



B ELLIOTT & CO LTD
Machine Tool Manufacturing Division

Research & development

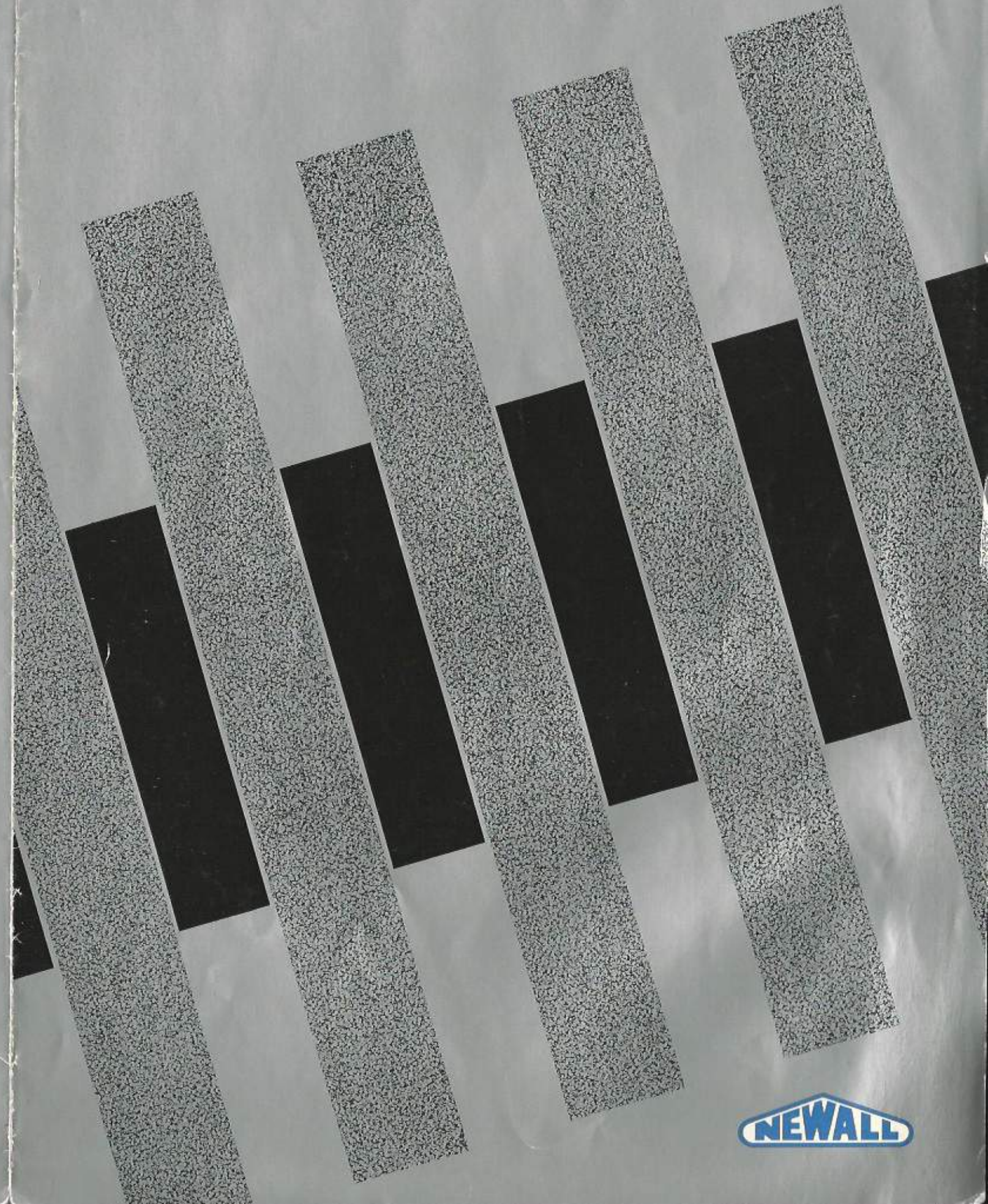
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NEWALL MODEL MJ MULTIWHEEL GRINDING MACHINE



NEWALL MODEL MJ MULTI-WHEEL GRINDING MACHINES FOR THE HIGH THROUGHPUT PRECISION GRINDING OF MULT-DIAMETER COMPONENTS, AUTOMOBILE CRANKSHAFTS, CAMSHAFTS AND MAINSHAFTS

■ BASE

Extensive research into machine tool vibration in the Newall Vibrations Laboratory has resulted in several design innovations to promote structural stability and optimum rigidity. Foremost among these is the fact that the MJ base is cast in one piece in Meehanite iron. This has proved demonstrably better than the prefabricated casings used in some competitive designs. Built-in screws are provided to facilitate positive, accurate levelling. The generously proportioned, widely-spaced slideways are produced to close tolerances for geometric alignment. Machined grooves, to a field-proven pattern, in the slideway surfaces guarantee an even distribution of slideway lubricant. Coolant outflow is sloped from front to rear and further assisted by flushing jets to eliminate build-up of sludge in the base.

