ENGINEERING

Machine-Made Jobs

Labor-Saving Improvements Are Creating Opportunities As Well as Crowding Some From Old Employments

By WILFRED OWEN

See Front Cover

EVER since man created machines to multiply his powers of production there has been divided opinion regarding the effects upon employment which follow the adoption of technological improvements. With equal fervor the machine is blamed for unemployment and praised as the agent of our economic supremacy, and while the prophets of calamity see industrial salvation only in their land of Erewhon, Utopians joyfully measure production to infinity.

The fact remains, however, that while machinery may and often does displace the laborer, it also has the power of creating employment, and net effects are always dependent on particular circumstances, many of which lie beyond the machine.

When the electric refrigerator began to bar the ice man from America's back doors, many a disciple of the "good old days" lamented his passing. They overlooked the fact that electric refrigeration had joined the industrial roll call, creating new employment and new purchasing power, and that the marketing of this new machine was stimulating a demand for ice. By 1930 the number of ice dealers had increased 237 per cent over the census of a decade before.

Clerical Work

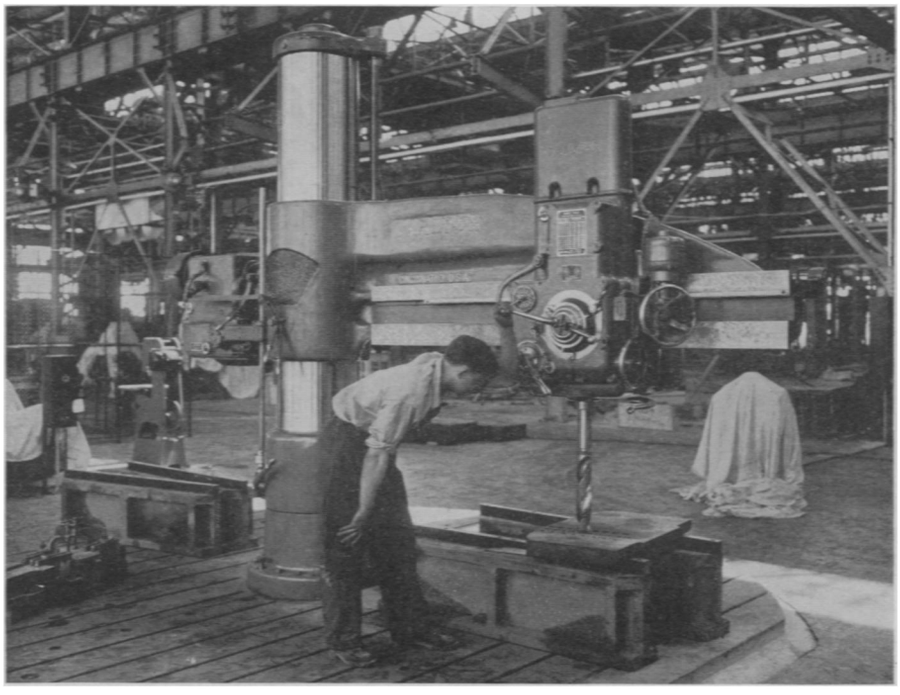
A number of such examples have been pointed out by the Machinery Institute to illustrate the possibilities of technological improvements in the creation of employment and prosperity. The modern office building, for example, is alive with the lesser monsters of a mechanized age: dictaphones, calculators, typewriters, and other labor-saving devices. It might be supposed that such equipment as this would mean sharp reductions in the office force. In reality it has made possible an amount of clerical work which could never have been attempted by unassisted labor, and in the period from 1920 to 1930 the total number of persons working as typists, stenographers, bookkeepers, cashiers and accountants had increased by 392,000. Large-scale business built by machinery has made such workers a necessary part of the industrial structure, and a mechanized office has become the offspring of dynamo and power loom.

