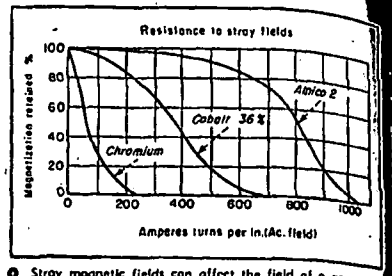


7 Impact or vibration of magnet under normal operating conditions affects magnetic fields above, but only slightly



8 Stray magnetic fields can affect the field of a permanent magnet. Above curve shows the effect of various fields

cleaned for a given belt thickness. A word of caution: Since the belt thickness separates material from the face of the magnet, provide a manufacturer with dimension specifications.

Pulleys of 24 in. dia have been known to clean successfully crushed coal up to 4- to 6-in. depth on a belt conveyor. Pulleys up to 30 and 36 in. dia are now being produced for heavier service, for instance, run-of-mine coal.

Magnetic Drums. Another form of self-cleaning magnetic separator is the magnetic drum, Fig. 4. Material introduced to the top of the drum comes under the influence of the magnetic field. It is pulled to the sides of a nonmagnetic revolving shell. The shell carries both nonmagnetic and magnetic material through the stationary magnetic field. Nonmagnetic material falls off after it passes a divider plate; magnetic carries beyond, Fig. 4.

Drums are compact, can double as a means of even feeding of free-flowing material and give automatic removal of tramp iron. Their application is usually with materials that cannot be cleaned by pulleys.

Magnetic Humps. Two plate-type separators, enclosed in a rectangular sheet metal or cast iron housing, Fig. 5, constitute a magnetic hump. Such a device, in sizes from 4- to 40-in. width, removes tramp iron from heavy volumes of material.

When located in vertical or steep drops these separators constitute a barrier in the material path. This barrier sets up a tumbling action that gives the magnetic field a chance to clean tramp iron from the material. They have also been tried successfully in pneumatic conveying systems.

The Magnet. Now how about the heart of magnetic separators—the magnet? It is made of a magnetic alloy consisting of aluminum, nickle cobalt and iron. This alloy once charged by a strong electromagnetic field possesses interesting characteristics.

Unless acted upon by a demagnetizing force in excess of that provided for in the initial stabilizing treatment, the alloy retains its magnetism. This same material in domestic watt-hour meters gives a constant magnetic field within a few one-hundredths of one percent per century. It stays that way unless (1) exposed to heat over 300 C, Fig. 6 (2) subjected to impact or vibration, Fig. 7 (3) influenced by stray magnetic field, Fig. 8 (4) changed in physical arrangement such as increasing air-gap length.

Even if a magnet reaches 300 C it retains 90 to 95% of its peak power. Upon cooling it returns to 98 to 99% of its original magnetic strength.

As for vibration, the Mill Mutual Fire Prevention Bureau in Chicago put a magnetic separator on a heavy hammermill subjected to severe vibration. After a year it retested at slightly less than its original magnetic strength.

A stray magnetic field, too weak to pull a paper clip loosely held on the end of a pencil, will not affect a permanent magnet of this alloy construction in any measurable way.

Freezing Hits a New Low

▶ LIQUEFIED HELIUM develops temperatures as low as —456 F and does it on a large enough scale for research work. A device now regularly produced, the Collins helium cryostat, is credited with such a performance. Last November, Allen Latham, Jr and Dr H O McMahon, of Arthur D Little, Inc, presented the subject in a paper before the American Institute of Chemical Engineers.

Cold space of the unit and part of the refrigerating equipment is contained within a steel vacuum jacket. Other accessories include a 10-hp compressor and a gas holder for the helium. Novel technical features include: (1) heat exchanger that cools the compressed helium from room to liquid-helium temperature (2) piston-expansion engine developed for oxygen generation.

The expansion engines use flexible coupling rods in tension. This aligns a specially hardened, close-fitting piston within the cylinder. The arrangement permits piston operation at the extremely low temperatures without lubrication.

Helium is kept pure. No cleanup system, requiring a continuous supply of liquid air to freeze out impurities, is needed, and laboratory technicians handle the machine without attention by scientific personnel.

