

ing to USDA figures, the nation's first ranking grazing and pasture area is in the Great Plains States. In 1954, the belt running southward from North Dakota to Texas had 28% of the nation's cattle, 27% of the sheep, and 12% of the hogs.

Demand Grows in South and West

Production of livestock in southern areas is rising at a faster rate than anywhere else in the country, resulting in an increase in packing operations in the region. Cattle grown in the South Central states are usually slaughtered and sold locally. A growing demand for better quality beef in the area has forced some of the feeder stock that used to go North to stay on home grounds, and only a little is shipped to the West. The South and Southeast have developed more productive pastures and better adaptive cattle, and large acreages of cropland have been shifted to grassland.

Cash receipts from farm marketing of cattle and calves in the Middle South have increased 700% since 1925, compared with a national increase of 290% for the same period. At the start of this year, more than 5.3 million head of cattle were on Middle South farms, or 5.6% of the entire total in the United States. The number of cattle on farms there has increased 101%, almost twice the national average increase. An even larger rise was registered in production pounds of cattle and calves—up 154% compared with the national increase of 81%.

Pacific Packers Unable to Keep Up with Population

On the Pacific coast, a growing cattle industry has been unable to keep up with an even faster growing population. Last year, the region had 10% of the population, but only 6% of the nation's cattle. Packing operations in the West are also performed mostly by local companies. The top 10 packers of the United States do approximately 70% of the meat business east of the Rockies, and the independents have about 30%. On the West coast, these figures are reversed, although most of the majors have some facilities in the area. Los Angeles is one of the biggest beef and lamb slaughtering centers in the country. Almost every town of significant size in the West has at least one meat packing plant, the result of the way the meat packing industry grew in the western regions. Small packers began operation in isolated sections, compared to Chicago packers who are at the center of an extensive transportation system.

Livestock for slaughter in California is mostly shipped in from out of state, some

from as far east as Omaha. One half of the cattle, sheep, and lambs are produced elsewhere, and 85% of the hogs are grown outside of state boundaries. The reason for the extensive importation is that California growers make more money growing crops than they would raising grain to feed stock.

Industrial shifting or expansion in the western areas will not affect wholesale and retail meat prices to any extent, because of the low profit margins in meat packing and the high percentage of cost going for transportation, labor, and middle-man expenses. Currently, meat slaughtered in the Midwest sells at about the same price in California as meat slaughtered on the Pacific coast.

East Has Big Deficit

The shift of the meat packing industry, together with growth of local independent processors, does not herald an end to the firm hold that the Chicago area has on the industry. Although losing some of the edge it had over other slaughtering centers for years, Chicago is assuming growing importance as a funnel for eastern markets. As far as receipts are concerned, any losses due to production switches like Wilson's are largely offset by increases in sales to the East. The Northeastern states are the big deficit into which meat pours, chiefly from the Midwest. With 28% of the population and an above average income per person, the stretch from Maryland to Maine has less than 10% of the country's livestock.

Chicago's butchering reputation will probably be maintained for a long time, thanks to the Eastern market, and the Midwestern Corn Belt with its resulting high hog production. The eight states from Ohio to Minnesota produce three fifths of the nation's corn crop and about 69% of all the hogs. Chicago's stockyards led the nation's market for total hog receipts in the first seven months of 1955, and its rate of gain topped its competitors. Cattle slaughter at Omaha topped Chicago by about 200,000, but the Nebraska center ran second in hog slaughter by at least 370,000. Because of the city's continuing importance as a livestock market, Armour is spending \$10 million to modernize its Chicago facilities.

Little Effect on By-Products

Changes in geographical locations of livestock slaughtering centers will probably not have much of an effect on by-product manufacture. Hides are the most important by-product, and most of the tanneries are in the East. With hides, fats, and glands for medicinal purposes, freight costs are of secondary importance.

Safety Progress

Fertilizer industry prescribes surgery for thorn in its side — an unenviable safety record

IT HAS BEEN SAID that blame for the fertilizer industry's unimpressive safety record rests not with the workers, who are generally the accident victims, but with management. Strong statements pointing to management's lack of interest and know-how in safety and even accusing some administrators of irresponsibility are still heard.

While the latter attitude is by no means typical, there is an element of truth in the statement. Because the fertilizer industry includes many relatively small plants, often family-owned and -supervised, systematic safety programs of broad scope have been slow to evolve and in some sections of the industry have still not appeared. Adding to the problem of insufficient management interest are the seasonal nature of the business, calling for rush operation during a few months, and the relatively unskilled—definitely unschooled—labor available.

