streamers of even and regular structure and with firm bright centers. In the south polar region the streamers were rolling from a point not near the center of the sun, but near its limb. They were of somewhat finer structure than those in the north polar region, and some of them crossed. On the left limb of the sun there was a very perceptible eruptive solar prominence with a detached fan and extending about one-tenth of the diameter of the sun. This was of a deep scarlet red in color. The corona was bluish green.

Mr. Nevil Maskelyne, one of the observers of the British Astronomical Association, took 600 cinematograph photographs of the eclipse, 350 of which were during totality.

None of the observers has as yet worked out the exact times of the different contacts, but in a general way it is established that the actual hour of the eclipse was about two seconds behind the computed hour, which for the first contact was 7 o'clock 36 minutes 10 seconds. There is still some confusion in the records from the five seconds delay on the part of the Smithsonian observers in sounding the signal bell.

TWELFTH CENSUS OF THE UNITED STATES.

By GEORGE E. BOOS, Supt. of Printing.

THE newspapers of the country have, from time to time, published articles upon the work of taking the Twelfth Census of the United States and its newly acquired possessions. Suffice it to say, however, that the preparatory work in this connection is so far advanced that a few days only will be necessary to find the enumerators fully equipped with the required blanks and instructions to perform their duties with accuracy and within the time specified by law. In this connection, I wish also to say, that the public has no conception of the enormous quantity of printed schedules, blanks, circulars, envelopes, cards, etc., that will be distributed to the enumerators and canvassers to facilitate them in their work of gathering the statistics relating to the population, manufacture, agriculture, and the numerous other industries that will be included in this census.

At this age of civilization, when it is a rare thing to find a man, woman or child over the age of eight years who cannot read or write, you will readily understand why so much literature and printed matter is needed. It is the intention of Hon. W. R. Merriam, the Director of the Census, to leave no stone unturned in securing a concise and accurate count in all the branches named, and he thinks this can best be reached through the medium of printer's ink.

I will not at this time, however, go into details, as the subject is too broad to do it justice within the allotted space. The object of this article is to direct your attention, or rather to enlighten you, upon the modus operandi of the use of the card record (of which a cut appears below in reduced form), for ascertaining the population and other information incident thereto. There will be eighty millions of these cards—one for each living inhabitant.

These cards are being made at the Union Paper Mills, New Hope, Pa. Special machinery is constructed for the production of this stupendous work. The paper is made in one large roll, then this roll is cut into four smaller rolls and placed on two "Kiddier" printing presses, which print, number, cut and clip 14 cards in one impression at an average rate of 600,000 cards per day, requiring 134 days to complete the job, provided there are no delays from accidents. The making of these cards requires the most careful attention, and a constant inspection is had during the progress of their production. They are made of rope manila stock, and must be of an almost even thickness, not to exceed .0075 and not less than .0065 inch, being 6½ inches long by 3¼ inches high, with the lower corner cut off.

Each card is fed through several devices—the first, a keyboard punch, and is perforated by symbols just as the schedule represents each individual that is taken by the 52,000 enumerators, giving his district, language, color, literacy, sex, months unemployed, age, occupation, conjugal condition, birthplace, etc. This work will be done by an army of clerks acting in the capacity of punchers, tabulators, and sorters.

The enormity of this undertaking can hardly be realized. Each card is handled a number of times. These eighty millions, if piled on top of each other would reach a distance of over nine miles. It became necessary to invent the best labor and time-saving device that brain could produce.

The following is a description of the three principal parts of these almost human machines:

KEYBOARD PUNCH.

The keyboard punch is about the size of a typewriter tray, having in front a perforated punch-board of celluloid. Over this keyboard swings freely a sharp index finger, whose movement, after the manner of a pantagraph, is repeated at the rear by a punch. The movement of the punch is limited between two guides, upon which are placed thin manila cards 6½ inches long by 3¼ inches high, with the lower corner slightly clipped. The keyboard has twelve rows of twenty holes, and each hole has its distinctive lettering or number that corresponds to the inquiry and answer respecting every person. Hence when the index finger is pressed down into any one of these holes the punch stamps out a hole in the manila card. The keyboard is scientifically grouped, and it is very readily learned. For such inquiries as are answered by one of a very few possible classes—sex, for example, which recognizes only two parties in the State—the answer is simply "male" or "female," or "M" or "F." So, too, in regard to conjugal relationships, where the answer would be either single, married, widowed or divorced. These holes may easily be found in "D," "Wd," "Mr.," or "S." Where, however, the answers would cover a wider range of classification, as in age, running from 1 to 100, recourse is had to a combination of two holes, the first indicating a group, as from 25 to 29 years, while the second hole designates the detail single year in that group.

