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No. 16

Selected Translations on Farm Machinery Plants

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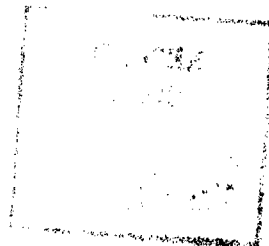
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FOREWORD

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SOVIET AGRICULTURE

No. 16

Selected Translations on Farm Machinery Plants

[Following is a translation of selected articles from the Russian-language periodical Mashinostroitel' (Machine Builder), Moscow, No. 2, February 1960. Page and author's name, if known, are given under individual article headings.)

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I. NINETY PERCENT OF ALL ASSEMBLY OPERATIONS MECHANIZED

Pages 12-13

A. N. Chorepakhin,
chief technician of
the Rostov Agricultural
Machinery Plant

The basic operation of the plant is the building of combines. But this had not always been true. Before 1956 the plant produced, besides combines, tractor plows, self-propelled mowers, etc. Naturally, the long list of manufactures represented a high degree of labor input.

In the main shop of the plant--the combine assembly shop--there was only one assembly line. The combine sections were assembled mainly on stands, most of them unmechanized. Such operations as tightening nuts were completely unmechanized and in large part carried out with hand wrenches. All this led to high labor consumption in assembly work.

Thus, in the assembly of the tractor-drawn S-6 combine in 1956, general labor consumption amounted to 68 norm hours, including 20.5 norm hours of hand work, or 30 percent. Of course, it was impossible to remain reconciled with such technological backwardness in assembly work.

As early as 1956, drawing from the experience of advanced automobile and tractor plants, we undertook a broad conversion to assembly line methods of assembling combine units. Today these methods are firmly established in the plant.

How is assembly of a self-propelled combine conducted?

The SK-3 combine consists of several large units: chassis, threshing apparatus, combine body, hopper, driver's space, and motor. All these units are assembled on separate assembly lines (figure one).

Then, from the side assembly lines the parts and units move to a main assembly line, where final assembly is carried out. All the side assembly lines are located perpendicularly to the main one, making for continuous production.

There is a basically closed cycle of manufacture of units and parts as well as a very high speed of assembling. While formerly the manufacturing shops (the forging, mechanical, pressing, cold punching, and other shops) sent on to the assembly shop only parts of machines, today the cycle of manufacture in these shops is basically a closed one. The parts to be sent to the assembly shop are either painted alone or assembled in subunits (through welding or minor assembly), painted, and then sent on to the assembly shop. For example, in the forging shop 23 combine

units are welded, in the cold punching shop, 162 units, etc. Assembly of bearings, chassis units, and threshing apparatus is also carried out in the manufacturing shops.

At present there are 16 assembly lines in the combine assembly shop: two lines for assembly of the front and rear wheels, one for assembly of the suspension of the guiding wheels, two for assembly of the chassis, one for assembly of the threshing apparatus, one for the combine body, two for assembly of the sifting and shaking apparatus and one line each for assembly of the hopper, driver's space, and motor. In addition, there are a main line for assembly of the SK-3 combine and a line for finishing and painting the threshing apparatus.

All assembly lines are equipped with mechanized devices for assembling, and there is a wide application of pneumatic equipment, electric screw turners, suspended welding machines, and hydro-riveters.

The process begins with assembly of the wheels and the guiding suspension. Assembly of the tires and tubes, putting on the wheels, and filling of the tires with air are done on an apron conveyer. Assembly of the rear wheels with their suspension is also carried out on a conveyer. Then an assembly worker hooks the suspension with the rear wheels and the front wheels to a suspended conveyer, on which this assembly is transported to the chassis assembly section (figure 2). Here the frame, chassis, front suspension, blower, augurs, and sieves are welded and painted. The assembly of the chassis is completed on an apron conveyer with two feeder conveyers. For convenience the chassis is assembled in a reversed position, while during attachment of the wheels and the sieves the chassis is turned around to working position.

Assembly of the threshing apparatus, combine body, driver's space, hopper, and motor is carried out on an apron conveyer reinforced with assembly stands.

The combined assembled units are transferred by suspensory cranes to the main conveyer, which is of the apron type with two feeder lines (see the photograph on the cover page), on which the machine is put together. Polishing of the machine is carried out on a chain conveyer.

After testing, the combine is moved by a chain conveyer to be painted, dried, and finished.

Special interest is attached to assembly of the straw shaker apparatus. This operation is carried out by spot welding with suspensory welding machines and hydraulic riveting. The electric welding apparatus is located on a specially manufactured mounting above the conveyer. The welding pincers and riveting clamps are held in place with spring bobs. The speed of assembling straw shaker parts is 1.5 minutes, which permits the manufacture of 280 per shift.

A special assembly line is used for subassembly of the motor, supplied by another plant (figure 4).

The mechanization of assembly work has led to a large reduction in labor consumption. In the combine assembly shop alone the level of mechanization of assembly work rose from 76 to 90 percent since 1958. At present, the technicians of the plant are working on the problems of mechanizing greasing of the combine and assembly of the side and roof panels of the combine, and several other problems.

