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A new turn in rotary transfer

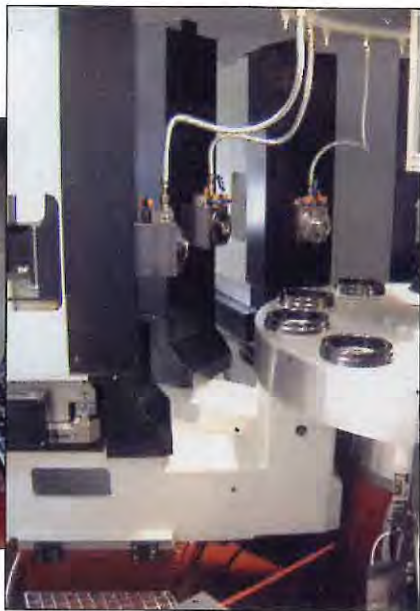
Hydromat of St. Louis continues to emphasize flexibility with the launch of its AT 115-10 CNC rotary-transfer machine. The new model sports an open architecture and follows the recent release of the company's HydroTurn Series, which gets its flexibility from a sliding headstock.

Both machines are modular designs and offer flexible alternatives to conventional manufacturing processes. The HydroTurn, for instance, is special because it combines Swiss-turning with rotary-transfer machining. The AT, on the other hand, is a departure from proven rotary machines in that its base units, or stations, are single-piece castings which support a



The Hydromat AT's workholding pallet chuck system features Erowa power chucks to accurately and consistently locate pallet fixtures to within 2μ of the machining units.

pallet-fixturing system together with its servo-drive units. This design permits quick, easy removal of entire modular bases for toolchange,



Base units on the Hydromat AT are modular single-piece castings which support a pallet fixture, fixture servo-drive, and machining station. Unlike other rotary-transfer systems, the machine's table serves only as transport device.

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complete part changeover, or routine maintenance.

According to Martin Weber, vice president of manufacturing at Hydromat, the Advanced Technology (AT) machining system is ideal for mid to high-volume production of parts from irregular-shaped cast or forged blanks. It comes in 8 to 10-station models with a 115-mm-diameter work envelope and is adaptable for machining families of parts or highly engineered complex-component shapes.

Each AT base unit is a 3 to 5-axis

CNC machining cell, offering a range of tooling possibilities. These include horizontal and/or vertical toolspindle setups, multi-tool turrets for multi-tasking, and/or an automatic toolchanging system with redundant or common tools to reduce down time associated with worn tool replacement.

Servo drives are built into every base and provide unlimited axial positioning of the pallet fixture, high-speed fixture rotation, and a vertical *B*-axis movement for horizontal or vertical milling. Shops can set up and fixture workpieces on these modular pallets outside the machine, much like presetting a toolhead on a conventional rotary-transfer machine, says Weber. Once parts are ready, they transfer into the machine by way of an integrated load/unload station. Loading and unloading of pallets and/or workpieces can be done automatically, by conveyor, robot, or pick-and-place device.

Unlike conventional rotary-transfer machines, the AT's table serves only as a transport device. On a 10-station machine, for example, all 10 stations simultaneously release pallets carrying workpieces. The table lifts, transports each pallet to the next pallet fixture, and lowers it to the fixture pallet where it is located and clamped.

To precisely locate and clamp pallets, the AT uses Erowa power chucks. These deliver accuracy and repeatability between the pallet fixture and the machining unit to within $2\ \mu$.



Hydromat's AT is a departure from proven rotary-transfer machines.

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“Erowa power chucks operate, in principle, to a Hirth ring coupling”, says Weber, “in that there are a number of precision-ground teeth arranged in a 90° pattern that engage and lock with a clamping force of 9,000 N.”

The pallet fixtures’ base-mounted servo drives have rotary encoders and hydraulic brakes. This provides unlimited axial positioning of the pallet fixture as well as high-speed rotation up to 5,000 rpm for precision lathe-type operations. Thus, shops can perform many combinations of machining operations at a single station, such as heavy milling

followed by turning.