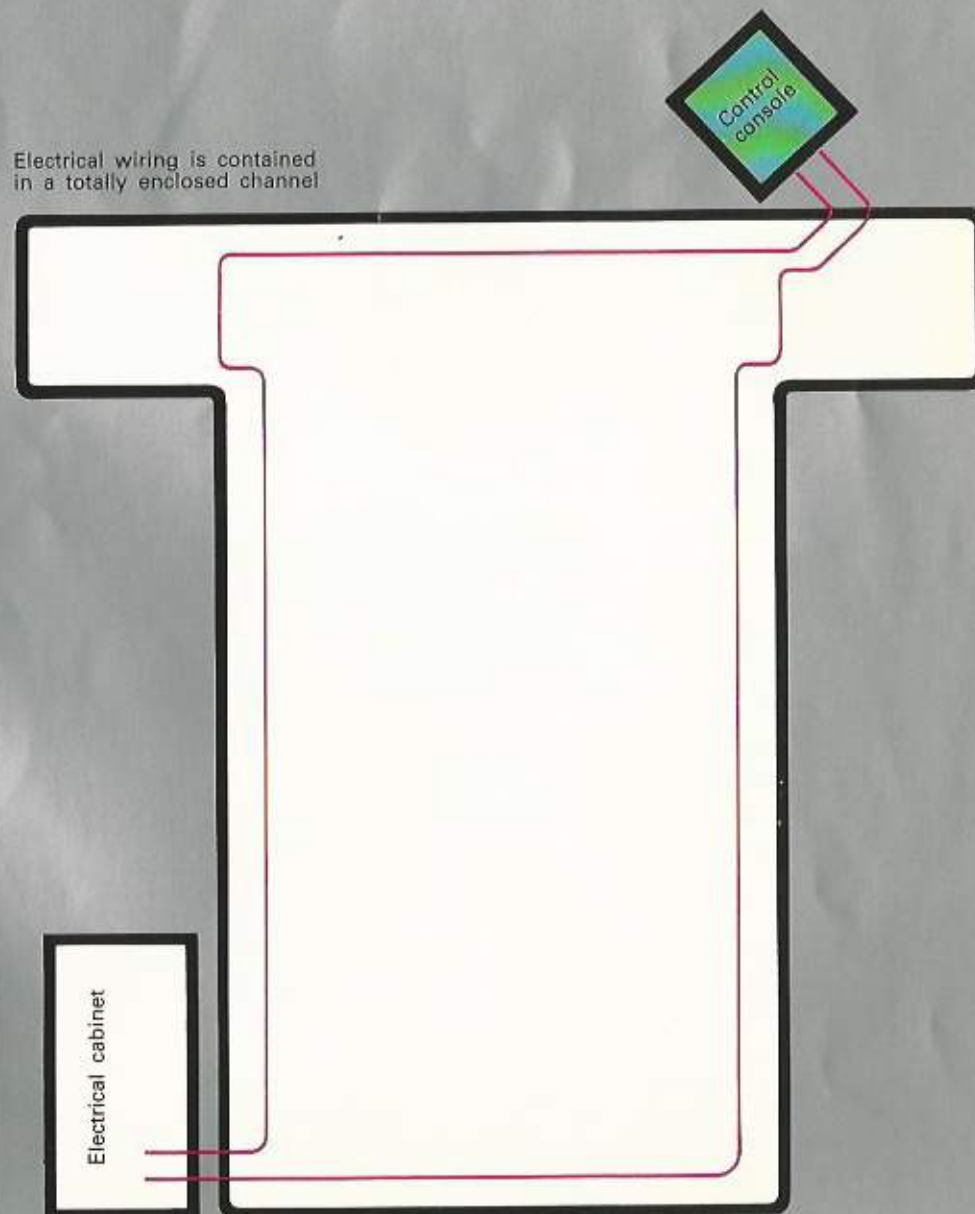
■ WORKTABLE

Built in similar massive proportions the worktable is constructed in two parts and bolted direct to the machine base. Vee and flat slideways of the bottom section are lubricated automatically from the central system. Manual traverse of the table is provided, through a rack and pinion handmotion wheel to assist with wheel dressing. A table swivel movement is provided for manual correction of taper, adjustments achieved by means of a screw reading to a dial indicator. Alternatively, automatic taper correction, fully interlocked with the machine cycle and responding to differential in-process sizing equipment is offered as an optional extra. It should be noted that with the Newall MJ it is the table (i.e. the workpiece) that is moved for taper correction, not the spindle as in many competitive designs. This is because research has proved over many years that total rigidity of the spindle is fundamental to the precision and repeatability of multi-wheel grinding.

■ MJ FEATURES

- One-piece, Meehanite cast-iron base, for maximum rigidity.
- Electric feed system to wheelhead
- Full microprocessor control of all major machine functions
- Extremely heavy duty wheel spindle
- Easy access to critical areas for simplified maintenance
- Advanced control system with diagnostic facilities
- Full automation facilities

Electrical wiring is contained in a totally enclosed channel



NEWALL MODEL MJ MACHINE SUPPLIES AND EQUIPMENT

Electrical equipment

Electrical control system conforms with JIC standards and all machine transformers, control relays, fuses, overload and other electrical equipment are housed in a free-standing, floor-mounted metal cabinet in an accessible position for servicing. The cabinet is designed to prevent the ingress of dust, coolant and oil mist. Standard connections between the machine and cabinet are made using Harting 24-pin plugs and sockets. This system is used to speed up the installation time and to avoid the possibility of incorrect connections being made. Terminals can be supplied as an alternative. The control panel is equipped with a simple but effective fault-finding device which enables all control circuits to be checked rapidly and any fault pin-pointed.

Hydraulics

With the increased usage of electronic control for all critical movements the hydraulic power pack of the MJ has been considerably reduced in size over previous models. It now services only the tailstock retract, workspindle clamp and work steadies/gauge carriers on standard models, but can also provide power for the optional profile-dresser lift off and wheelguard cowl lift when fitted. The power pack is a free standing unit with connections for pressure, exhaust and drain lines which are the only connections to be made at installation. The system is built to JIC standards and for protection purposes a filter unit, with indicator, registers the state of contamination.

