

keys such as exist in the Smith-Premier typewriter, and the use of a machine having all capitals and a single bank of keys, as with the Remington or Monarch. By this means the motions of the shift key are entirely dispensed with and a legless one-handed typist is enabled to equal the output of many of the commercial typists who are using but two of their ten fingers to-day; and a cripple with but a single finger can earn a living. We have also found dictating machines of use in decreasing the number of variables against which the typist works. When provided with a dictating machine, a typewriter requiring no shift-key action and with the rolls of paper properly attached, a one-handed willing worker can compete successfully with the average stenographer typist with the old equipment, and perhaps, in some cases, be able to earn more money than before being crippled."

The writers report that they have so far found manufacturers of devices more than willing to adapt their work to the requirements of the maimed and crippled. They hope to arouse still

putting the cripple again on the pay-roll, with a consequent economic gain to the world.

"This work will undoubtedly be done. Individual histories and improvements will come from each man and woman interesting himself or herself, to observe, record, and pass on data describing actual histories of cases where cripples have become successful. It is this active, interested, practical cooperation that is needed—and is needed now."

BRAIN-TESTS OF ANIMALS

PIGS ARE SMARTER than either rats or crows. Monkeys are still brighter, and the large apes show decided signs of thought. These findings have been ascertained by Robert M. Yerkes, of the psychological laboratory of Harvard University, who put the animals through certain brain-tests. The results were related by him to the National Academy of

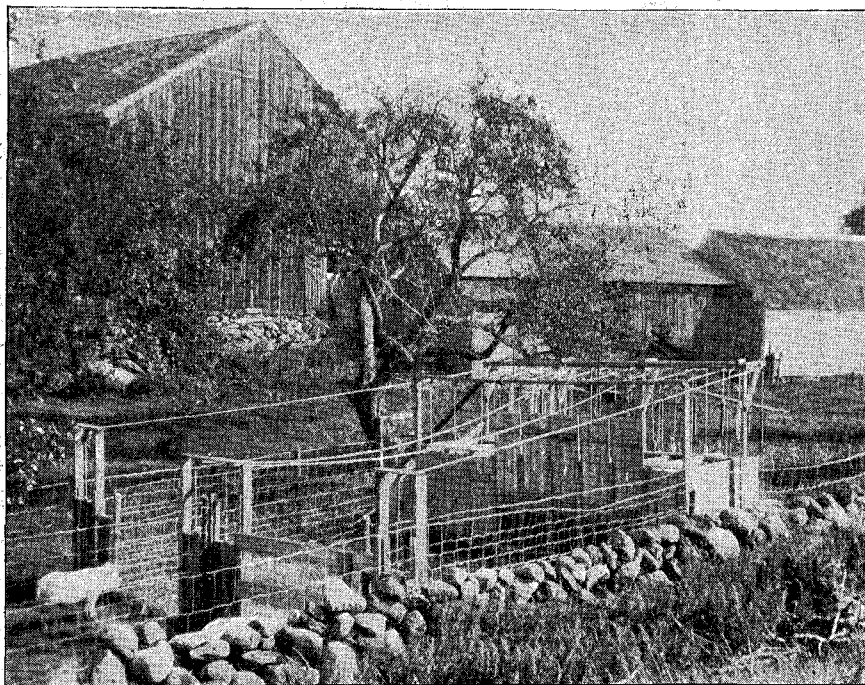
Sciences, at Washington, on October 20 last, and are printed in its *Proceedings* (Baltimore, November). The competitive examinations were conducted on what is known as the "puzzle-box" plan, devised by Dr. E. L. Thorndike and improved by Mr. Yerkes for his present purpose. A series of practical problems is put before the animal and the quick and complete solution of them depends upon ideational processes. Writes Mr. Yerkes:

"The apparatus consists of twelve, or, in some forms, nine identical reaction-mechanisms, of which any number may be used for a given experimental observation. In the type of apparatus originally used for human subjects, these mechanisms are simple keys; in that which has been used for lower animals, they are boxes arranged side by side, each with an entrance-door at one end and an exit-door at the other, which may be raised or lowered at need by the experimenter through the use of a system of weighted cords. Under the exit-door of each box is a receptacle in which some form of reward for correct reaction may be concealed until the door of the appropriate box is raised by the experimenter.

"It is the task of the subject to select from any group of these boxes whose entrance-doors are raised that one in which the reward (food, for example) is to be presented. The experimenter in advance defines the correct box for any group of boxes which may be used as that which bears a certain definite spatial or numerical relation to the other members of its group. Definitions which have actually been employed (problems presented) are the following: (1) the first box at the left end of the group (as faced by the subject); (2) the second box from the right end of the group; (3) alternately, the box at the left end and the box at the right end of the group; (4) the middle box of the group.