To assist the clerks in memorizing the keyboard for punching, classification lists are used, which show the combinations used to designate each occupation. At first this looks a little complicated, but after all, the symbols "come easy" with each lot of schedules.

How Birthplace is Recorded.—The birthplace is re-

corded by punching first the general nativity, either "N" for native or "F" for foreign. The particular country of birth is recorded by punching one of the holes indicated in the lower lines of the symbols for birthplaces on the card. Thus "Sc" for Scotland, "Ch" for China, "Hu" for Hungary, "Fr" for France, etc. For example, "Fr" being punched in connection with "F" for general nativity, would mean France, but the same hole punched according to the upper symbol, "Sc," in connection with "N" for general nativity, would mean South Carolina. By this simple means the birthplaces are indicated in half the space that would otherwise be required on the card.

A clerk punching the card for an agricultural district has but few symbols to bother about. It will thus be seen that these innocent combinations are no more burdensome on the memory than the details of a typewriter keyboard. On the contrary, they are vastly interesting. That the work of punching becomes as easy as any other task requiring ordinary intelligence is shown in the fact that the estimated average of 800 cards per day per clerk is the actual average. It is stated that some of the more expert punchers, working seven hours, have done 1,100 cards, with an aggregate of 18,700 holes, each card having 17 holes in it that relate specifically to the individual whose life history is thus condensed. After the cards leave the punching clerks, they are kept in their enumeration districts, and they have now to be further punched to show the exact locality they belong to, i. e., the civil division of which the enumeration district formed a part. For this purpose the space of about 1 inch across the left hand end of the card is used, no portion to the left of this line being punched on the

ILLUSTRATION OF TABULATING CARD.

This card is blocked out in nineteen (19) divisions indicated by black lines. The first relates to "Birthplace," the one below this on the left (read downward) indicates "Children living," and "Children born," "Conjugal condition," "Age," "Sex," "Color." The space on the right below the first division indicates "Birthplace of father," and next below this "Birthplace of mother." Thus, "Naturalization," "Occupation," "Months unemployed," "Literacy," "Language," and the last six divisions at the bottom of the card indicate "Enumeration District."

keyboard punch. This space is further divided into 48 squares, in the combinations of which every enumeration district can be recorded, and it is perforated by means of the "Gang Punch." The combination for any given enumeration district is arranged in this, and then all the cards of that district are passed through. From six to twelve cards can be punched at a time, hence the name, and pressure may be applied by either the hand or foot. When this is done, the cards are complete.

Familiarity with combination.—So familiar do the clerks become with the position of the holes in these cards, they can read them off at a glance. As a means of verifying, however, a "reading board" is provided for that purpose, the same size as the card, and having also each of the 240 abbreviations in a quarter-inch space, so that when a perforated card is put on this template, the abbreviation will show wherever a hole has been punched.

These wonderful little cards have now come to stand for over 70,000,000 people. Each card is not only full of holes, but has its number, and is ready for the next stage of treatment, when each of the holes will tell its story in just the same manner as the perforations in an organette strip will cause certain notes of music to be played. The cards are stacked up on end in boxes, measuring 20 by 7 by 3½ inches, each box tak-

ing 2,000 cards. In front of each box is a label stating its contents.

THE ELECTRIC TABULATING MACHINE.

The Electric Tabulating Machine consists of three main parts, namely, the press or circuit closing device, the dials or counters, and the sorting boxes. The press consists of a hard rubber plate, provided with 316 holes or pockets, the relative positions of which correspond with those of the holes in the keyboard and gang punches. Each of these pockets is partially filled with mercury, and they are thus in electrical connection, when the circuit is closed, with the binding posts and switchboard at the back of the machine. Above the hard rubber plate swings a reciprocating pin box, which is provided with a number of projecting spring-actuated points, so hung as to drop exactly into the center of the little mercury cups below. These pins are so connected that when a punched card is laid on the rubber plate against the guides or stops and the box is brought down, all the pins that are stopped by the unpunched surface will be pressed back, while those that correspond with punched spaces pass through, close the circuit, and count on the dials. The circuit is broken first through platinum contacts at the back of the press. In this way no difficulty is experienced from the oxidation of the mercury from the spark, as would be the case without this precaution.