Coolant system

Electro-Hydraulic coolant shut-off valves are standard features. These control the flow to the main nozzles, the dresser and coolant tray flushing supply and enable the machine to be used with a centralised coolant system, linked into the

machine auto cycle. During a normal grinding cycle coolant flow is automatic and interlocked electrically with wheelhead advancement and retraction. Coolant is supplied to each wheel through separate nozzles and is adjusted by individual flow restrictors. A separate flexible pipe and nozzle are fitted to direct coolant to the diamond point during rough face and side dressing of the wheels. Coolant outflow has been improved on the MJ with a continuous slope from front to rear of the bed. Proprietary free-standing coolant filters can be fitted to suit customer requirement.

Lubrication

Lubrication is pressure fed to the wheelhead feed mechanism and all slideways from a centralised system which is independent of the machine hydraulic fluid. Individual meter blocks are used for each slideway lubrication point and warning lamps are fitted to indicate both insufficient lubrication and blocked line conditions. Wheel spindle bearings and electric motor bearings are grease packed and require no further attention.

Work steadies

The two-point steady, developed to reduce setting-up time and supplied in number to suit requirements, is hydraulically operated after manual presetting to component finish size and locking. A micrometer adjustment is provided for the top tip and has a total range of 0-125mm (0-005 inch) with graduations to facilitate settings directly to 0-0025 (0-0001 inch).

Lateral location

An endwise location unit is available providing a facility for automatic lateral positioning of the component datum face. The unit is moved into the operating position where, upon contact with the component, the lever-operated transducer

drives the component into correct alignment with the grinding wheels.

Size control

A wide range of visual and in-process gauging devices is available to provide a constant check and control on component accuracy during the grinding cycle. Workprobes can be of the dial indicator type or electronic units mounted to the table tooling. In-process gauging can be of the manually applied, wheelguard-mounted, swing-down type or can be mounted to a gauge carrier with automatic hydraulic application and retraction.

Work loader

A table-mounted, hydraulically-operated, twin-arm, workloading cradle, fully interlocked with hydraulic tailstock, is available as an optional extra to assist in the loading of components between work centres.

