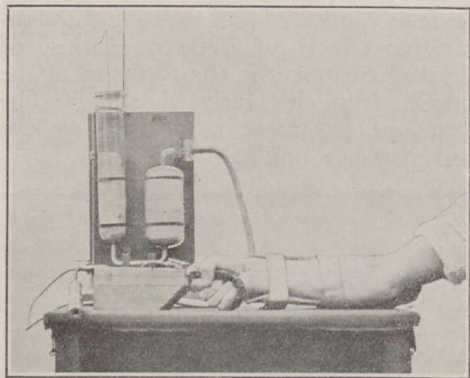


made it possible to record tracings of all the experiments conducted.



Amar's *Poire Dynamographique*.  
Grip contracted, air expelled from bulb.

The object was not to estimate the total capacity of the muscles for work, nor was it to study the time necessary for the onset of a degree of fatigue against a definite load. It was primarily to produce, within a reasonably short time by isotonic contractions, a condition of absolute fatigue, and then after a definite period of rest or treatment, study the degree of recovery for the same type of work. Since the construction of the first digital ergograph by Angelo Mosso<sup>20</sup> in 1884 a great many modifications have been made, and many experiments conducted by Maggiora, Lombard, Hough, and others. Most of these experiments had to do with problems other than that of the ability of the muscle to recover from the effects of fatigue.

One-half second was allowed for contraction, and a similar time for relaxation, the  $\frac{C. \frac{1}{2} \text{ sec.}}{R. \frac{1}{2} \text{ sec.}}$  rate being somewhat faster than Hill's<sup>21</sup> conclusion as to the optimum rate for maximum effort. From 60 to 120 contractions were recorded before absolute fatigue set in, which, therefore, occupied from one to two minutes of time. Care was taken to see that the maximum contraction of the fingers was made each time, and this would readily be determined by the excursion of the needle. There is a possibility of error in that the range of movement and the force applied would gradually diminish. This, however, would remain moderately constant in all experiments, and was con-

sidered satisfactory for comparative purposes. Care also was observed in the rhythm of contraction, this being much more difficult to maintain after the onset of fatigue. The psychic factors were reduced to a minimum, and each subject was asked to do his utmost at each attempt until he could stand the pain no longer. He was also requested to exert at the outset only sufficient force to expel the air from the bulb. It is recognized that the "will to do" cannot be measured in any investigation of this kind, and some subjects would probably discontinue relatively sooner than others. As this characteristic would no doubt be fairly constant for the same individual, the result of the comparative study would not necessarily be markedly affected.

Periods of not less than a week intervened between the tests made, and the custom was to test the right hand on one day and the left hand another, alternating for the next occasion on which the patient appeared. In some cases the "rest" tests were conducted first, and in others, one or other of the forms of treatment employed. The factor of practice and "training" was thus taken into account.<sup>22, 14, 15</sup> Each of the fifteen subjects was tested on all phases of the study, and each one, therefore, performed eight different tests, right and left hands under rest, under radiant heat, under massage, and under galvanism.

After working the muscles to absolute fatigue, that is, until they could not perform any more of that particular kind of work, and then giving them ten minutes rest, it was found that the *average recovery percentage of all thirty tests was 82.2%*.

It was interesting to note that the highest initial effort and the two lowest recovery percentages were made by one man "A," while the two highest recovery percentages under treatment, and the highest recovery under rest were made by another individual "B." A's muscles were of the short, knotty, well-defined type, while B's were long, smooth, and poorly defined, even when contracted. Does this observation have any relation to the supposition that type "A" is the sprinter type, from which one can expect a maximum of speed in a minimum of time in contradistinction to type "B," as