A well-known iron monster is the steam shovel which digs and lifts and loads materials that armies of men might be doing by hand; and we readily deplore, without thinking, the numbers of workers who no longer dig for a living. But the steam shovel, while it has admittedly displaced this type of unskilled labor, has at the same time made possible a program of industry which might never have been dreamed of had men and their shovels been required to build its foundations. The steam shovel, which has opened the earth for endless roads and towering skyscrapers, has created a tremendous new demand for raw materials, public works, transportation, and plant construction, employing a tremendous succession of workers from miners and lumbermen to steel workers, masons, carpenters, riveters, and a host of others. Without the power of this single machine how could we create such a demand for the products of other industries?

Printing

Printing is another industry which employed hand labor to a large extent some forty years ago. With reductions in the cost of printing which followed the introduction of machinery, the price of reading matter became a minor issue, and demand for the printed word soared to such heights that despite the increased output per laborer made possible, the total number of such workers has become five times as great as it was in 1890. The effects felt by the lumber and paper business, moreover, and on mechanics, newsdealers and writers are not to be overlooked.

When the dial telephone was installed on less than three per cent of the Bell system in 1921, there were 190,000 operators asking us, number please? By



NEW POSSIBILITIES

A radial drill press used in the production of solid steel bodies for automobiles. Could we have done this by hand?

NOT FORGOTTEN

There are machine-made jobs in industry for women, too—occupations undreamed-of before the coming of the modern era. Operating the "fadeometer," which tests the resistance of fabric colors to the bleaching action of light, is one of the skilled occupations requiring a considerable degree of training.

1930, with 32 per cent of the system on dial service, the telephone girls we had thought might disappear altogether numbered 249,000. Telephone calls had increased more than 100 per cent, at the same time nearly doubling the need for both telegraph and telephone linesmen.

Auto Brings Jobs

A prime example of the beneficial effects upon the labor market which may be realized by the introduction of machinery and mass production is the automobile. Had it been impossible to attain our present labor-saving technique in the manufacture of motor vehicles, it would be difficult even to visualize the 28 million we now possess. It is reported that in 1935 six million persons depended either directly or indirectly upon the highway and motor vehicle industries for their livelihood—one out of every seven gainfully employed. In 1931 there were approximately a million men engaged in the building of roads, and two and a half million truck, taxi, and bus drivers, and private chauffeurs. The purchasing power created by these tremendous new industries is tremendous. The automobile is the largest consumer of rubber, mohair, plate glass, lubricating oil, gasoline, nickel, lead and steel. Our use of this latter product has increased from 2,600 pounds per capita in 1900 to 16,800 pounds in 1935. Such are the salutary signs of machine-made industry.

We have purchased more clothing than ever before since machinery made possible its production at lower cost, and though but a fraction of the human labor formerly required is now employed per unit of goods, demand has so increased with lower prices that almost a third more workers are making women's clothing today than ten or twelve years ago. For every seven persons engaged in the manufacture of men's furnishings between 1923 and 1925 there now are eight. The textile industry, according to the National Industrial Conference Board, was on the whole providing more employment per unit output in January 1936 than in the same month of 1929. Who would return to the spinning wheel?

Displacement Too

Nevertheless, to conclude from these examples that machinery never causes permanent displacement of labor would be as far from the truth as to assert that economic ailments are the inevitable result of technological innovation. The classical theory that labor-saving devices cause only a short-run period of unemployment is not always substantiated by the facts, for lower unit costs made possible by machine processes will not increase demand when the conditions of demand are inelastic.

Demand May Be Constant

For example, if some necessity of life, such as bread, were produced and sold at half its present price by the use of improved machine methods, there would be little increase in the amount of bread consumed. It is true that purchasing power thus released might be used for the buying of some other product, but only by those with restricted incomes whose demand for other things has been hitherto limited. And such releases of consumer spending would in all probability be distributed over so varied a number of goods that no one industry would necessarily need to increase its labor force to meet the added demand. The permanently displaced baker would not be reemployed as a result of the technological improvements in his industry. Such is the case with the introduction of mechanized farming equipment.

Another factor to be considered with regard to displacement of labor, either temporary or permanent, is the decrease in consumer spending when workers lose their jobs. We are so intent upon the supply side of the economic equation that we too often forget that production cannot be profitable when consumption cannot keep pace, and that the wage earner is the consumer.