This is the dark side of the picture. Fortunately, the industry's safety record has become a matter of great concern to many persons connected with fertilizer manufacture, and through both individual and concerted effort they are bringing safety-consciousness into the fertilizer plant.

Results of their efforts have been encouraging over-all, and in some instances have been spectacular. A special industry-wide safety program inaugurated by the North Carolina State Department of Labor, for example, led to a 47% reduction in on-the-job accidents in the state's fertilizer industry during a two-year drive completed in 1954.

Lending strong support to the North Carolina drive was the fertilizer section of the National Safety Council. Existing as an independent section of the council for only three years, the fertilizer section is one of the fastest-growing in the council, and has already moved near the top in membership. The section's growth reflects a powerful drive to arouse greater interest in safety and in the council's work—with its ultimate goal the elimination of all preventable accidents.

The section this year launched the "three-year plan," a step-by-step outline of attainable objectives designed for accomplishment over a three-year period. The goal for 1955 is a reduction of at least 10% in frequency rate and 20% in

severity. To achieve these improvements, the plan specifies: improving physical layout of plants, increasing safety activity by top management in all fertilizer plants, upgrading plant personnel, improving circulation of safety information, and sponsoring research into the causes of accidents and the possible means of preventing them.

Motivation Study Guides Program

To determine the learning habits and personal drives of the average fertilizer employee, in order that safety training might be adapted to their needs and interests, the section this year sponsored an employee motivation study. From the report on the project presented at the National Safety Congress in October, it appears that the goals which motivate

average fertilizer workers often are not those now offered as "rewards" by their employers. Concrete and immediate rewards for performance have been found more attractive than such long-range goals as the possibility of promotion. Each employee is concerned with how own job and cares little how it fits in with the entire plant's operation. But job satisfaction is important, and the worker takes pride in acquiring competence to handle technical work; the satisfaction stems, not from doing the job well, but from having the technical ability to do it safely and easily.

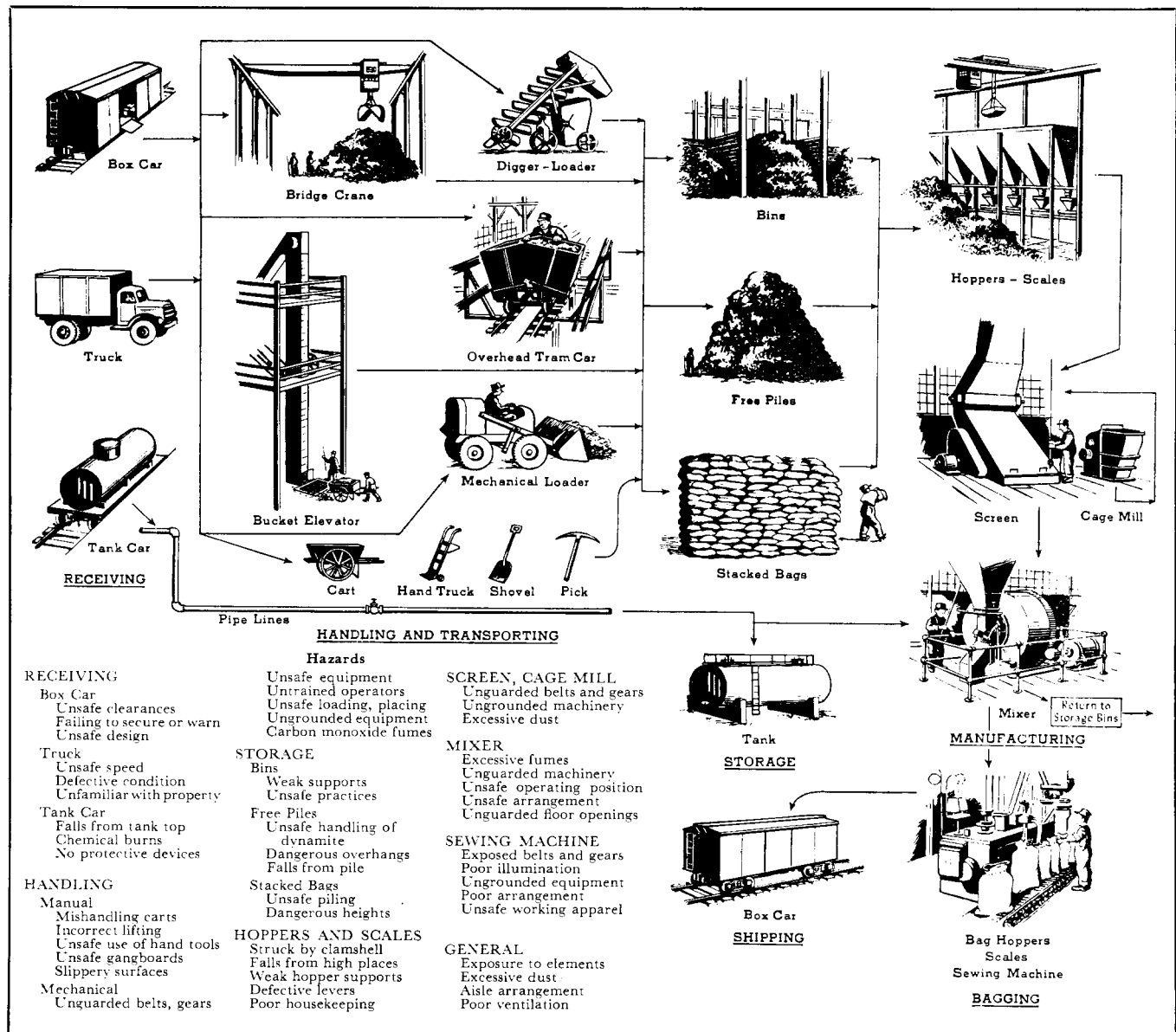
Because the average employee sees no route open to him for moving upward in the organization, he is adjusted to remaining where he is, and he concentrates on making his present position as easy and satisfying as possible. While he