FIGURE APPENDIX



chassis
assembly
line

Threshing
apparatus
assembly line

Combine
body
assembly
line

Hopper
assembly
line

Driver's
space
assembly
line

Motor
parts
assembly
line

Figure 1

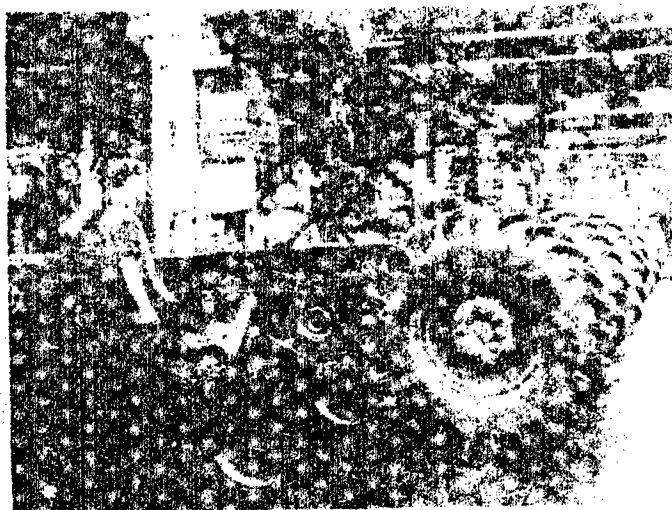


Figure 2



Figure 3



II. MECHANIZATION AND AUTOMATION OF PAINTING OPERATIONS

Pages 14-17

N. N. Ignatenko,
head of the
Department of
Mechanization,
Automation, and
Machine Tool
Building of the
Rostov Agricultural
Machinery Plant

In the production of agricultural machinery different painting operations must be carried out on a large scale. Mechanization of this work is of great importance in lowering labor consumption, raising quality and durability of machinery, and improving its external appearance. In our plant we have introduced and are introducing different advanced methods of painting and drying machine units and parts. Painting chambers have been installed with water spraying apparatus and purification baths, electric field painting chambers and thermal radiation drying chambers have been built, nonheating gas furnaces with air circulation drying have been installed, etc.

The use of painting chambers with combined drawing off of air and water spraying has greatly raised the level of productivity and has very much improved working conditions. Thus, the chamber installed on the main assembly line (figure 1) has led to a significant improvement in working conditions in the painting of the assembled self-propelled combine. Harmful paint particles and chemicals are removed from the area of the painter. Carried off by a current of air they enter air outlet one (1) and drop into a hydro-filtering mechanism 5, where they are removed from the air by sprayed water. Then the air is pumped by fan 8 through pipes 10 and 9 into the atmosphere, while the paint particles are carried by channels 2 and 4 into the purification bath 6. On passing through the bath the paint settles into a sediment collector, and the cleaning water is pumped on the next cycle to the hydro-filtering mechanism and the channels and also into the water spraying system.

The wall opposite the worker is washed with an even layer of water, which is carried along the channels to the purification bath and the paint trap, without falling on the machine being painted. The paint is removed from the paint trap by a rotary pump and is reprocessed.

A water spray paint chamber has been found excellent in spray painting of large units and parts (figure 2). This chamber is based on the same principle as the other and differs only in arrangement. It is installed directly above the purification bath, which is covered with a grating through which the air is pumped toward the hydro-filtering mechanism. In such a chamber the amount of paint particles and chemicals in the working area is 1.5 to 2 times lower than normal.

The use of a water spray chamber greatly improves working conditions and leads to economy in the use of paint. But this system does not solve the problem of automation of painting, thus liberating man from a laborious and burdensome operation. The electric field paint chamber (figure 3) is a more up-to-date system, eliminating losses of lacquer materials--cost of painting is reduced by 40 to 50 percent compared with ordinary spray painting. The coat of paint is spread on more evenly without running down in rivulets. The cost of electric power for this operation is lower than the cost of ventilation.

In electric field painting pneumatic tubes and mushroom sprayers are widely used. These are preferred by users. They are distinguished by simple design, light metal weight, small size, and good vertical and horizontal regulation.

In order to minimize loss of paint lacquers and obtain a high quality of painting it is necessary to spray a definite amount of paint per unit of time. In the plant this result is attained under pressure by measuring pumps sending out an amount of 40 grams per 40-50 rpm. The number of revolutions of the pumps are regulated by dials, and partial switching off of pumps is done by couplings. This system can be operated on an automatic cycle controlled from a control panel.

Sanitary conditions in the shops are radically improved with the introduction of electrical painting. The burdensome physical labor of spraying is eliminated. The work of the operator consists of observing the control panel of the painting chamber.

The electrical painting chamber leads to great economies. Thus, for example, the introduction of only two of such setups furnished the plant with an annual saving of over 700,000 rubles.

The next, no less important, stage of painting work is drying of the items after painting. For this purpose the plant employs nonheating gas furnaces and thermal radiation drying chambers operating on natural gas.

The nonheating gas furnace (figure 5) consists of gas burners one (1), a chamber for burning the gas 2, a pipe for drawing off the products of combustion 3, a mixer 4, and a spark extinguisher 5. In these furnaces there is no intermediate heating chamber, the products of combustion going through the spark extinguisher directly into the mixer, where they are diluted with pumped in fresh air and

blown into the drying chamber. All the heat given out by the furnace is utilized, and losses are limited to external heatloss of the furnace.

In the drying chamber (figure 6) the products of combustion from the furnace chamber 2 are drawn by a fan 5 through the spark extinguisher 4 and an air vent 12. The air vent regulates the amount of fresh air drawn in for dilution of the hot mix. The resultant mixture, which attains a temperature of 130-140 degrees, is directed to the center of the chamber through adjustable vents in the air tube.