Auto loading equipment

Optional automatic workloading equipment, providing total automation of the loading, grinding and unloading cycles is also available.

Programme control facility

The Newall MJ range can be further advanced by the use of programmable control systems, which further reduce the number of relays used and provide every facility associated with this advance in control technology.



NEWALL MODEL MJ MACHINE SPECIFICATION

Maximum diameter of work between centres	254mm	10"
Maximum length between centres	1016mm	40"
Maximum width over multiple wheel assembly	825mm	32.5"
Maximum wheel diameter	1100mm	43"
Maximum diameter ground with new wheel	127mm	5"
Quick approach to wheelhead (programmable)	51 to 102mm	2" to 4"
Total diametral stock removal, roughing and semi-finishing	infinitely variable	infinitely variable
Continuous roughing infeed rate	infinitely variable	infinitely variable
Continuous semi-finishing infeed rate	infinitely variable	infinitely variable
Finish grinding picking infeed, diametral stock removal	infinitely variable	infinitely variable
Finish grinding picking infeed, amount per pick	Preset to requirements	Preset to requirements
Finish grinding picking infeed, rate of picking	infinitely variable	infinitely variable
Dead centre workhead, single speed, range 50 - 150 rpm	To choice	To choice
HP of wheelhead motor	30 or 50	30 or 50
HP of workhead motor	3	3
Coolant pump capacity, main	109 litres per min	24 gals per min
Coolant pump capacity, dresser	23 litres per min	5 gals per min
Approx. net weight of machine and standard equipment	19505kg	43000lb
Approx. gross weight of machine	20930kg	46150lb
Floor space for machine, coolant filter, hydraulic tank and electrical control cabinet (w x d x h)	4 x 3.2 x 1.8m	13' 2" x 10' 6" x 6"
Height of work centres above floor	1100mm	43"

WORKHEAD/TAILSTOCK

The standard dead centre type workhead has a swing of 250mm and is driven through vee belts by a variable speed motor of sufficient rating to meet the requirement. Facilities are provided for the workhead to be programmed to give different speeds during the grinding cycle. Automatic single-position stopping to within plus or minus ten degrees to facilitate component unloading is incorporated.

The tailstock assembly, mounted on the top table is fitted with a hardened and ground Nitralloy spindle, lapped into a Meehanite bearing. Its centre is spring loaded into the normal working position. Interlock switches are fitted and linked into the auto cycle to indicate over-run, located and retracted positions. A hydraulically-operated tailstock is available which can be actuated either by pushbuttons in the main electrical control console or by a footswitch.

WHEELHEAD

For optimum rigidity, the heavy-duty wheelhead is of very robust construction with a total gross weight approaching 8 tonnes. Basically, it comprises a Meehanite casting mounted on vee and flatways of generous proportions and on which are fitted the wheel dressing assembly and wheel spindle motor.

Pressure lubrication of the slideways is provided by an electrically-driven Trabon oil lubrication system fed by an independent oil reservoir which has a capacity consistent with at least 200 working hours.

To facilitate rapid removal of the wheel spindle assembly, the wheelguard cowl is hinged and incorporates a cushioning device to avoid shock when the vertical position is reached. Spindle retaining caps are also hinged. Wheelguards are designed to meet American Standard ANSI B7-1970 and are arranged to suit grinding wheels of 1100mm or 915mm as required. Automatic adjustment of the wheelguard cowl in step with wheel wear is available as an optional extra. This ensures that the coolant nozzles remain in close proximity with the grinding wheels.

WHEELHEAD FEED SYSTEM

To eliminate feed rate variance due to thermal drift which is inherent in hydraulically-operated feed systems, the rapid advance and retraction of the wheel and the follow-up face and diameter feedrates are entirely electrically controlled by a dc servo drive. Productivity is therefore improved by more constant cycle times and elimination of the need for a warm-up period.

Direct electrical drive without the need for an intermediate hydraulic unit is made possible by the use of a 100mm diameter high precision ball nut and screw which eliminates backlash. This results in very precise control of the wheelhead feed distances, feed rates and compensation for reduction in wheel diameter due to dressing. To prevent accidental over-run of the system a totally independently-driven safety system is incorporated.

The feed system is fully protected and accessible without the need to remove the wheelhead assembly.

Four feeds (i.e. three change points) are provided, all of which are infinitely variable in speed and have a facility of change point variation. A five digit, readout display records the amount of stock removal and the position of the wheelhead, relative to the final size point. A VDU is provided to show the wheelhead position and which grinding feed is in operation.

