

Hollerith works at the rate of 150 cards per minute, as against sixty cards per minute by the Powers. I may mention that the Hollerith Company are at present working on a printing attachment for their machine, which they hope to have perfected and on the market within twelve months.

The Powers tabulator differs from the Hollerith in several respects, but mainly in that it automatically prints off its own results, clears the machine, and starts on again, while the results have to be read off and taken down by hand from the Hollerith and machine restarted. It can be made to list or add, and has seven unit counters of nine figures each, as against the five on the Hollerith; the counters can also be split where required, but a separate connecting-box adjusted to the columns to be operated on has to be specially built for each distinct job. Thus in transferring from one job to another the connecting-box must be changed; the operation of changing the connecting-box is not a difficult one, however, and can be effected in a very few minutes. Where the machines are rented three connecting-boxes are supplied with each machine, and extra rent is charged for every additional box supplied. By arranging the work for the cards so as to use the same fields for more than one job the same connecting-box can be used.

As already stated, the Powers tabulator automatically prints its results; it will either give a detailed record of the data being tabulated on each card, or will omit all details and print only totals, and may be set to either list or add. It will *not*, however, as in the case of the Hollerith, cumulate totals, the machine being cleared each time it prints a total.

While the Powers tabulator works only at the rate of sixty cards per minute as against the 150 cards per minute of the Hollerith, yet on work where there is a large number of small classes being dealt with this disadvantage is largely discounted, owing to the automatic action of the Powers in printing, clearing, and going on again without stopping, whereas the Hollerith stops at the end of each class, and there is a delay taking down the results and in starting the machine again, which considerably offsets the difference in speed. On long runs, of course, this does not hold; also, owing to the same automatic action, so long as there are plenty of cards for it to work on, and paper to print its results on, the Powers tabulator can be left to run itself. In the Inland Revenue Department at Washington one junior clerk was attending to four Powers tabulators, and I was told he sometimes took care of six; all he had to do was to keep the machines fed with cards, and even if he neglected this nothing went wrong as the machine merely stopped. Both Hollerith and Powers tabulators are decimal machines, and require special provision built for English currency; on the Hollerith two columns are required for dealing with pence, while pence can be dealt with on one column in the Powers, which is an advantage in favour of the latter. In both cases, however, it has to be determined beforehand how many counters are to be built for English currency.

In regard to the general efficiency and economy in the use of either plant I desire to emphasize one or two points. I noticed the highest efficiency in each case was obtained from the larger concentrated plants where there was abundant, constant, and continuous work and a well-directed staff of expert punch operators, with a plant sufficiently large to require the continuous attention and care of a mechanic to regularly overhaul, test, and see that all the machines are always working smoothly and accurately. To attain and maintain speed and accuracy in punching the cards an operator must in the first place be properly trained, and then have continuous and constant work on the machine. The fastest operator is frequently the most accurate, and a falling-off in speed usually means an increase in the percentage of errors. Then, where no mechanic is in constant attendance small faults may at any time develop, which if not immediately rectified may result, before being noticed, in incorrect work and then considerable delay and loss. With a mechanic taking care of the machine such faults are not allowed to develop; the machines are all cleaned, oiled, tested, and tightened up twice daily, which, besides avoiding errors and delay, considerably extends the life of the plant. On the New York Customs statistics one mechanic attended to nineteen slide punches, eight sorting-machines, and thirteen tabulators. The card consumption in this office amounted to 750,000 a month.

Properly organized and directed, there is no doubt whatever as to the economy of the machines. They are, of course, seen to best advantage on the big jobs. Where hand methods are to be employed one is usually concerned to study to cut down the detail required to a minimum, but with the machines the extent of detail to be tabulated is of little importance. The bigger the job and the greater the detail involved the greater the economy. Once the detail is accurately transferred to the card it can be tabulated and analysed in any combination and to any extent required very rapidly and cheaply, with absolute accuracy. To all my inquiries as to the extent to which economy had been effected the replies were emphatic as to the value of the machines, but the estimates varied from 20 per cent. to 50 per cent. according to the size of the job. I was informed that it was difficult to say exactly what economy had been effected, owing to the fact that immediately the machines were introduced and their capabilities realized the scope of the work was enormously extended; in the majority of cases, I was told, they were now getting three to four times as much work for practically the same or less cost.

In the case of the United States Customs statistics I was told that in pre-machine time it took a staff of 115 to handle statistics for the New York port alone and issue one report. Now, with the machines and a staff of ninety they are handling five times the volume of work and issuing eight reports. They said that without the machines the increase in work and reports occasioned by the war could not have been handled.

Another great point in favour of the machine is the ease with which additional details to those determined on may be taken out. So long as the cards are retained any further particulars can be obtained from them at any subsequent time and with very little labour. For instance, I was told by the United States Army Medical Statistical Office in Washington that a medical Board sat to consider what statistical tables should be prepared from the records of the medical examinations of men for the United States Army, and determined that fifteen tables would cover all that was necessary. The Statistical Office then set to work, and after some twelve to fifteen months, with a moderate staff and a Hollerith plant, these were completed. As each table was completed it was examined carefully by the Board, and quite a number of unexpected points were brought to light, which led the Board to ask for two new tables. Major Love, in charge of the Statistical Office, told me they were able to get out these additional tables in just a little