At the front and rear of the chamber are installed flues with a natural or forced draft.

Because of the introduction of drying chambers with nonheating gas furnaces it is possible to raise the drying temperature to 140 degrees, as a result of which the time of drying is reduced from 1.5-2 hours to 30-50 minutes, and labor productivity is increased by 2 to 2.5 times. The initial cost of installing such chambers is relatively low, compared to direct heating or steam drying chambers. The volume of construction work is twice as low. In addition, the design of the ventilating system is simplified, and, most important, there is no need for intricate heating equipment made of expensive and heat resistant steel. The absence of heating equipment also simplifies operations, prolongs the period of service of the drying installation, and increases its operational reliability. At present all drying installations of the radiation heating type in the plant have been converted to the nonheating system.

A great deal has been achieved in devising and putting into operation thermal radiation drying chambers. Infrared radiation is applied on the basis of new type gas dryers with heating of radiation panels by an open flame gas burner.

Infrared rays penetrate through the paint lacquer coat. Because of this, metal surfaces can be heated much faster. The heat is transferred from the metal to the paint, as a result of which, hardening of the paint or lacquer begins on the surface of the metal and spreads evenly along the outer surface. This occurs best at a radiator temperature of 350-450 degrees.

Deviation from these temperatures lowers the penetration capacity of the rays.

This source of heat radiation is superior to incandescent lamps or other sources of heat, because it lasts longer, is simpler in design and manufacture, and requires much less energy for heating, because of the absence of light rays, useless in drying.

The use of thermal radiation dryers in drying combine units and parts after priming and painting reduces the time of drying from 40-50 minutes to 7-10 minutes. Under thermal radiation drying there is an incomparable improvement in texture and quality of the paint covering and in commercial appearance and durability of painted objects.

The heating panel is an aggregate of welded steel plates with a thickness of 4 to 6 mm. The length of a panel is from 800 to 1,200 mm., the height from 400 to 800 mm. In order to enlarge the heating surface ribs are welded to the inner walls of the panel. On the lower part of the panel is a reversible lid, used for pumping in air and for visual observation for burning.

The heating panels can be adjusted to the configuration of the painted object. The gas is conducted through a mixer, attached to a tubular burner with calibrated apertures for burning gas. The thermal radiation chamber, composed of such panels (figure 7), is put together with bolts and, accordingly, can be disassembled and transferred to a new place. The chamber has recirculation ventilation, consisting of forced air ducts 1 and 8, intake air ducts 3 and 4, a fan 5, a pipe with regulatory lids 6 and 7, and thermal radiation panels 2.

A chamber for drying bulky objects such as fuel tanks and bottles, etc. has an interesting design (figure 8). In these chambers the panels have the same shape as the object being dried. The operational design of the chamber is similar to that described above.

Using thermal radiation drying chambers has several advantages over other methods of drying. It is sufficient to point out that the cost per square meter of surface dried by the air circulation method is 52 kopecks, while it is only 10 kopecks by the thermal radiation method.

The use of the thermal radiation chamber reduces the area of construction, since separate units for heating and forcing the heat into the drying chamber are not required. Furthermore, the ventilation system is simplified and the need of power to run the electric fan motors is not as great. Operational reliability is high because of the even distribution of burners. Efficiency is increased because of nearness of source of heat to point of application. All these advantages create a basis for widespread use of the thermal radiation drying chamber and its further improvement.

Much has been done at the plant to mechanize auxiliary processes in painting. Thus, for example, special facilities have been set up for centralized distribution of paint to painting points, and a system of paint distribution has been organized, facilities have been installed for hydraulic cleaning of vats of sediment of priming paint and enamel, etc.

At present a group of designers and technicians of the plant are working on further improvement of painting operations. A complex automated line is being developed for electric field painting, in which the surface is prepared and cleaned for painting with the aid of ultrasonics. An automated system of regulation of paint distribution in electric painting chambers is being worked out. Among other developments is the introduction of a mechanized line for reprocessing paint wastes. During the first half year of 1960 complete mechanization and automation of painting operations will be completed.

FIGURE APPENDIX

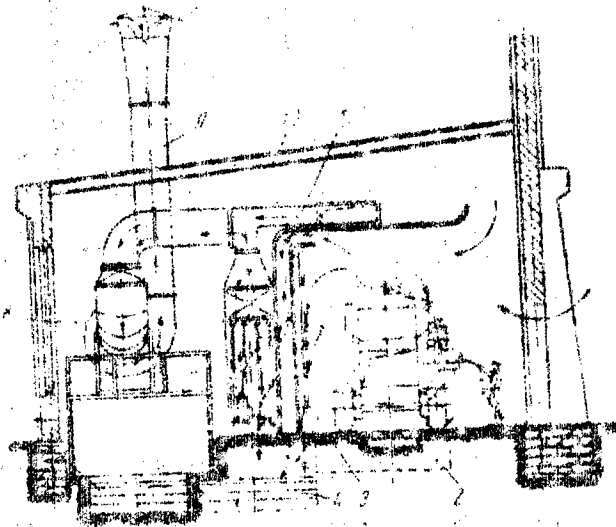


Figure 1. Water spraying chamber for painting combines on the assembly line:

1,10--air ducts to the hydrofiltering system;
 2,4--channels for the flow of water; 3--wall with
 flow of water; 5--hydrofiltering system; 6--puri-
 fication bath; 7--scaffold; 8--fan; 9--air vent.