Feed cycle, powered by a DC servo drive, is set by means of a keyboard which enters the necessary data into memory.

WHEEL DRESSER

The accuracy and simplicity of wheel truing are features of the MJ multi-wheel grinder. The dresser assembly is mounted on the rear of the wheelhead casting and consists of the following three sections — A diamond in-feed controlled by a stepping motor which is initiated by a parts-ground counter. Wheel wear compensation is automatic. A cross-slide is mounted on the main section of the dresser and traversed by a DC servo motor.

Thirdly the dresser barrel carrying, according to requirement, either a single-blade diamond tool or a diamond roller. A multi-barrel unit is also available.

Single-barrel dressers have variable traverse around radii and can compensate for wheel wear on the radius of 1100mm diameter wheels of up to 228mm; 162mm on 914mm wheels.

Optional multi-barrel dressers, either plain or form-copying types, with a separate dresser barrel for each grinding wheel have increased travel to cover wheels from 1100mm to 640mm diameter. These allow for much faster dressing times as the traverse time will only be the time required to traverse the widest wheel. Feed is by pre-loaded ball screw and stepper motor drive and loading cylinders are not required.

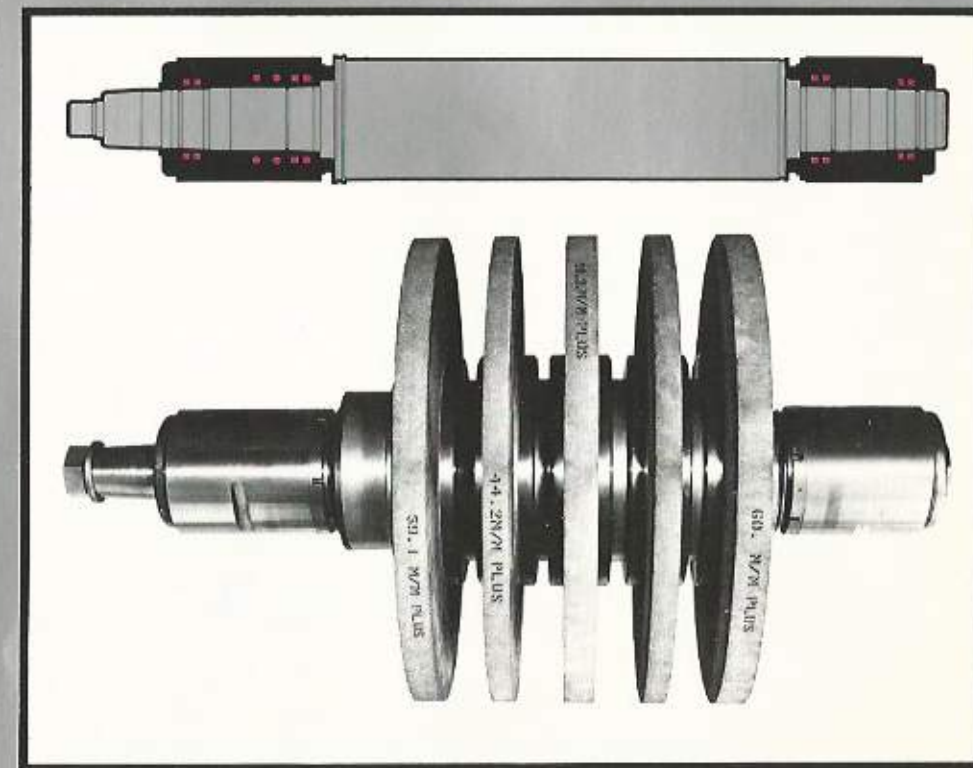
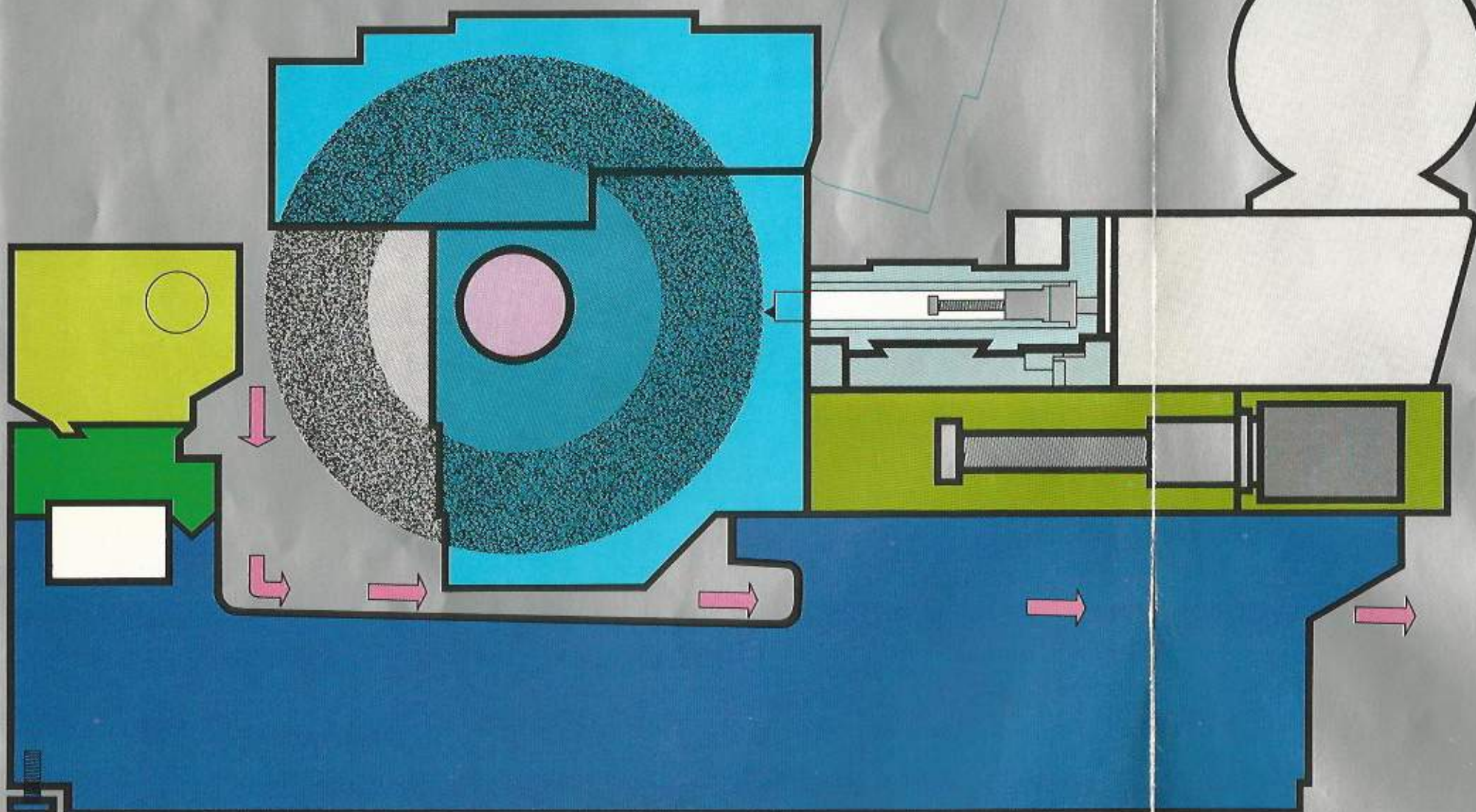
WHEEL SPINDLE

