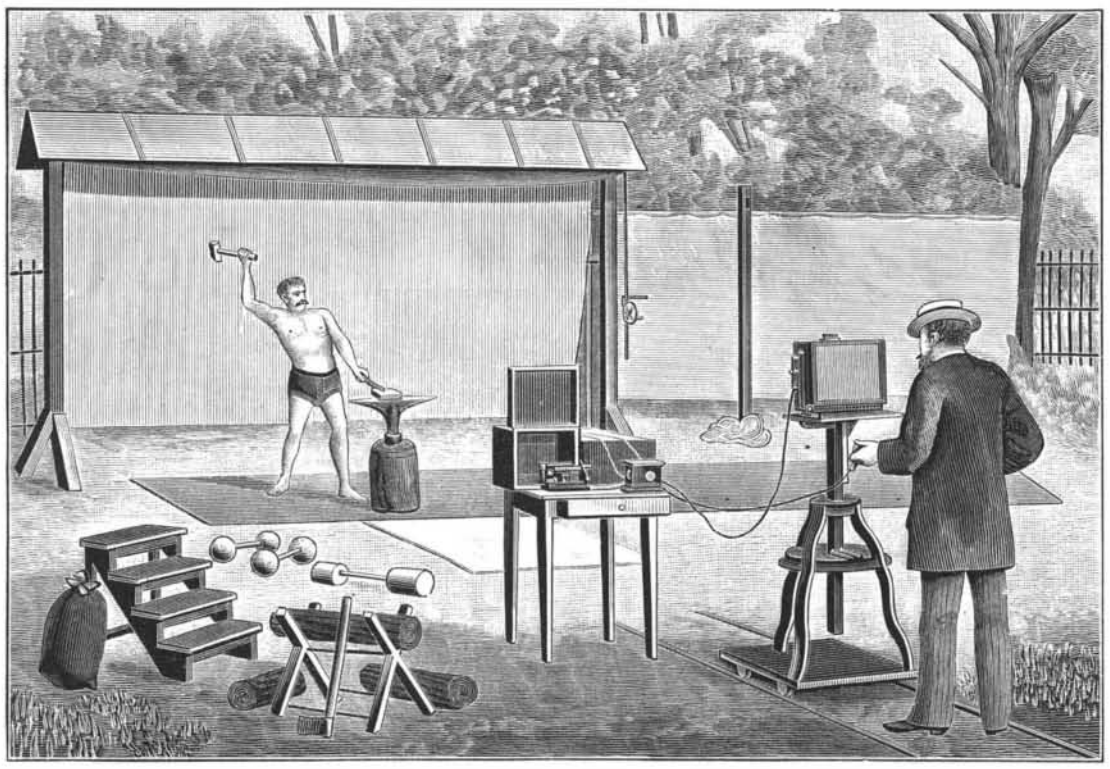


Fig. 4.—NEW OPEN AIR PHOTOCHRONOGRAPHIC LABORATORY.

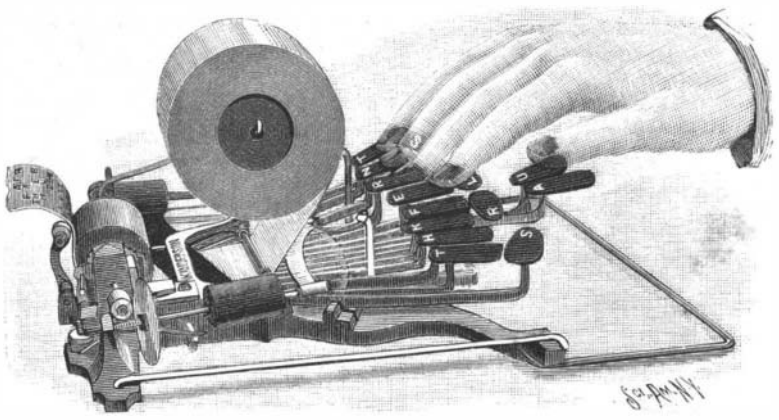
ARTIFICIAL wood suitable for making furniture, roof covering and insulating purposes can be made according to a patent process by burning magnesite together with waste vegetable or animal matter, such as wood, shavings and chips, sawdust, cellulose, cotton, hair or wool. The materials are first pulped with a solution of magnesium chloride in water, or a solution obtained by saturating hydrochloric acid with magnesite, with which mineral the pulp is then mixed and moulded into any desired form. The articles are subsequently lixiviated, preferably in running water. Suitable coloring matter can be added to the materials at will.

Transportation.

The principal lesson suggested by the Fair, as it appears to me, is the importance of improving the means and methods of transportation between the different parts of our country, so that food products of all kinds and perishable goods and materials in general may be carried to market with the greatest possible celerity and in the best possible condition. The great mass of the American people need better food. It is an indispensable basis and condition for their attainment of permanent prosperity and of the fullest civilization of which they are capable. Most of them still think of their food without seriousness and with slight perception of its relations to the highest uses and objects of human life. Though every dish prepared by unwilling hands is poisoned, yet cooking is mostly slave's service, without honor, respect or reward. The life of American working people needs reconstruction, from its basis in the character of their food to its apex, whatever that may be, and one of the most important means for improving the food of the mass of the people is the development of the better methods for the transportation of food products between the different regions of our country. The people who work with their hands for wages, and especially those who work in shops, mills and factories, need more fruit for food, fruit in better condition and at less cost. We should, as fast as possible, reduce the time for railway transit between the great fruit gardens of our Pacific coast region and the homes of the vast populations of our northeastern States. We shall soon have a home market for all our food products; our system of railway management should be such as to secure the best possible markets for producers and the best products for consumers at reasonable prices.—*J. B. Harrison in Chicago Tribune.*

A SHORTHAND TYPEWRITER.

This is a typewriter built especially for rapid work; simple enough to be very strong and small enough to be light, portable and noiseless. In fact, it is not much larger or heavier than a pair of opera glasses. Speed is gained by arranging the keys and type so that every letter on the keyboard can be printed at one time without shifting the hands, all the most frequently used letters being duplicated. Thus in writing the word "start," the "sta" would be struck with the left hand and the "rt" with the right hand simultaneously, the entire word being printed at one stroke, after which the machine automatically draws the paper forward and is ready for the next word to be printed, so that it really requires no more strokes of this kind to print a whole sentence on the Anderson Shorthand Typewriter than it would to merely strike the space key for making spaces between the same words on an ordinary typewriter. This arrangement of the keyboard restricts the number of keys and necessitates the omission of the less frequently used letters of the alphabet. These omitted letters are represented by combinations of those the machine prints, and as soon as this list or code of cipher letters is memorized, the learner has a complete alphabet at his service and can begin practicing for speed. Six weeks' practice will, it is said, give a speed of about 100 words a minute. No knowledge of stenography is required; there is nothing to learn except the list of cipher letters.



ANDERSON'S SHORTHAND TYPEWRITER.

The New York office of the Anderson Shorthand Typewriter is in the World building, rooms 149-151. Among the well known firms employing its operators may be mentioned the Forbes Lithograph Manufacturing Company, of Boston, the *Journal of Commerce and Commercial Bulletin*, of New York, the Trust Company of North America, at Philadelphia, the Kellogg Newspaper Co., Memphis, Tenn., the American Public Health Association, with numerous lawyers, Congressmen and business houses.

Crops of the United States.

The total value of the crops of the United States during 1892 is estimated at $3,000,000,000, of which the largest item is $750,000,000 worth of hay. The animal products, including meats, dairy products, poultry and eggs, and wool, are placed at $965,000,000 more.