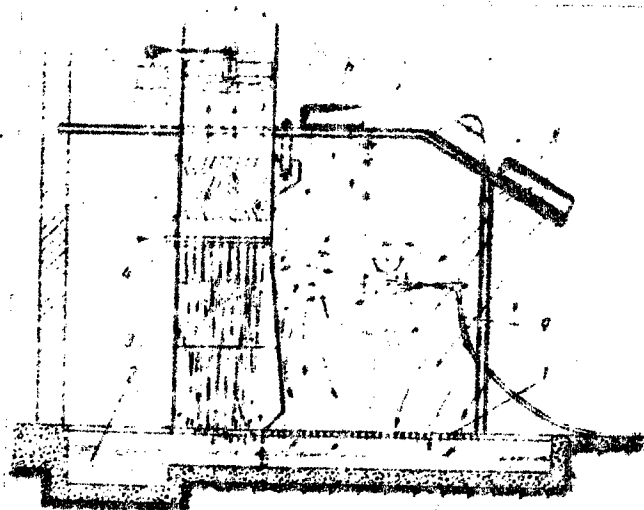


Figure 2. Water spraying chamber for painting combine units:

1--grating; 2--purification bath; 3--wall with flow of water; 4--hydrofilter; 5--axial fan; 6,8--water inlets; 7--suspensory conveyer; 9--sprayer.



Figure 3. General view of electric field painting apparatus.

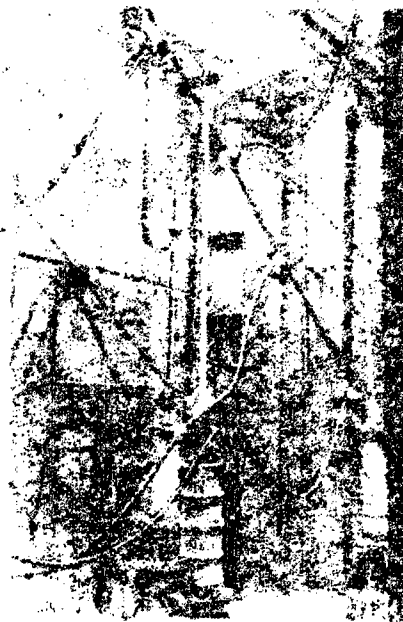


Figure 4. Interior view of electric field painting chamber.

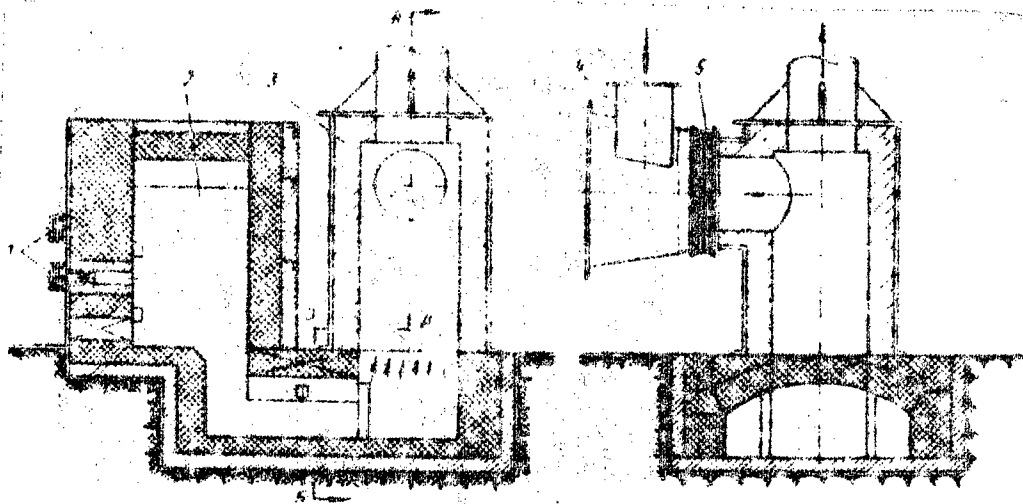
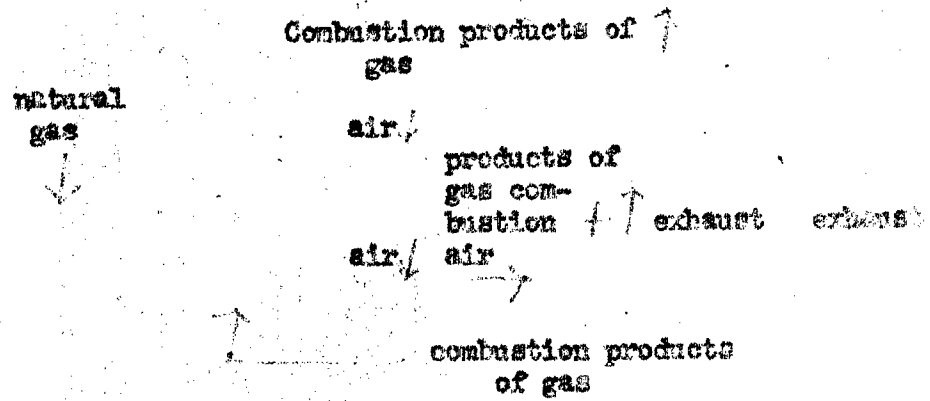


Figure 5. Nonheating gas furnace. (cross sections).



