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THE PRODUCTION OF STEEL

WHETHER the steel industry, which reaches flexible fingers into many other industries, can step up its output in time with defense tempo and at the same time reduce its cost of manufacture is a vital problem. Some economists hold that the cost of making a ton of steel is practically the same whether the plant is running at 80 per cent. capacity or at only 50 per cent. At the Chicago meeting of the American Statistical Association reports presented by Dr. Mordecai Ezekiel and Miss Kathryn H. Wylie, economists of the U. S. Department of Agriculture, state that analysis of the records kept by the United States Steel Corporation indicate that stepping up production from 50 per cent. to 80 per cent. of capacity actually decreases the unit cost of production about seventeen per cent. to nineteen per cent.

Labor costs per ton of steel decrease materially as the output is increased. When a plant is operating at only 20 per cent. of its capacity, it takes 56 man-hours of labor to make a ton of steel. If the output could be stepped up to full capacity, the labor per ton would amount to only 32 man-hours. Output per additional man-hour is about three times as great at 90 per cent. capacity as it is when the plant slows down to only 40 per cent. capacity.

It is pointed out that "If this relation is found to hold true in other mass-production industries such as automobiles, cement, aluminum, etc., material revisions may be required in much of current economic theory to make its assumptions consistent with the facts of a major part of modern industry.

"Our defense planning," Dr. Ezekiel and Miss Wylie conclude, "requires such information about our major industries that it may be most effective. Since steel is one of the major raw materials of defense, knowledge of the cost functions in that industry is particularly important. The prices which the government will pay for steel might be directly related to costs at different levels of output. Excessive profits might easily result from inadequate knowledge of these relations. On the other hand, the industry might be adversely affected by the adoption of an unduly low price structure without adequate knowledge of these relations."

The steel industry is in a peculiar position in regard to the balance of increased purchasing and lowered prices, according to Dr. W. Gregg Lewis, of the University of Chicago.

The railroads as large purchasers of steel were cited by Dr. Lewis as an example of this dislocation. Since the railroads do not sell steel products but services, he explained, the amount of their purchases depends upon the amount of travel or shipping and not upon the price of steel.

The question was raised by Dr. Lewis as to whether the timing of railroad purchases might not be adjusted to periods of low steel prices, regardless of the fact that amount of purchase is independent of the price to be paid. He pointed out that "There is practically no evidence in the historical record that the railroads have followed such a policy. The decisions required are apparently longer run than the railroads have been willing to make. When traffic and income are low, replacement pressure is also low. The short-run policy of postponing replacements is followed. When traffic is high, replacements become necessary almost without regard to price." In fact, he said, there is in general a perverse tendency in steel buying. Price advances generate expectations of further price advances and cause increases in purchasing and over-accumulation of inventories. Price declines have an opposite effect.

AUTOMOTIVE ENGINES

THAT defense may be endangered by the number of special oils that have been developed to meet the demands of a particular engine, class of design or service, was suggested by R. J. S. Pigott, of the Gulf Research and Development Company, at the closing session of the meeting of the Society of Automotive Engineers.

In the past five years, he said, a situation has developed that, "economically, is thoroughly unsound."

Charging that chemists have been called in to solve problems that really belong to the engineer, he stated that the chemist should be called as a last, not the first, resort.

"A considerable number of oils have been developed," he said, "which show improvement in some desirable characteristic, but by no means in all. Further, these oils generally work in a particular engine, class of design, or service, much better than the earlier oils; but in no case of which we are aware do they fit all cases. For example, an oil with additives to suit one design of Diesel engine may not be satisfactory in another design, nor serve for heavy-duty gasoline engines (truck and bus service). At the same time many Diesels and many heavy-duty gasoline engines are getting along perfectly well on high-grade, straight mineral oils.

"It looks as if the program is getting to be prescription oils for too many cases. Look at the defense situation a moment. The Army and Navy will want not over four oils for *all* engine purposes, and they would be glad to use less. How can they possibly handle 15 or 20 prescription oils for particular designs? The answer is, of course, that it can not be done, and it won't be done.

"When almost any kind of engine trouble occurs, the first thing blamed is the oil; next, the fuel. A long while after the smoke clears away, sometimes the design is reconsidered. The net result of this unthinking procedure is to throw into the lap of chemists many problems that ought to have been handled by the engineers themselves. Usually (and quite naturally) the decision is to call for a special oil if there is trouble; any fault of the design, especially the oiling system, is generally overlooked."

