August 7, 1919.

Dear Wilson:

I have just received yours of the 5th. I will gladly tell you all I can about the developement of the Tabulating machine. Please make due allowances for errors of spelling etc. Life is too short to correct type writing.

In 1879 I was appointed a Special Agent of the U.S.Census and worked as an assistantv to Prof W.P.Trowbridge who was in charge of the s statistics of Powor and Machinery used in Manufactures. This brought me in contact with Dr.Billings who had charge of vital statistics and as an amusement or at least a diversion I computed a loy of life table for Dr. Billings. Of course for our life tables we used the population figures and so it happened that one sunday evening at Dr B tea table he said to me there ought to be a machine for doing the purely mechanical work of tabulating population and similar statistico. We talked the matter over and I remember his idea was something like a type distributing machine. He thouht of using cards with the description of the individual shown by notches punched in the edge of the card.

I went to Mr.Leland of the Census office who had charge of the population division and asked him to take me as a clerk reporting for duty and let me see what the job was. After studing the problem I went back to Dr.Billinfs and said I thought I could work out a solution for the problem and asked him would he go in with me. The Dr said no he was not interested any further then to see some solution of the problem worked out.

Soon after General Walker who left Washington to accept the presidency of the Mass Institute of Technology invited me to come to Boston as an Instructor in Mechanical Engineering. While at Boston I made some of my first crude experiments. My idea at that time was to use a strip of paper and punch the record for each individual in a line across the strip. Then I ran this strip over a drum and made contacts throughthe hole to operate the counters. This you see gave me an ideal automatic feed. The trouble was however that if for example you wanted any statics regarding chinamen you would have to run miles of paper to count a few chinamen.

I then abandoned the continuous strip and took up individual cards. Some of the very earliest work I did was for the City of Baltimore where I compiled the vital statistics by punching a card for each death with a conductors punch. I punched down one side across the bottom and then up the other side of the card. The card was cobnsiderably larger then the present card. I have some of these cards around somewhere and if you are interested I will try and find some when next in Washington.

One thing that helped me along in this matter was that some time before I was travelling in the west and I had a ticket with what I think was called a punch photograph. When the ticket was first pre sented to a conductor he punched out a description of the individual,as light hair ,dark eyes.large nose etc. So you see I only made a punch photograph of each person.

In due time along came the census and it was indeed a brave act on the part of Mr. Porter to award me a contract for the use of the machines in compiling the census. Where would he have been had I failed.

While the census was underway my attention was drawn to the statistic of agriculture. Here was a question of adding not counting. The only previous work approximating this was in the case of some work I did for the Surgeon Generals office under Dr Ainsworth afterward Adjutant Gen. Here was the problem for detrming the number of days sick for the soldiers. The reports were made monthly and any case may have been sick from 1 to 31 days so I had to develope a machine for this and I follwed the same lines in the Agricultural statistics. They were certainly wonderful machines. They were operated by weights and I had these weights over against the wall and small wire ropes running from the machines over pullies.

Now while I was struggling along with these agricultural statistics along came J.Shirley Eaton whose brother was a clerk in the Agric census and asked me why I did not use the machines for railroad accounting. I remember distinctly telling him there was one godd reas on and that was that I did not know the first damned thing about railroad accounts.

I took up the study of this matter and after some years I made the same proposition to Mr Riebenack and to Mr Carstensen. Then I came down here on Mobjack bay and awaited deveopments. It seems that about the same time both decided to give the matter a trial. But Carstensen telegraphed while Riebenack wrote so it came about that I started with the New York Central. It was sr

(At this point I was interrupted last night)

This experiment was started with machines like I used in the Agric census. That is to say a dial for each column that was added. This will show the transition from census machinery to railroad machinery.

While engaged in this work the Russian census came along and I went to Russia leaving the railroad work in charge od Eaton. When I returned from Russia I was greeted with the news that the machines were thrown out. I then got busy at once and developed the machine with counters or more properly adding mechanisms such as you first worked with at the P.R.R. It required some effort and patience to get the N.Y.C. to try it over again but I succeeded and you know the history from there on.

Now the railroad work reacted on the consus work in that when the census of 1900 came along we used machines such as were used in R.R. for compi ling the Agricultural census. See Newcomb paper on this subject.

Now comes a reaction from census to railroad. At luncheon with Governoe Meriam he called my attention to the enormous work involved in sorting the agricultural cards. I said he ought to use a machine and in reply to his question I said no I did not have one but could build one. and so it was finally agreed in order to save time I was to build him some machines and he was to pay me cost plus a profit of ten or twenty percent. In my opinion I think this was the worst mistake I made in a business way. You see I let the title to those machines go to the government which was contrary to my general policy. However I built the horizontal sorters and some of these afterwards went into R.R. offices.

Now this brought up the question of sorting machines for population cards and I then developed and built some vertical machines for sorting pop

ulation cards. The problem here was very different then in the case of Agric ulture and R.R. In the latter case we only had to sort to locations of a hole in a column. In case of population cards we had to sort according to combina tios of two or more holes. One of these holes might be at the top of a card and the other at the bottom besides of course they might be in different columns. As I recall it I built only two of these machines and instead of selling them or even renting them to the Government I ran them on the basis of so much per thousand cards sorted. It was good paying business. The machines sorted about 400 cards per minute and I think I was paid 17 cents per thousand. We of course had to keep the machines in order but the government clerks handled the cards. Hayes played nurse to these machines I think for some time and he no doubt could tell you lots about them.

There is no doubt that these machines are the very best type I ever developed and the only reason I did not continue to use them was that they were rather complicated and especially they would have tied up a lot of capital in building them. The wonder to me is that as these patents have or about to expire that Powers or some one like that dont take them up. I have heard lots about Powers sorters but I dont think they would be worth considering along side of a machine built on these old lines.

Now as regards useof machines for other purposes I think I started cost keeping with Hershom Smith at Penn Steel Co before the census of 1900. Merrill could give you data on this . But no it must have been after the census for Merrill was in washington first. For sales analysis I think the Western Electric was about first. They used the machines both in New York and Chicago.

When we bought the Taft Pierce Co I put in a system of cost accounting and used the machines.

The first real good job of sales analysis was the introduction of the machines at Marshall Field. This came about in a peculiar way. Mr. C.E.Martin of Marshall Field was in the east and called on a friend at Wannamaker in New York (Mr.Comstock) Martin asked what was new and comstock reached down in his desk and showed Martin a reprint of an article that had appeared in the Railroad Gazette describing the accounting of the New York Central. Martin went back to Chicago and wrote to me from there

After the census of 1900 things moved pretty fast and after my row with Porth I devoted my attention entirely to commercial work and as you know one customer brought another.

However I always have regretted that I could not stay in census work long enough to carry out my ideas regarding verification machines.

In all statistical work certain stupid errors will go through in spite of every effort. I once wrote to the Director of the census on the subject and after pointing out some of the blunders in his publications I called his attention to the fact that others were guilty in the same way and as an illustration pointed out that in a publication of the city of Paris they carefully specified the ages of three females who died of diseases of the prostate.

I used a modified automatic tabulating machine for verification in the census but I was arguing for a much more extended use. By simply studying the problem and then hitching up a lot of relays you get a machine which will handle cards at the rate of 400 per minute and in this way throw out all inconsistent cards such as widows 5 years old foreign born in this country less then 5 years yet reported as naturalized citizens, etc etc .

Now my dera Wilson if I have not given you what you want indicate just what you want and I will try again. Yours,