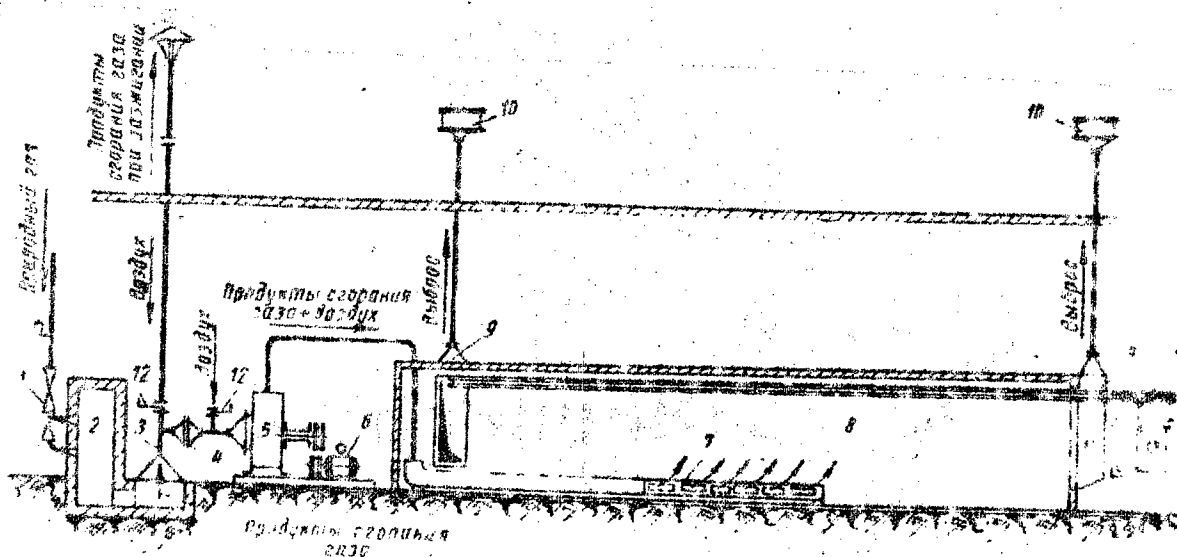


Figure 6. Design of drying unit for frame of SK-3 combine, with nonheating gas furnace:

- 1--injection mixer; 2--gas furnace; 3--natural draft pipe of furnace; 4--spark extinguisher; 5--fan;
- 6--electric motor; 7--air vents; 8--drying chamber;
- 9--flue; 10--deflector; 11--flue blind; 12--air vent;
- 13--unit being dried; 14--monorail conveyer.

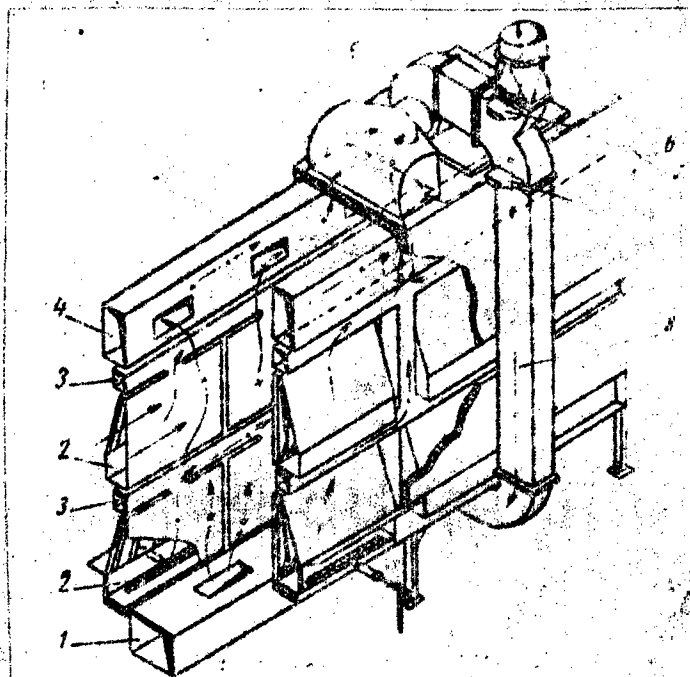


Figure 7. Design of thermal radiation chamber for drying side panels.

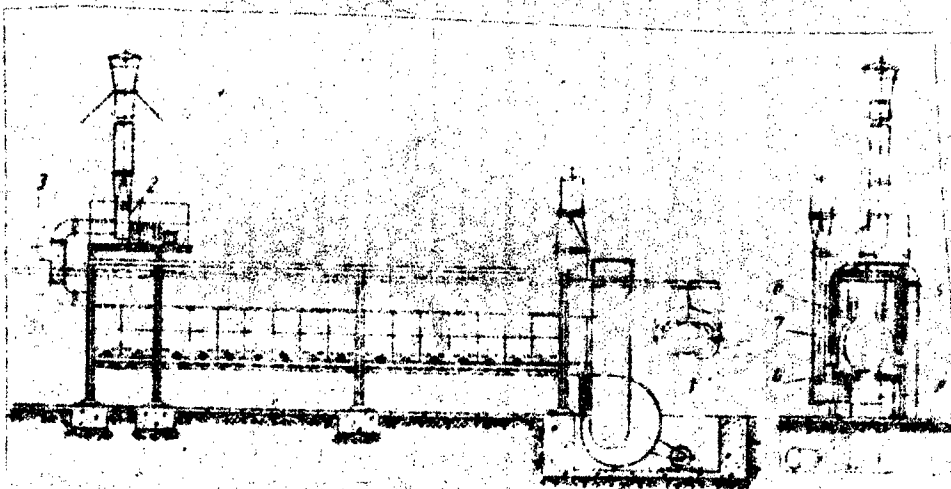


Figure 8. Design of thermal radiation drying chamber for drying bulky units:

1--recirculation fan; 2--exhaust fan; 3--regulatory lid; 4--panel shaped to item to be dried; 5,6,7--air exhaust ducts; 8--forced air duct.