readily obeys formal commands from those in authority, he does not want responsibility and, therefore, feels no urge to perform his job with initiative. He is more interested in social acceptance in his work group.

The report concludes that, until technological improvements in the industry decrease the necessity for employing unskilled temporary labor during rush seasons, motivational devices must be based on employee motivations as they now exist. For the present, at least, motivational devices should emphasize paternalistic formal authority; technical training; concrete and immediate rewards for job performance; and group approval at the employee level.

This venture into the behavior sciences—is expected to guide officers in their choice of visual aids, selection of

Analysis by National Safety Council of various hazards in a typical dry fertilizer mixing plant



literature, and preparation of slides, planning for accident prevention supervisory training, and recommendations for safety programs in the small plant.

Accident Frequency Down

Charts of accident frequency and severity in the fertilizer industry, based on data reported to the NSC by its members, show a gratifying downward trend in the past 15 years. The trend is clear and fairly consistent in the case of frequency; the severity curve seems also to trend downward, but with wider fluctuations, and smaller net improvement. The final frequency rate for 1955 has not yet been determined, of course; in mid-November it stood slightly higher than the 1954 figure, but the winter seasonal slump could bring it back into line.

While NSC has long served as a prime mover for greater fertilizer safety, it is by no means alone in its efforts. The National Plant Food Institute continues to give heavy emphasis to safety in its communications to its members and cooperates actively in the promotion of the NSC's programs. Regional and local safety groups, too, are active.

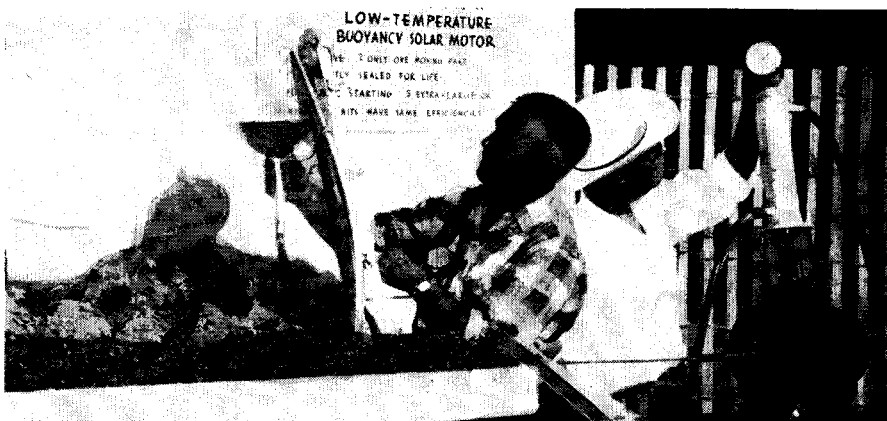
Individual companies vary greatly in the amount of time and effort they give to safety promotion, but the trend is generally in the direction of increasing the total effort while improving the efficiency of safety training and supervision. Here again the NSC plays an important role through distribution of safety information and training aids, sponsorship of nationwide safety contests, and provision of a forum for exchanging ideas.