"The boxes are presented in varying groups in accordance with a prearranged plan. The subject is punished by confinement in the box selected every time it makes an incorrect choice and is then allowed to choose again, and so on until it finally selects that box which is by definition the correct one. It is then rewarded with food and permitted to pass through the box and return to the starting-point, where it awaits opportunity to respond to a new group."

All the animal candidates succeeded in solving Problem 1—the crows in 50 to 100 trials, rats in 170 to 350, pigs in 50 or less, and monkeys and apes in 70 to 290. The crows and rats failed with all the other problems; the pigs solved the two next, but failed with the fourth; the monkeys succeeded with No. 2, but not the large ape. This looks, at first sight, as if the pigs had worthily maintained the tradition of the "learned pig" who played cards at the old-time fairs; and as if our nearer



Illustrations by courtesy of Robert M. Yerkes.

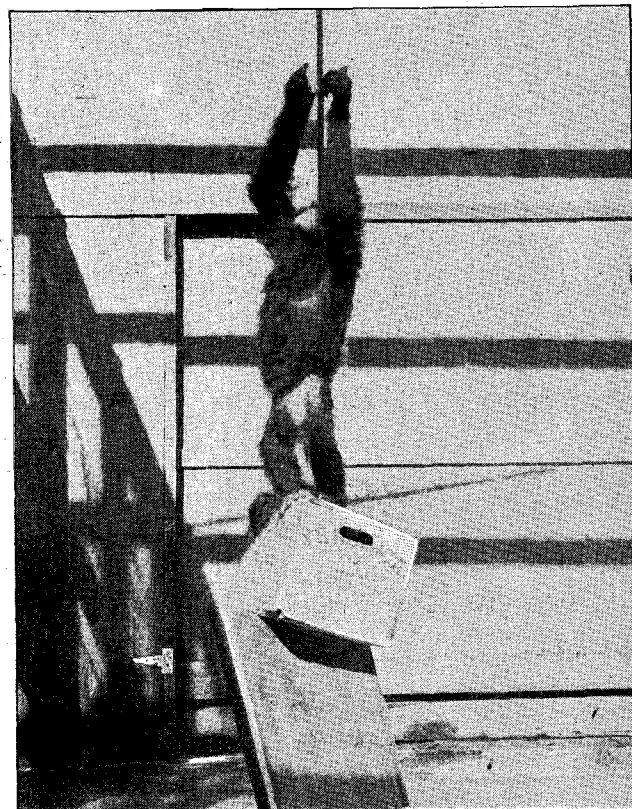
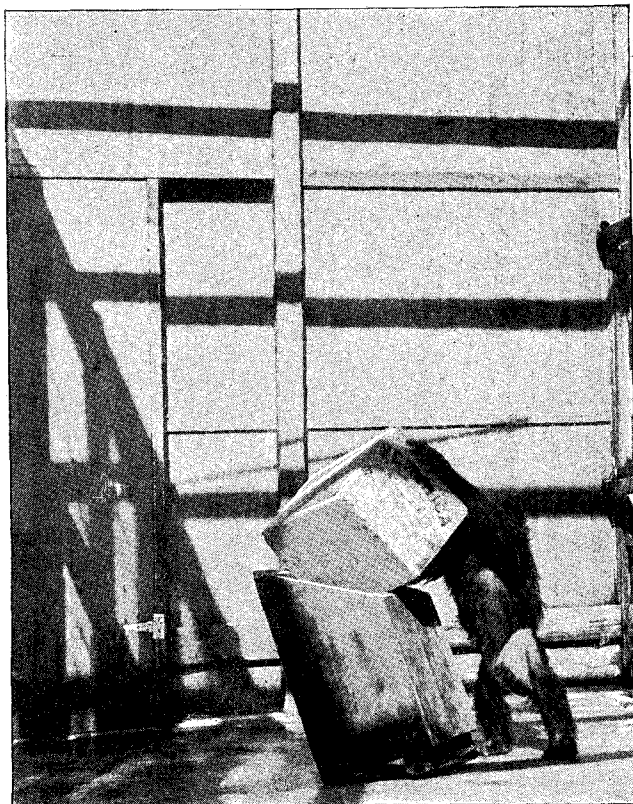
THIS LITTLE PIG SHOWED SENSE

By learning after some fifty trials in which box his food would be concealed.

further cooperation in the makers and users of devices, that they may "think in terms of cripples" as well as of the usual types of users, during the inventive, manufacturing, and using periods. We read, in conclusion:

"Given your individual cripple, study his motion possibilities carefully, then use or adapt every device available or procurable. When you have done this, still more can be done by fitting your cripple to your best existing device. Those who have read the record of the marvelous work being done abroad, and of the increased number of minutes of happiness that are resulting among these cripples who are enabled to become interested, productive members of the community through this work, can appreciate the need of cooperating, here in this country, and of thus reducing the amount of work that must be done there to a minimum, for while we hope the wars will cease, the knowledge will be useful for industrial workers forever.

