Figure A is a graphical representation of a typical cycle. The graph shows the synchronization between main and bypass valves. It also demonstrates the timing control which is necessary to fully meet the operational requirements in the decoking process.

**FUNCTION**

- The decoking process begins with the bypass valve open and the pump on.
- The operator initiates the decoker start.
- Next, the valve drive motor starts. The main spindle is lifted to a partial opening, which is determined by the cam configuration and preset system controls.
- The valve drive motor stops at this predetermined position, and "prefill" takes place.
- When the preset "prefill" time expires, the valve motor starts again to lift the main valve to full open and closes the bypass.

- On input from the cam position encoder, the valve motor stops at main valve full open position. Full volume at working pressure is now available for decoking.
- At completion of the decoking cycle, the valve drive motor is started, rotating the cam closing the main spindle and opening the bypass valve.
- Hydraulic pressure on the top of the spindles insures the spindles will follow the cam configuration. Additionally, the main spindle is designed spring actuated closed to insure the spindle is closed in all conditions.
The hydraulic decoking process uses high pressure jets and obtains its pressure typically from electric motor multi-stage centrifugal pumps. Control of high-pressure water is best obtained by using a specially designed, fully sequenced, Elwood/Nordberg Motorized Decoking Valve.

The Nordberg Decoking Valve was specifically designed and built for the Refining Industry. Nordberg engineers worked closely with engineers from pump manufacturing companies to develop the Nordberg Decoking Control Valve Assembly.

The Elwood Decoking Valve, incorporating all required design features, is the most reliable and permits maximum decoking production. The Elwood Decoking Valve has the following design features:

- Non-clogging design
- Low pressure drop
- Electro-mechanically synchronized.

A complete 6 x 3 decoking control valve assembly with base, gearhead motor drive, cam shaft, main valve and bypass valve, cam shaft position encoder, not shown.

The unit is designed completely self-sufficient, electro-mechanically synchronized, and equipped with an electrical interlock to prevent the main pump from starting, if the bypass valve is not completely open.

Above is the cam shaft assembly. Note that the highest points on the cam profiles are 180° apart between the bypass and main valve. The cam profile also illustrates how varying positions of openings are obtained to control initial acceleration, prefill and full open.

Shown is the cam position absolute encoder. This provides rotational position for accurate control. The encoder is used in conjunction with a limit switch for verification that the main spindle is in the closed position.

Photograph above shows a spindle assembly. All working parts are 400 series stainless. The seating disc appears as a white band around the spindle. The disc is made of industrial duty polymer. Under load, the disc will accept foreign particles while maintaining 100% drop tight seal. On spindle opening, particles normally wash out, however, even if particles are imbedded into the disc, 100% drop-tight sealing is maintained.

Decoking Control Valves on test at Ruhrpumpen

- Pressure (up to) 5000 PSI (345 BAR)
- Flow, type 6x3 (up to) 2000 GPM

Typical 4-Drum Decoking Operation
The hydraulic decoking process uses high pressure jets and obtains its pressure typically from electric motor multi-stage centrifugal pumps. Control of high-pressure water is best obtained by using a specially designed, fully sequenced, Elwood/Nordberg Motorized Decoking Valve.

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Decoking Control Valves on test at Ruhrpumpen

- Pressure (up to) 5000 PSI (345 BAR)
- Flow, type 6x3 (up to) 2000 GPM

Typical 4-Drum Decoking Operation
Figure A is a graphical representation of a typical cycle. The graph shows the synchronization between main and bypass valves. It also demonstrates the timing control which is necessary to fully meet the operational requirements in the decoking process.

**FUNCTION**

- The decoking process begins with the bypass valve open and the pump on.
- The operator initiates the decoker start.
- Next, the valve drive motor starts. The main spindle is lifted to a partial opening, which is determined by the cam configuration and preset system controls.
- The valve drive motor stops at this predetermined position, and "prefill" takes place.
- When the preset "prefill" time expires, the valve motor starts again to lift the main valve to full open and closes the bypass.
- On input from the cam position encoder, the valve motor stops at main valve full open position. Full volume at working pressure is now available for decoking.
- At completion of the decoking cycle, the valve drive motor is started, rotating the cam closing the main spindle and opening the bypass valve.
- Hydraulic pressure on the top of the spindles insures the spindles will follow the cam configuration. Additionally, the main spindle is designed spring actuated closed to insure the spindle is closed in all conditions.