Seven of these machines are now in operation—in university, government and industrial laboratories. Until 1947 when the cryostat appeared only four helium liquefying installations existed in North America. All were specially designed for a specific laboratory. They employed a cascade refrigeration system to reach desired temperatures.

VERTICAL TURBINE PUMPS Q&A

W C Mumford, application engineer, vertical turbine-pump division, Worthington, gives practical information on construction, operation, characteristics, troubles, remedies

3—Installation: Troubles and Remedies

Q 1—What precautions should be taken during installation of a pump to avoid operating troubles?

A—Unlike most centrifugal pumps, a vertical turbine pump generally requires field assembly of the various parts. These have been carefully manufactured to close tolerances, and are part of a machine, not merely a "string of pipe." Observance of the following 13 points helps prevent troubles that might result from faulty installation.

1. Thoroughly inspect shipment to be sure no damage occurred in transit.

2. Locate installation equipment hook accurately over the well's center line.

3. Check shaft in bowl assembly to be certain it rotates freely without binding or misalignment.

4. Be sure pressure relief vent, in the diagram, is open in bowl-assembly discharge casing of oil-lubricated pumps.

5. Remove burrs on ends of shafting or oil tube. A 0.005-in. burr on the end of a shaft causes considerable misalignment and rapid bearing wear.

6. Handle shafting carefully so there is no possibility of bending.

7. Before assembly, thoroughly clean all threads and finished surfaces.

8. Make up all joints to proper location so shaft end or enclosing tube is properly located in relation to column pipe throughout pump length. Failure to tighten column pipe to seats causes errors in shaft or enclosing-tube extension when the driving head is assembled. Correct assembly of column pipe also insures proper location of bearings and sleeves in open-shaft pumps.

9. Set driving head so its axis is in alignment with the pump's center line. The driving head's center line may not always be perpendicular to the ground level as would happen in a slanting well. Before grouting, shim the driving head.

10. Check rotation of driver before coupling to pumpshaft.

11. Adjust impeller vertical clearance in accordance with manufacturer's instructions. Accurate adjustment is required for best performance of semi-open impeller.

12. Lubricate both pump and driver according to instructions.

13. Do not let discharge piping put unnecessary strains on the pump.

Q 2—What maintenance do vertical-shaft turbine pumps require?

A—Wells may require cleaning, bailing, development, renewal of casing, straightening, or other services of a well driller or engineer. Sumps, pits and tanks require periodic cleaning and checking so suction conditions remain correct. Maintain the discharge system to meet head and capacity characteristics. Carefully study proposed changes in the system for effect on pump operation. Float controls, pressure controls, alternators and other similar devices must be kept properly adjusted and regulated.

Very little mechanical maintenance is required. Follow religiously the operating and maintenance instructions that are furnished with pumps and drivers.

Keep the oil reservoir full on oil-lubricated pumps and maintain correct flow to the bearings. Most pumps require only four to six drops of oil per minute of 100- to 150-ssu viscosity at pumping temperature. Water-lubricated pumps require occasional packing adjustment or replacement. Where rubber-line-shaft bearings are prelubricated, the prelubrication equipment must be kept in proper operation.

Q 3—What are the principal causes of vertical - turbine - pump troubles?

A—Misapplication, unsuitable well conditions, faulty installation, poor maintenance and mechanical defects are the basic causes.

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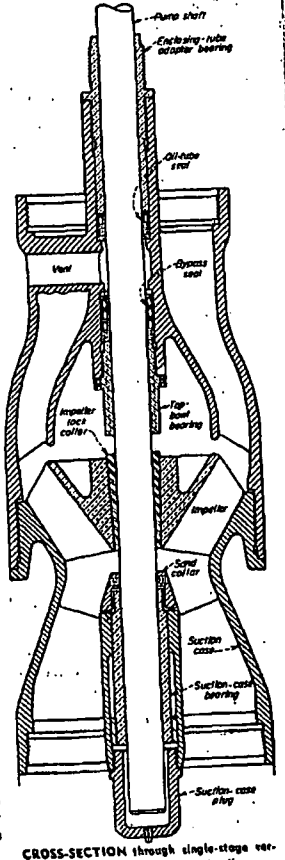

CROSS-SECTION through single-stage vertical-shaft centrifugal turbine well pump