THE AUTOMATION-69 INTERNATIONAL EXHIBITION

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Automation-69, an international exhibition of modern equipment for the automation of production processes, was held in the Sokol'nik Park of Culture and Rest in Moscow from May 14 through 28, 1969. The products of more than 1100 industries, combines, firms, and organizations from the USSR and 20 other countries were displayed in pavilions and on open sites, occupying an area of more than 50,000 m².

The exhibition mainly displayed instruments and automation equipment, together with complete systems for the automatic checking, regulation, and control of industrial processes, equipment, and plants based on them.

The biggest interest for hydraulic engineers was provided by a number of types of building machinery displayed by the Soviet Union, Sweden, and the German Federal Republic. Some foreign firms were displaying modern machinery lacking any automatic control features.

In the Soviet section of the exhibition there was a demonstration of the use of automatic control systems for the industrial processes involved in the preparation, in field conditions during the summer, of stiff and plastic concrete mixes using the S-780 batching plant with an output of 15-30 m³/h, consisting of mixing and batching sections, connected by a conveyor belt and a S-753 automatic cement store, with a throughput of 15 tons/h, with pneumatic cement delivery. The overall size of the batching plant (length, width, height) is 30 x 8.4 x 7.4 m and the weight of the main plant approximately 24.5 tons. It is transported on flat railway trucks or trailers in large units, so that the plant can be erected in five or six shifts.

An overall automation system for the cement mixing unit of the commercial concrete batching plant was also advertised, consisting of a control, checking, and signalling unit, from which all the machinery was operated, designed for the automatic control of concrete and mortar preparation, from charging the ingredients into the service bunkers right up to delivering the finished product.

New batch weighers are at present being developed for the ingredients of concrete and other materials, equipped with general-purpose moving dial indicators. This equipment can carry out a program from punched cards, counters, or switches and can also automatically introduce corrections with variation in the moisture content of the materials or consistency of the finished mix. The same indicators can be widely used on plants for loading motor vehicles and wagons with cement and other building materials. The indicators use contactless switches and changeovers, designed to operate with electronic logical elements and starters. The contactless sensors are designed for a 12- and 24-V dc supply, so that they can be used in "safe" control circuits and can be used on self-propelled, trailer, and semi-trailer road-building machinery. An example of this is provided by the Profil'-1 and Profil'-2 units, which can be used on graders for the final levelling of road foundations. As distinct from the Profil'-1 units, the Profil'-2 system not only automatically maintains the transverse surface gradient of the foundation, but provides the longitudinal level to an accuracy of 1 cm, along a span defined by a stretch-wire, the curb, or the surface of the finished stretch of road. The Bryansk road-building machinery works displayed the 90 hp D-710 light-weight grader on the Profil'-1 system, with automatic stabilization of the transverse angle of the plowshare, 3040 mm long and 800 mm high, independently of the position of the machine (Fig. 1). The 8.7-ton grader, with a 4700-mm base, has a road-span of 400 mm, with an equal front- and rear-wheel gage of 1850 mm. The maximum traveling speed is 30.4 km/h forward and 11.6 km/h reverse. The overall dimensions of the machine (length, width, height) are 7000 x 2380 x 2945 mm.

With the 55-hp. continuous-duty ETT's-202 caterpillar excavator (Fig. 2, Tallinn excavator works) for driving rectangular trenches 0.5 m wide and up to 2 m deep in groups I and II soils without big rock inclusions, in one pass, at a speed of 15-250 m/h with a given bottom batter (up to 0.002), the depth and angle of the bottom of the trench can be maintained automatically, independent of the unevenness of the site. In order to maintain the batter of the bottom of the trench, a wire is run along the route on a special type of peg to the design height.

Translated from Gidrotekhnikheskoe Stroitel'stvo, No. 2, pp. 53-61, February, 1970.
Fig. 1. The D-710 grader.

Fig. 2. The ETTs-202 excavator.

at an angle corresponding to the batter of the bottom of the trench. When working the excavator jib, a sensing element, suspended from the frame of the working member, slides along a guide wire. Automatic control of the hydraulic pistons of the rise and fall mechanism is operated on an electrohydraulic system from the sensor signals.

A reversible bow-shaped belt conveyor piles the soil on one side of the open trench. By varying the speed of the belt (2.98 and 4.39 m/sec), the distance can be controlled between the plowshare and the trench. The working speed can be regulated continuously by means of a hydromechanical speed reducer, so that the work is carried out under optimum conditions. The transport speeds of the 9.84-ton machine are 1.13 to 4.42 km/h. The overall dimensions (length, width, height) are 9500 x 2480 x 3120 mm.

Automatic units of a single standard system, based on a single model, can be used on different machines with a minimum of changes.

These units are also used on the Avtoplan-1 and Avtoplan-2 systems, which can be installed on bulldozers for automatic stabilization of the angular position of the plowshare frame in levelling, and for overload protection of the engine. These increase the productivity of bulldozers, lighten the driver's work, and extend overhaul schedules. The Avtoplan-2 system consists of pendulum-type measuring device, control unit, engine crankshaft speed indicator, engine protection unit, and an electric slide valve.

Any change in the set position of the plowshare frame relative to the longitudinal axis is taken up by the flywheel-type pick-up. Rotation of the flywheel is converted to an electrical signal which is transmitted through the sensitive element of the control unit to the corresponding electromagnet of the reversing slide valve. This controls the hydraulic piston, by means of which the plowshare assumes the previously set position.

When the engine shaft revolutions fall below the set value, the signal from the engine camshaft speed indicator is converted to a signal for switching a hydraulic unit, which raises the plowshare until the set speed is restored, after which the angular position of the frame is again stabilized.

At the Kolyushchenko Chelyabinsk roadway machinery works, it was decided in 1969 to manufacture 100 D-687 bulldozers on 100-hp caterpillar tractors with the Avtoplan automatic control system, and to carry out project design work for manufacturing similar bulldozers on 130-hp caterpillar tractors. Tests have also been carried out at the works on 250-hp D-396V graders fitted with the Profil' automatic control system.

The automatic control system on construction cranes primarily provides safe operation. For this purpose, load limiters are installed, in addition to crane indicator signals and signalling anemometers on tower cranes. Overall crane protection requires logical devices combining all these units, providing signals for the crane operator. Partial automatic control of crane operations form the basis of simple, compact remote-control devices, frequently obviating the need for slingers. Combined semi-automatic control systems such as these can also be used for the automation of single-bucket excavators, loaders, and other machinery.

The Ivanov truck crane factory displayed the KS-3561 full-rotation crane, with a lifting capacity up to 10 tons (Fig. 3), mounted on the 180-hp MAZ-500 motor chassis, with chain jib-suspension, remotely controlled from a distance up to 25 m. The crane is fitted with devices for safe operation, such as load limiters on the jib hoist and overwind, emergency pneumatic feed, and automatic jib span and loading-capacity indicator.