"While waiting for the slow progress of inventing methods and devices to be modified and adapted to the need of cripples, it is hoped that some society will cause to be collected as many as possible of the histories of cases where cripples have become able to cope successfully with their handicaps. Such data should be compiled, properly classified, cross-indexed, and incorporated in a series of books, copies of which should be put in every large library in the world. The book would eventually pay for its cost of compilation and distribution. Such a series of books would not only cheer and encourage many a discouraged cripple, but would also be a contributing cause toward actually



AFTER THINKING IT OVER, THIS APE DECIDED THAT BY STACKING THE BOXES HE COULD GET THE SUSPENDED FOOD.

relatives, the anthropoids, were backward in intelligence. The reasons that induce Mr. Yerkes to conclude that the orang-utan, or large ape, showed superior mental powers are these:

"The orang-utan (Julius) reacted uniquely. . . . At the very outset he developed a definite habit of response which, as it happened, was inadequate for the solution of the problem, but yielded constantly 60 per cent. of correct first choices. The habit or reactive tendency was that of choosing each time the box nearest to the starting-point. Julius continued to use this method without variation for eight successive days. Then a break occurred, but after a few days he settled back into the old rut. At the end of 230 trials, it was decided to try to destroy the ape's unprofitable habit. This attempt was made by using as correct boxes only those to the left of the middle box of the series. The nearest box, in such case, was never the correct box. Consequently, this modification of method greatly increased, as the curve of errors shows, the number of mistakes.

"For a few days after this change was made, no improvement in reaction appeared. On May 10, in a series of ten trials, seven were incorrect, but the following day and thereafter only correct choices appeared. Thus, suddenly and without warning, the ape solved his relational problem.

"Is this the result of ideation? If not, what happened between the poor performance on May 10 and the perfect series on May 11? Because of varied results obtained in other experiments with this ape, I suspect that ideational processes developed."

Mr. Yerkes's high opinions of the ape's mental ability were increased by additional tests, including the stacking of boxes to reach a suspended banana, the use of a pole to obtain food, and that of a stick to pull food into the cage. Here the ape succeeded, tho in the box-stacking problem some instruction was necessary. The monkeys failed in every case. Says Mr. Yerkes:

"The general conclusions which may be deduced from this limited experimental study of two monkeys and an orang-utan are that the ape exhibits various forms of ideational behavior, whereas the reactive tendencies of monkeys are inferior in type and involve less adequate adaptation to factors remote in space or time. I suspect, from data now available, that both monkeys and apes experience ideas; and I believe that it will shortly be possible to offer convincing evidence of the functioning of representative processes in their behavior."

DOCTORING THE STREETS

INSTEAD OF HAVING TO FLUSH OUT our respiratory passages with antiseptics to cure grip, it would be better, thinks an editorial writer in *Engineering and Contracting* (Chicago, February 7) to do the work a little earlier and to perform it on the streets instead of on our own mucous membranes. The object is to kill germs, and it is rather better to kill them before than after they obtain a lodgment in the human organism. The editor advises engineers to adopt all available methods of propaganda against the "dust nuisance," promising them the same measure of success that they have already obtained in eliminating water-borne diseases, such as typhoid, by furnishing towns with a rational water-supply. No sane city would think of going back to the old era of wells and cesspools, in more or less free connection. Perhaps we shall one day cure also our present dusty streets. Says the writer:

"Dwellers in American cities owe to civil engineers a debt that they never can repay—a debt for a service that is rarely thought of now that it has been rendered. We refer to the practical elimination of typhoid fever in all cities that have installed filtration and water-treatment plants. Not only were these plants designed by engineers, but engineers, personally and through engineering journals, were the educators who taught the public that it could be protected against typhoid.

"The editor recalls some of his own educational work twenty-five years ago when he moved to a small city where a typhoid epidemic was in progress. He found that, aside from physicians, no one in the city seemed to know the cause of typhoid and the steps to be taken to prevent it. The doctors were strangely silent, so the epidemic had spread and was still spreading, for nearly every family used water from shallow wells. A new water-works plant had just been built, and its source of supply, a lake, was free from possibility of contamination. The owner of the water-works did not know the cause of typhoid, but he was quick to spread the knowledge when the writer told him the cause. The epidemic was brought under control as rapidly as people ceased using well water and took their supply from the lake.

"Civil engineers all over the country were similarly instrumental in spreading the knowledge that pure water is readily