III. MECHANIZATION OF ELECTRICAL INSTALLATION AND REPAIR OPERATIONS

Pages 18-19

A. V. Dovgiy,
Repairman in the
electric shop of
the Rostov Agri-
cultural Machinery
Plant

The electric shop of the Rostsel'mash Plant carries out a large volume of different installation and repair operations, many of which, for lack of necessary equipment, were done by primitive methods requiring a heavy application of labor. Workers and engineering-technical personnel of the shop decided to conduct a struggle against inefficient methods of labor. Through its own efforts the shop has devised several contrivances and simple machine tools, which have considerably lightened labor, improved the quality of work, and raised the technology of production.

For example, in installation work a large amount of gas pipes are cut daily in the electric shop. They used to be cut by hand with saws. Recently a machine tool was built to cut gas pipes with an abrasive disk (figure 1). The mount, welded of carbonized steel, has a movable platform, on which is mounted and asynchronous 1.8 kw. electric motor. A v-belt connects the rotor of the electric motor to the axle of the abrasive disk. A lever placed opposite the motor and the abrasive disk is equipped with a handle for releasing the disk. When out of gear the lever, together with the disk, is returned by means of equipoise. In order to fasten the pipe to be cut the machine is equipped with a pneumatic clutch, consisting of a pneumatic cylinder and a pneumatic clamp, mounted on the stand, a coupling device, and air hoses. Gas pipes with a diameter from $\frac{1}{2}$ to 2.5 inches can be cut on the machine. Time of cutting is 3 to 6 seconds. The quality of cutting is good and finishing work on the cut is not required. Introduction of this machine tool produced for the shop an annual saving of 15,000 rubles.

A special machine tool was also devised for bending gas pipes. (figure 2). The mount has two immovable steel rollers, which turn freely about their axles. The rollers are adjustable, permitting alteration of the distance between them. There are several drilled apertures for the axles. A third roller, which carries out the bending of the pipes, is placed at the end of a worm rod and may be shifted horizontally. A progressive movement is communicated to the worm rod by an electric motor by means of a worm gear. An end switch limits the course of the rod by switching off the motor. The direction of the motor is changed with a reversing switch. In

order to change the angle of bending of the pipe the distance between the immovable rollers must be changed. Bending of pipes on this machine is fast and of high quality.

We must also give note to the lever scissors for cutting sheet metal (figure 3). In this design a movable blade is attached by a system of levers to a piston rod of a pneumatic cylinder. The cutters are operated by pressure on a foot pedal equipped with a return spring and connected by the lever system to a pneumatic valve. While these cutters formerly, under manual operation, cut metal sheets 1.5-2 mm. thick, now they are able to cut sheets 4 mm. thick.

In the electric shop it is frequently necessary to repair commutator motors of electric drills and nut turners. A laborious operation in repairing these motors consisted of "tuning up" the commutator, that is, removing dirt, bits of mica, and copper dust from between the commutator plates. This operation used to be done by hand with a cleaning cloth attached to a holder. Recently a mechanism was devised for mechanical cleaning of commutators. On this device is mounted an 0.125 kw. electric motor, which can be manually shifted into vertical and transverse directions. The motor is attached in the necessary position with thumbscrews. On the end of the motor shaft is attached a miniature cutting disk. The armatures of the electric motors of drills and nut turners are mounted in the center and can be manually shifted to a longitudinal direction. The mounted commutator is moved by hand against the spinning disk and cleaned, the disk moving across the width of one commutator plate at each rotation. The time for completing this operation under this method is greatly reduced and the quality of work is improved.

Also found useful is a table press for drilling holes with a diameter up to 6 mm. in parts up to 1.5 mm. thick (figure 4). The rod of the press is connected by lever to two electromagnets, one above the other. The purpose of the upper magnet is to hold the rod in an extreme upper position. It is constantly switched on during operation of the press. On pressing the button this electromagnet is disconnected and simultaneously switches on the lower magnet, which has a drawing force of 15 kg. and operates the press. Application of this press makes it possible to carry out the most laborious drilling operations. The press is portable and very convenient in handling.

Many other new inventions have been introduced in the electric shop: machine tools for winding wire during mending, for winding electromagnetic coils, punches for manufacturing items on presses, etc. All this technological progress is directed toward improvement of working conditions, lowering labor input, and economizing on deficient materials. Mechanization of work in the electrical shop

leads to the solution of complex production tasks. And the results are apparent. For several consecutive months the shop has won first place and the Red Banner in competition with a group of production preparation shops. Recently the shop collective entered the competition for the shop banner of communist labor.

