After the war a number of countries set to work in desperation to solve the problem. In 1921 a way that worked was found at a plant in Syracuse, New York. Plants of various countries are now able to produce over 300,000 tons of fixed nitrogen each year, but the capacity of Germany's plants alone accounts for over 90 per cent. of the total.

This process sounds as simple on paper as any of the others but it was the hardest nut to crack. A properly proportioned mixture of nitrogen and hydrogen gas is passed over a catalyst, a substance that by some seemingly magic influence can make two unwilling elements react chemically toward one another. The combination forms ammonia. Heat is produced, and not absorbed, during this reaction and the more the temperature is kept down and the pressure up the more ammonia is evolved. A difficulty of this process is to obtain pure hydrogen and nitrogen, for impurities lessen the efficiency.

"The synthetic ammonia process is much better suited to American conditions than the arc or the "cyanamide process," Dr. J. M. Braham of the U. S. Fixed Nitrogen Research Laboratory has stated. "There are in this country enormous potential sources of hydrogen. The power requirements are small and the process does not require a large amount of labor."

NEW MACHINE SENDS CODE MESSAGES AUTOMATICALLY

If the code message in Edgar Allan Poe's famous story "The Gold Bug" had been written on the machine described recently to the American Institute of Electrical Engineers, Legrand, would not have had such an easy time deciphering it, for the age-old search for a method of putting important messages into a code which cannot be interpreted without the use of the key seems to have been achieved.

The new machine was described by G. S. Vernam, engineer of the American Telegraph and Telephone Company, who stated that it had beendeveloped for the use of the Signal Corps of the U. S. Army during the war, but until recently it has been kept secret. However, one of the advantages of the device is that even an unauthorized person who has full knowledge of the methods and apparatus used can not interpret the message without the key.

In use, the sender writes the message on a keyboard similar to that of a typewriter, and a perforated tape results which canbe used in tape transmitters frequently used in telegraph offices. By means of another kind of machine, if it is desired, the cipher message canbe written directly in five letter code words on paper in ordinary characters. When the message is received, it is written on a tape in perforations, and when this is passed through the deciphering machine, the message is written out in plain text on a sheet of paper.

The method used is one involving what is referred to as a multiple alphabet substitution cipher. In the ordinary substitution cipher a cipher alphabet with the letters arranged inan arbitrary manner replaces the actual alphabet in the same order. That is,instead of starting A,B,C, etc., the cipher alphabet might start F,Q,R, etc., and in use, the letter A in the original message would become F in the cipher; B would become Q,, and so on. Such a cipher may easily be interpreted in the way Poe made famous in "The Gold Bug", by noting the letter that occurs oftenest and calling it E, which is most used in the English language.

O is the next oftenest used, with T a close third, J. X and Q being the least used.

With the multiple alphabet cipher, a series of cipher alphabets are used one after the other, the order being given by means of the key word, but the same alphabet is used over and over at regular intervals. While more difficult than the single alphabet, the cipher expert, or "cryptanalyst", can interpret such a message without the key. However, if a key as long as the message itself is used and the letters in it are selected at random, it is practically impossible to translate it. This is the system used in the machine, and the key is another tape, so that the transposing of the letters is done automatically.

As a further improvement, a way was found to obviate the use of a tape as long as the tape of the message itself. This was accomplished by using two loops of tape which combined give the key. One loop is one character shorter than the other, so that as the two tapes pass through the machine at the same rate of speed, they must go around many times before the same combinations are repeated. This gives the effect of a very long tape.

Mr. Vernam stated that the apparatus could also be used for radio, or if necessary the code tape could be sent by mail without fear of its being interpreted by an unauthorized person.

ULTRA-VIOLET LIGHT NECESSARY IF MILK IS TO PREVENT RICKETS

Batteries of quartz-tube ultra-violet lamps may become a necessity in stables where dairy cattle are fed in winter, if the experiments performed at the Maine Agricultural Experiment Station by Dr. John W. Gowen and his associates may be taken as an indication. The experiments show that milk from cows receiving a "dose" of ultra-violet light from mercury vapor lamps contains the substance that prevents rickets in children and young animals, while the milk from cows kept away from sunlight and not treated with ultra-violet light was powerless to prevent the ailment.

In the experiments, Holstein- Friesian cows of nearly the same age and calving date and receiving like treatment as to feed, temperature, etc., were placed side by side in the same barn.

"Throughout the experiment these cows did not leave the barn. For one month none of the cows received ultra-violet light. For the second month two cows received ultra-violet light fifteen minutes a day generated from a Cooper-Hewitt alternating current light at three feet above their backs. For the third month these cows received ultra-violet light for thirty minutes a day under the sameconditions. In the meantine Rhode Island Red chickens were allowed to develop rickets, shown both clinically and by X-ray photographs. They were divided into two lots, one lot of three chickens receiving milk from the ultra-violet cows, the other of two chickens, milk from the control cows, Both lots received all the milk they wished.

"The chickens have now been under treatment fifty days," Dr. Gowen stated. "The lot receiving milk from cows exposed to ultra-violet light are in good condition with no appearance of rickets in X-ray plates. The lot receiving normal milk has moved progressively toward more extreme clinical and X-ray rickets. The