Sometimes Elastic

Suppose, on the other hand, that our technological improvement is applied to an industry whose product is sold under conditions of elastic demand, that is, a demand sensitive to changes in price. Clothing, gasoline, moving pictures, and choice types of foods might be mentioned as examples. Reductions in price effected by the lower unit costs of machine production might attract sufficient new purchases to actually increase the labor force required. The effect on the labor market, of course, is not restricted to the particular product in question, for machinery must be manufactured and raw materials supplied, with the result that increased consumer demands will affect business activity throughout the entire productive process. (*Turn to page* 154)

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The type of technical innovation most likely to benefit the economic system is that which is directed to the manufacture of an entirely new commodity or service which creates a net increase in wealth, making use of the idle factors of production which under our complicated industrial structure we have not learned to properly apply. Autos, radio, sound pictures and airplanes fall in this category of goods, constituting a type of technical progress which makes new employment and higher living standards. When the far-reaching influence of motor transport is considered in this connection it will be understood that it is machinery which creates a new and useful product and a net increased demand with a decreasing group of technologically unemployed.

Not New

Technological unemployment is not a new economic phenomenon, but it has become of very considerable significance with the more rapid rate of technical change and with the multiplying complexity of our industrial structure. We blame the machines which have created such amazing volumes of goods, although it is our own inability to use them properly, as well as certain other factors in our economy, which underlie our difficulties. The total supply of labor, for example, is inelastic and cannot be altered in quantity to fit the varying needs of production. When the demand for labor falls off, the original supply remains. Moreover, it is immobile, neither shifting readily from one type of skill to another nor among different geographical regions. And because the market for labor is unknown to the laborer, he is unable to find new employment, even though such may exist, without going through a period of readjustment, or unemployment.

Finally, it should be noted that modern industry has spent practically the total of its efforts planning and perfecting its methods of production without regard for the needs of the markets as a whole. We expect the problems of distribution to care for themselves, and hope for order instead of planning it. To blame the machine for our own shortcomings is to cloud the issues that we should be facing.

Welding, a new occupation not possible to hand labor, is illustrated on the front cover of this week's SCIENCE NEWS LETTER in a photograph from the Lincoln Electric Company.

SENSITIVE FINGERPRINT METHOD

Fingerprints left by kidnapers and other criminals are sometimes too faint to be "developed" by means of the present dusting process. Dr. Francis F. Lucas, working in the Bell Telephone Laboratories, makes them show up in bold black lines by a trick he learned from biologists. Fingerprints consist largely of oily or fatty material from the skin. Oils and fats are turned black by exposure to fumes of osmic and chromic acids in a preparation known as Flemming's reagent. Then the paper or other material bearing the print is washed with a dye that shines blue-green under ultraviolet rays. Examined with a magnifier or photographed with an enlarging camera, the faintest of prints is made to "stick out like a sore thumb." If they are on printed or handwritten paper, the ink lines can be cut out of the picture by suitable manipulation of the ultraviolet radiation and the use of light filters, leaving only the fingerprints showing black against their glowing background.

BIOCHEMISTRY

Animal Disease Now Linked To Non-Living Protein

FIRST indication that an animal disease may be caused by protein molecules, non-living bits of matter that grow much as though they were living germs, is contained in studies reported by Drs. J. W. Beard and Ralph W. G. Wyckoff of the Rockefeller Institute for Medical Research laboratories (*Science*, Feb. 19).

From warty masses that occur on western cottontail rabbits and are considered to be virus-induced, the experimenters isolated a high-molecular protein with which is associated the infectiousness of the disease. These warts are known as papillomas and are epithelial tumors.

Recently Dr. W. M. Stanley, also of the Rockefeller laboratories, startled the scientific world by demonstrating that a crystalline protein obtained from the juice of tobacco plants with mosaic virus disease is the agent responsible for the disease. This won him the $1,000 prize of the American Association for the Advancement of Science.

The work of Drs. Beard and Wyckoff extends this research to viruses that cause animal ills. The protein molecules were separated by whirling the wart extracts in a centrifuge with a field of 60,000 times gravity. It is estimated that the molecular weight of the protein extracted is in excess of 20,000,000, which would make it the heaviest known to science.