FIGURE APPENDIX



Figure 1

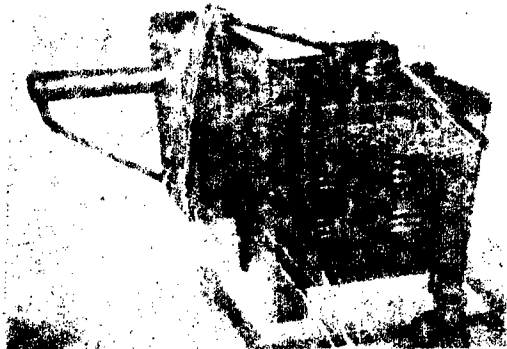


Figure 2

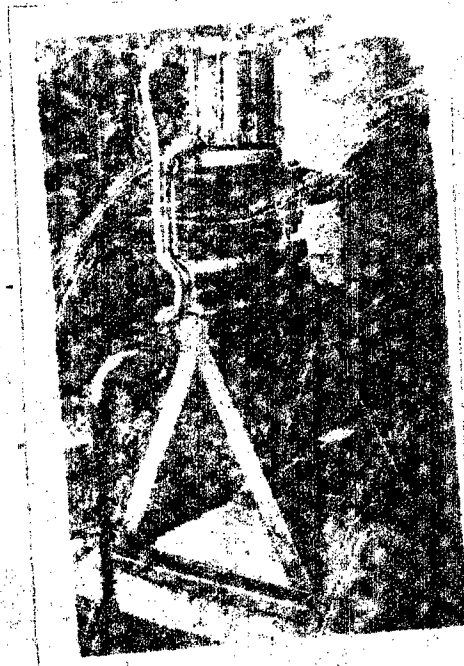


Figure 3

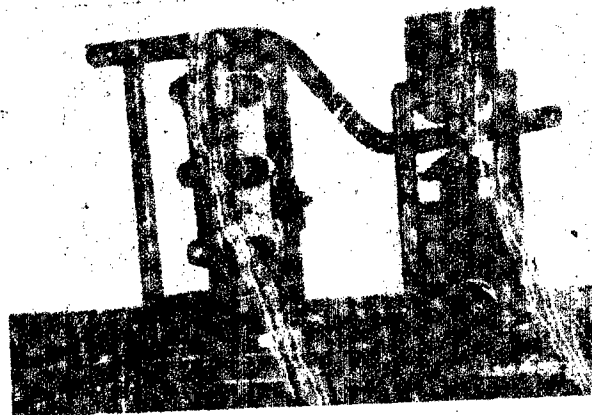


Figure 4

IV. MECHANIZING LOADING OPERATIONS OF FRIABLE MATERIALS AT THE ROSTSEL'MASH PLANT

Pages 20-21

D. N. Val'dman and
A. S. Besschastnyy,
engineers

Recently great efforts were made at our plant to mechanize hauling and loading and unloading work. The most effective measures adopted are: installing two unloading machines of friable materials at the warehouses of the steel foundry shop and the pig iron shop, setting up an intershop suspension conveyer for transporting parts from the wrought iron shop to the straw piler shop, organizing a loading platform with a gantry crane for loading and unloading containers up to 5 tons in weight, and, finally, installation of gantry cranes for loading combines on railroad cars. These and other measures have yielded the plant a regular annual saving of over 800,000 rubles.

Of great interest to many plants with warehouses by rails for storing and processing friable materials is the plant's mechanization of unloading friable materials from railroad cars directly into the warehouses of the foundry shops.

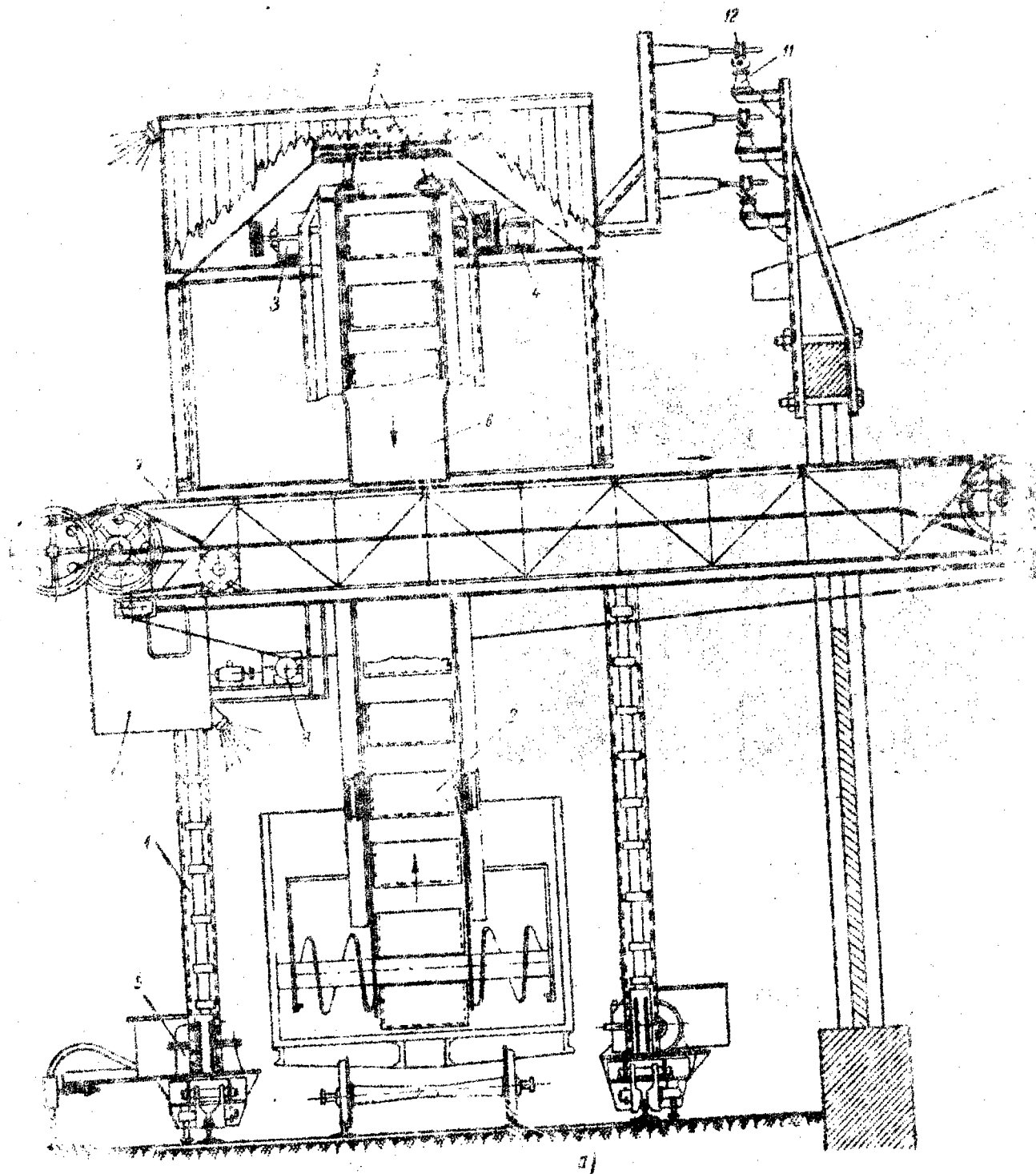
Formerly sand was unloaded from railroad cars by hand. The sand was unshoveled on the ground on both sides of the cars. After unloading the cars were removed and the sand was dumped into warehouse bunkers with bucket cranes. Afterwards, the rail area had to be cleared of remaining sand. In this way about 30 percent of the railroad cars were unloaded. The other 70 percent of the cars, because of the limited loading area beside the warehouse and the low speed of operation, had to be unloaded at a distance from the warehouse. Then the sand was reloaded onto platforms belonging to the plant and taken to the warehouse, where the unloading process was repeated. Mechanization of unloading has made it possible to unload the cars alongside the warehouse. The unloading apparatus can be shifted along the unloading area and unloads sand directly from the cars into the warehouse. As they are emptied the cars are removed and loaded cars move in. The capacity of the unloading apparatus is 100 to 120 tons an hour.