With growing awareness of the human relations value of safety operation—and an appraising eye on the economic advantages it offers—fertilizer manufacturers are investing more of their time and money each year in safety programs.

Solar Energy

It isn't just around the corner, but research forges ahead on algae, engines, and weather

SOME 20 million kilocalories of solar radiation fall on each acre in the medium latitudes each day, but so far the world's technology hasn't tapped this most abundant energy source to any practical degree. However, the vast potential of solar energy isn't being overlooked; some 1000 scientists from 30-odd nations gathered in Arizona last month for a six-day session under joint sponsorship of Association for Applied Solar Energy, Stanford Research Institute, and University of Arizona.



Solar motor demonstrated by its developers for irrigating model of desert country

While progress reported and predictions for the future may not have taken any startlingly new turns, the conference did serve to bring authorities together and to focus attention on where we stand.

Much of the effort directed toward solar energy use is agriculturally oriented; algal cultures for food, fuel, or chemicals; solar stills to distill brackish water for irrigation; solar pumps for irrigation water; solar collectors and reflectors for controlling microclimates in agricultural areas.

Algae may not find a place on the table in surplus-surfeited United States for a bit, but University of California workers Harold B. Gotaas and William J. Oswald are forging ahead on a sewage treatment process that makes algae economically attractive in protein deficient tropical regions and of potential interest as a livestock feed even in the U. S. In the Gotaas-Oswald system, under investigation for about five years now, sewage oxidation ponds are inoculated with green algae. Bacteria oxidize the wastes, liberating nutrients for assimilation by the algae. Algae, in turn, liberate oxygen used by bacteria.

Algae are harvested and the innocuous waste discharged. The California scientists get photosynthetic efficiencies of 5 to 8% in their pilot ponds, with yields of 30 to 35 tons (dry weight) per year per acre (low because of foggy days in the San Francisco Bay region; July-August yields are at a 65-to-70-ton-per-acre yearly rate). The material runs 45 to 60% crude protein, 10 to 20% fat, 15 to 25% carbohydrate, and 10 to 20% ash (dry basis).

Meanwhile, others at University of California are looking at algae for another purpose—nitrogen fixation. Mary B. Allen, Daniel Arnon, and others have been pegging down nutrient requirements of blue-green algae which have this important property. Potentialities lie in using blue-green algae in rice fields for maintaining nitrogen fertility, according to Dr. Allen. In laboratory scale experiments, she finds *Anabaena*

cylindrica fixes gaseous nitrogen in an organic form equal to 480 pounds of nitrogen per acre per month. While speculative, this figure compares to the legume-rhizobium combination which contributes about 200 pounds of nitrogen per acre per crop.

Hydrocarbons from Algae

Yet a third approach to algae use is suggested by R. L. Meier, University of Chicago, who sees algae as a potential future source of liquid hydrocarbon fuels. Meier proposes an algal culture similar to Oswald and Gotaas's waste disposal system. This would give a slurry containing 4 to 6% algae, and the slurry would then be fermented anaerobically to convert some 60 to 80% of the caloric content to methane and hydrogen. The methane could be liquified for sale as a fuel, or it could go to a Fischer-Tropsch hydrocarbon synthesis unit to make a variety of chemicals. The residual liquids from the fermentor could serve as a fertilizer solution. Meier estimates an annual hydrocarbon yield of some six to 14 tons per acre, with cost falling in the \$150 to \$400-per-ton range.

When?

Big question, of course, is how soon these and other applications will find widespread use. Initial investment is a big hurdle, especially in countries where some solar energy applications could operate competitively today. A solar oven can be made and sold in India for \$16, but the class of persons who could benefit most has slim chance of accumulating such a sum; solar pumps based on designs of today could be pumping irrigation water in some semiarid regions of the world, but capital isn't available in these regions.

As Farrington Daniels sees the future, "Too many people are beginning to expect too much too soon. There is no sudden era of solar prosperity just around the corner." Much work remains to be done.