To further the AT’s flexibility, Hydromat equips the machine with a GE Fanuc 2050 control system that features a user-friendly Windows-NT operator interface with 15-in. touch screen. According to Weber, operators can offset programs on-the-fly and do complete program changeovers either at the machine, from a host computer, or with any off-line PC. No special programming languages are required beyond industry-standard G code.

Five Fanuc 16i CNC units control the AT’s various servo drives. Linear-axis movement of the tool-spindles is via servo-controlled precision-ground ballscrews. A software package, called Simplicity, serves as a system supervisor and coordinates the actions of the Fanuc CNC units.

While modular single-piece station castings set the AT apart from the norm, a sliding headstock at the infeed station is what separates Hydromat’s HydroTurn series of machines from other rotary-transfer systems. This sliding-headstock configuration permits Swiss-type turning of rotating barstock prior to cutoff and clamping. The result, accord-



Hydromat breaks from the norm by incorporating a sliding headstock for Swiss-type turning at the infeed station on its HydroTurn series of rotary-transfer machines.

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ing to Weber, is excellent part concentricity, more precise diameter control, and consistent surface finishes.

Rotating barstock feeds through a rotating collet to an air and hydraulically activated guide bushing. This stationary guide bushing rotates with the bar and is driven by a timing belt synchronized with the machine's 5,000-rpm air-cooled main spindle.

"One of the immediate benefits of this design," says Weber, "is the elimination of the need to purchase expensive ground barstock to produce precisely turned parts. Users can buy less expensive drawn barstock that does not require special handling or packaging." Shops can over-turn stock for improved O.D. dimensional and roundness control, thus eliminating the O.D. variability associated with cold-drawn barstock.

A sliding headstock at the infeed station lets shops do additional operations in the lathe station, some of which include heavy recessing and turning and single pointing — all before the part is cut off and clamped. This, according to Weber, expands the capacity of the 12-station machine to perhaps 15 or 16, depending on the application. It further reduces the need for secondary operations and opens up the potential for a wide variety of jobs and more complicated parts.

The ability to do Swiss-type turning at the infeed station produces parts with precise O.D.-to-I.D. relationships. And in some cases, the HydroTurn permits longer turns than typically done on a standard Hydromat. On a standard machine, chip load or material removal is limited by where the part is clamped. How-

ever, with the sliding headstock, aggressive and accurate turning is feasible. Mainly because the part is turned before it's cut off and clamped, and the work is done immediately next to the guide bushing.

The HydroTurn cuts off barstock while it is rotating, which reduces cut time. When stationary stock is cut off, explains Weber, the whole part must be cut completely through. With the stock rotating, however, a portion can be cut perhaps two-thirds into the radius. Then, when the bar stock is moved through the collet and into the first clamping station, the remaining material is cut through. "Cut-off in two steps ensures precise alignment and takes less time," says Weber.

Sliding-headstock tooling packages consist of standard quick-change gang tooling with four 19-

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mm toolholders — one to cut off the bar (which in some applications can be used to turn other features) and three additional tools for recessing, contouring, single pointing, and heavy turning.

A precision-ground Hirth ring on the HydroTurn assures table accuracy, reliability, and station-to-station repeatability to within 0.0002 in. The HT 32-12 has an inverting unit, which removes the workpiece from the collet, turns it 180° end-for-end, and places it precisely back in the same collet. By doing this, the back side of the part is completely machined, eliminating what would normally be a secondary operation.

The HydroTurn is servo-hydraulically controlled with infinitely variable programmable feeds and speeds for each independently controlled toolspindle. This allows the longest machining operation to control the cycle

time. All toolspindles are modular and provide maximum interchangeability for retooling.

For job flexibility, HydroTurns consist of up to 12 horizontal and 4 vertical toolspindle units. And by simply disengaging the sliding-headstock feature, the machine operates as a conventional Hydromat, feeding barstock or blanks up to 6-in. long.