The unloading machine is constructed in the following way (see the illustrations): mounted on a self-propelled lorry one (1) is a bucket elevator 2 set in motion by a mechanism 3 located on the top part of the lorry. The elevator can be shifted to a vertical plane by an electric winch 4 through a system of blocks 5. A chute 6 serves to transfer the sand from the elevator. A moving belt conveyer 7 is located beneath the chute. In order to set the conveyer in the desired position there is a special mechanism 8,

and in order to shift the unloading machine along the loading area there is another mechanism 9. Movement is communicated to the machine by a wheel of an electric motor through reducing gears and a worm gear. The electric motor is fed current from a trolley extending above the roof of the warehouse (11 and 12).

The unloading machine unloads from open type cars. When the machine is being attached to a car the bucket elevator is raised to an upper position. Then the moving conveyer is introduced into a loading chute of the warehouse and set in motion. The sand is unloaded by letting the elevator down into the wagon and progressively shifting it downward. From the elevator buckets the sand is dumped in the chute and then moves onto the moving belt conveyer, the speed of which is adjusted according to need. The entire mechanism is controlled from a control panel 10. The plant saves an annual 256,000 rubles as a result of using the two sand unloading machines.

FIGURE APPENDIX



sand warehouse



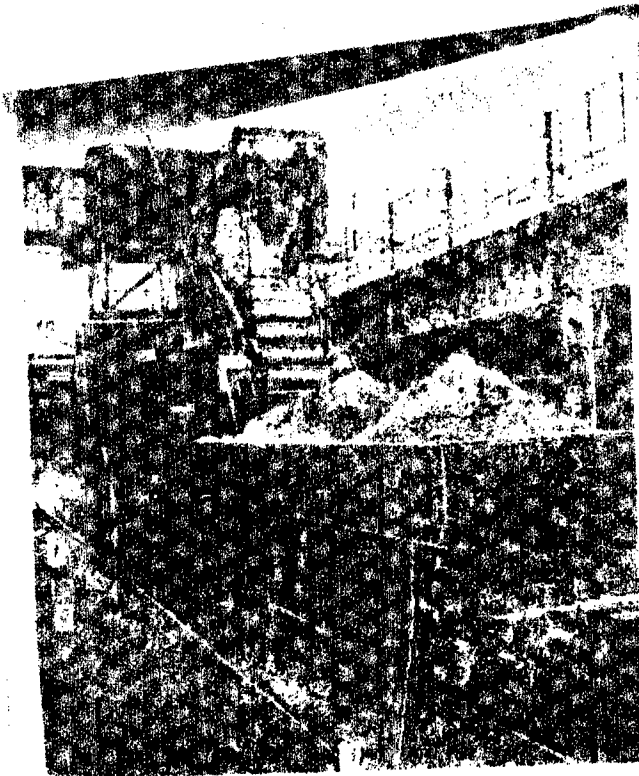
Frable materials unloading
machine

a. design; b (●) general view
[Page 21]

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- END -

sand warehouse



Friable materials unloading
machine

a. design; b () general view
[Page 21]

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- END -

FIGURE APPENDIX