In summarizing his comments on lubricants, Mr. Pigott made the following points: (a) Unnecessary high bearing temperature is the major factor in present lubrication

problems and the hurried development of an army of special oils. (b) Oiling systems can be, and for the future, must be, designed, not whittled. (c) Bearings must be made rigid enough to function at full advantage, and oil flows must be great enough to do the necessary cooling at reasonable temperatures for the oil. (d) External coolers should be used. (e) The mania for very light oils and completely "drying up" the engine should be reconsidered. (f) While compound oils are here to stay, "it is certainly bad judgment to keep calling for more and more special products, when what is needed is adequate designing to avoid that call." (g) Crankcases should be designed to drain dry.

Turning to fuels, Mr. Pigott pointed out that during the past 10 years the improvement in engine horsepower has been 20 per cent. due to increase in compression ratios following improvements in octane rating of gasoline, and 80 per cent. due to straight engineering design. If high horsepower is desired, he stated, supercharging is a good way to get it without going to synthetic chemicals for costly high octane gasoline. It costs millions, he said, to increase octane number a couple of points. He suggested that if supercharging is adopted "full intercooling should be used to cut down work for compression, lower terminal temperature to ward off detonation, and deliver a denser charge for high horsepower."

DIESEL ENGINES

AUTOMOBILE manufacturers can protect their own business and also help save our way of living, if they will organize for mass production of Diesel engines needed by the Navy and for other defense work, members of the Society of Automotive Engineers were told recently by Lieutenant Commander M. M. Dana, of the U. S. Navy.

The high-speed, light-weight Diesel for naval use differs but little from the automotive engine, he said, announcing that the Navy "has ambitious projects for its wider application in the future." He noted, however, that the present emergency is making severe demands upon the present source of supply and "it becomes necessary to attract other engine builders whose production facilities are not yet fully utilized." He presented the rating diagram, on which each engine is completely defined as to basis of rating.

These data for a number of modern Diesel engines now in use in the Navy, were also shown, as was a table of modern German light-weight Diesel engines.

Professor Eugene H. Fezandie, of the Stevens Institute of Technology, predicted increased adoption of Diesel power in many automotive fields.

Lower specific weights will be obtained for all classes, he said, through special materials and reduction of overall dimensions for a given power. In the case of the open-chamber type Diesel, he added, it is expected that no large increases of speed are likely and that the best opportunity for weight reduction will be in the two-cycle performance.

Improvement in combustion control and economy with existing fuels, Professor Fezandie remarked, will be looked for from the engine designer, while some progress in fuels for limited fields of use requiring this will be expected. He also stated that better lubricants will be necessary if higher power per cubic inch of displacement is to be attained without impairing engine life.

Meanwhile, he averred, the gradual reduction cost per horsepower should open up new fields of application where high-use factor, moderate-load factor and safety are important considerations.

Professor Fezandie compared the automotive Diesel with its stationary prototype and listed its pros and cons in relation to the gasoline engine. In the latter comparison he stated that the Diesel uses somewhat cheaper fuel (at present) and considerably less of it for the same power developed. The Diesel's handicaps of high first cost, weight, smoke and odor, high maintenance costs, lack of curb service, rough idling and hard starting, are being steadily reduced.

PARACHUTES

A NEW device has been developed for the parachuters of the U. S. Forest Service. It is a sturdy line, attached to the airplane. The cord breaks as the jumper makes his leap and automatically releases the rip cord.

Successful tests, made recently at Missoula, Mont., indicate that it is virtually fool-proof and may be of great value to the newly organized parachute corps of the Army. The Forest Service is obtaining a patent on the static cord. With the approval of the Civil Aeronautics Authority, whose official representative has witnessed the tests, it will be made standard equipment with the service. It is expected to eliminate the most difficult part of training, the teaching of the proper time to pull the rip cord.

It is pointed out that "Men jumping from an airplane under present conditions are required to trip their own parachutes in the conventional way. This has not been satisfactory in the past, as it takes much training for a novice to learn just when to open the 'chute. This is dangerous. If the jumper hesitates, he may project himself forward or snap backward; and if he jerks too quickly, he may open the 'chute into the tail of the plane with fatal results. Always there is the hazard that the jumper will 'freeze' from fear and fail to open his 'chute.

"The new parachute eliminates this danger," according to officers of the Forest Service. "All the jumper has to do is leap from the plane, whereupon the giant umbrella opens almost immediately, clearing the plane with plenty to spare."

THE SMOKE NUISANCE AND SOUND WAVES

IT may be possible for Pittsburgh, St. Louis and other smoky cities, in the not-too-distant future to get rid of the smoke.

The special studies division of the United States Bureau of Mines' metallurgical division is quietly perfecting a means of clearing contaminated atmosphere by means of high frequency sound waves.