The dials in front of each counter are 3 inches square, and, as now made, consist of paper ingeniously coated with celluloid, insuring a smooth, bright, clean face. Each dial divided into 100 parts, and two hands travel over the face, one counting units and the other hundreds. The train of clockwork is operated electrically, by means of the electro-magnet, whose armature, as it moves each time the circuit is closed, carries the unit hand for one division, while every complete revolution actuates a carrying device, which in turn causes the hundred hand to count. In this way each dial will register up to 10,000. A noteworthy feature of these ingenious little dials is that they can quickly be reset at zero, while they are also removable and interchangeable. The electrical connections are made simply by slipping them into the frames and clips.

SORTING BOX.

The third element in the system is the sorting box, which is divided into numerous compartments, each of which is kept closed by a lid. The lid is held closed against the tension of springs by a catch at the free end of an armature. If the circuit is closed, by the press on the machine, through an electro-magnet, the armature is pulled down, releasing the trigger of the lid, which is at once thrown up by the spring, and remains open until flipped back by a slight touch of the operator's hand. The connections with the machine are made by means of the short cable at the left of the sorting box. Wires are attached to binding posts on a small board, but a minor change has been made by which the board is pushed in between contact clips in the machine, thus saving valuable time by obviating the necessity of screwing and unscrewing so many binding posts whenever it is desired to remove the box for any reason.

If it is desired to know in a given enumeration district, or all of them, the number of males and females, white and colored, single, married, widowed, etc., the binding posts of the switchboard corresponding with these data are connected with the binding posts of the dials on which these items are to be counted. If it is also desired to assort the cards according to age groups, for example, the binding posts of the switchboard representing such groups are connected with the clips into which the sorting box plug fits. The circuits being prepared, when a card is placed in position in the press and the handle of the pin box is depressed by the operator, so that the circuit is closed through each hole in the card, not only will the registration be effected on the counting dials, but the sorting box that has been selected for a given age group is opened. The operator releases the handle, removes the card deftly from the press, deposits it in the open sorting compartment with the right hand, and pads the lid down again, at the same time bringing another card into position under the press with the left hand. It is done much more quickly than it is described. When all the cards in the case of any district have thus gone through the press, the record taken from the dials will show the number of males, females, white, colored, etc., while the cards will have been assorted into age groups.

The machine automatically throws out any card that is wrong. Suppose, for instance, that the age or sex has not been punched. Where there should be a hole for the plunger pin to go through, closing the circuit, the card is intact. The circuit is open, and the monitor bell just to the left of the press refuses to give its signal of correctness.

The mechanism of these three devices is the wonderful invention of Dr. Herman Hollerith, of the city of Washington, D. C. Many of these machines will be required. The building and adjusting of these machines is now in progress by the Tabulating Machine Company, under the personal supervision of Dr. Hollerith, who contracted with the government to furnish and maintain the efficiency of these mechanical wonders for the taking of the Twelfth Census of this country.

It is stated that the operation of these machines will effect a saving of 50 per cent. over the old method of tabulating and counting our people, besides a great deal of time, which is very essential in the taking of the Twelfth Census, which is in part to be completed in twenty-five months from the date of commencement.

Fruit Trees in Saxony.—Vice-Consul Murphy writes from Magdeburg, April 9, 1900:

According to a report published in the German Agricultural Press, the fruit trees in the province of Saxony, Prussia, were carefully counted in the years 1897-1899, and it was found that they numbered 12,793,461. Of this total 52.7 per cent. were plum trees, 19.6 per cent. apple trees, 16.8 per cent. sweet cherry trees, and 10.9 per cent. pear trees. Estimating the value of each tree at 8 marks (\$1.90), the fruit trees of the province of Saxony represent a capital of 100,000,000 marks (\$24,000,000).