Much of the success of the Newall multi-wheel machines has undoubtedly been due to the unique design of its large diameter, precision-ground Nitralloy wheel spindle, which runs between two special precision, anti-friction bearing assemblies. These are pre-loaded double row roller bearings and are both of massive proportions for extended life and freedom from chatter.

Releasing hinged clamp caps over each bearing assembly allows quick and easy removal of the entire wheel spindle assembly. This feature, combined with the fact that the bearings are

grease-packed for life and require no further attention, eliminates any necessity for the bearings to be disturbed or exposed when the spindle is removed for wheel fitting. Effectively, any number of grinding wheels can be accommodated within the maximum span of 825mm (32 1/2 inches). Wheel diameters can be 915mm (36 inches) maximum, with a minimum of 610mm (24 inches) or 1100mm (43 3/8 inches) maximum with a corresponding minimum of 640mm (25 1/8 inches).

Reduction in wheel peripheral speed, due to wheel wear, is compensated for by change pulleys.



MJ CONTROLS

The control panel incorporates a manual data input keyboard which allows variables such as work speed, feed rates and distances to be programmed to suit requirements. Data is displayed on a VDU situated at the upper section of the console, below this are located all control buttons for manual control of each machine function during setting up. A fault-finding system is incorporated which enables all control circuits to be checked rapidly and any fault pinpointed.