Experiments with laboratory equipment at the new experiment station at the University of Utah, have been so successful that Dr. R. S. Dean, chief engineer of the metallurgical division of the Bureau of Mines, stated

recently in an interview that he foresees the day when the device will be commercially possible to be attached to every important chimney in a city, even down to individual homes.

Salt Lake City, where Dr. Dean has his headquarters, also has a smoke problem in winter. Near by are smelters and mines which will be practical proving grounds for the device.

In laboratory tests, conducted by Hillary W. St. Clair, assistant metallurgist, the device has completely cleared smoke-laden, dust-filled and otherwise contaminated atmosphere. The biggest stumbling block to making the device commercially practical was an effective and efficient source of high-frequency sound. This has been found.

A twenty-three pound aluminum cylinder is the vibrator and automatically operated at the best frequency. The sound waves produced are so intense that the radiation produces a pressure that can be felt against the hand even when it is held eighteen inches or more from the vibrator. It is capable of supporting small objects such as a penny or lead shot in midair.

When these shrill, high-pitched sound waves are directed into a large glass tube filled with tobacco smoke, dust, smelter fumes or the like there is a brief turbulent motion. Then the solid particles in the atmosphere form flakes, like soot, and fall to the bottom of the tube.

Problems remaining to be worked out are those pertaining to continuous operation on smoke in motion and the vibration of air or gas at certain frequencies.

INFANTILE PARALYSIS

THE fight to save America's children from infantile paralysis, or at least from its crippling after-effects, is being waged with every weapon medical scientists can devise. These weapons in the anti-polio armory range from rats to respirators, it appears from the annual report, just issued in New York, of the National Foundation for Infantile Paralysis.

The value and use of respirators, popularly known as iron lungs, is so little understood that the foundation in the past year spent some of its money, received through the President's Birthday Ball celebrations, to publish and distribute a pamphlet telling the proper use of iron lungs and listing the exact location of approved ones. "As the result of such information, it was possible in the epidemics this year to shift these costly machines from one territory to another, and thus avoid the purchase of additional respirators—the continued necessity of which is at least highly questionable."

Breeding a strain of disease-free cotton rats for laboratory investigations, such as testing the value of possible chemical remedies for infantile paralysis, was carried on with financial support of the foundation.

The search for new weapons continues. Spraying the nose with chemicals did not succeed as a method of preventing attacks of infantile paralysis, but the problem is being studied now in an effort to find out "exactly what takes place when infection does occur by the nasal route."

Food has been suggested as a possible weapon against polio. Very little is known at present about the relation of nutrition to infantile paralysis or other virus-caused diseases, so a grant of $37,500 was made by the foundation to the School of Medicine of the University of Texas to investigate this angle.

Of all the activities supported by the foundation, the largest sum, $189,562, went for educational activities during the year covered by the report. Included in this was the $70,000 granted to the National Research Council for fellowships for training investigators.—JANE STAFFORD.

ITEMS

THE U. S. Forest Service has reported at the close of its annual stock-taking that deforested lands greater in area than the whole of Italy still await replanting with trees. The total tree-stripped land amounts to seventy-seven million acres, of which only three millions are owned by the government and seventy-four millions are held by private owners.

THE U. S. Department of Agriculture has found that deer in the Kaibab National Forest, north of the Grand Canyon of Arizona, have materially benefited by the introduction of a carefully controlled hunting season, during which shooting of does as well as bucks is permitted. It was in this area that some years ago a terrible famine occurred among the deer because a completely closed season plus destruction of mountain lions and other predators had permitted their numbers to increase far beyond the capacity of the food plants to support them. During the 12-day shooting season, the record buck taken weighed 280 pounds dressed. In 1937 the record was 247 pounds; in 1932 only 207 pounds. Seventy-five of the bucks killed this season weighed more than 200 pounds dressed, and 40 had antler spreads of from 30 to 41 inches. Does shot this season constituted less than two fifths of the total number of animals killed. The number of deer to be killed is determined each year in order to maintain the herd in balance with the carrying capacity of the range, with the result that winter deaths through starvation and disease are avoided.

THE European greenhouses that used to supply much of the American market for rare and exotic blooms have been cut off from the American market and the American orchid-raising industry has not yet been developed sufficiently to meet the full demand. As one result, orchids sent by collectors direct from their native homes in the tropics are having something of a boom. That this has its own drawbacks is pointed out by E. R. Sasscer, of the U. S. Bureau of Entomology and Plant Quarantine. Orchids grown in European greenhouses are usually free from pests and diseases, whereas those from the tropics must be very carefully inspected to see that they do not bring in any of their considerable assortment of the insects and fungi that prey on them in their native state, lest these get loose and wreak havoc in American greenhouses.