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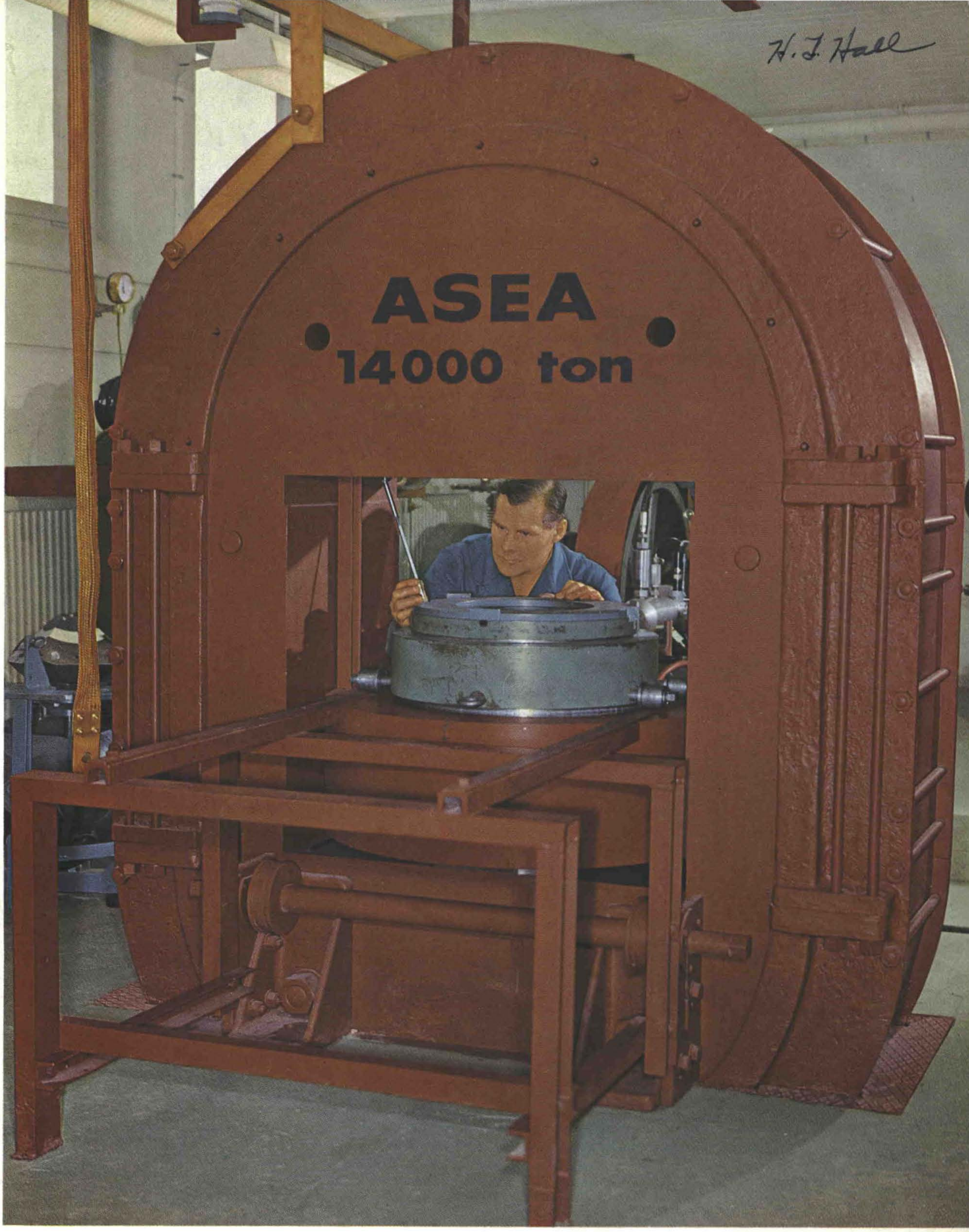

A press stand used for high-pressure research work at the Quintus Laboratory, Asea, Vällingby. Press forces of up to 14,000 tons are obtained with this equipment. (F 852)

Price: $ 200,000.

THE QUINTUS PRESS – A LOW-WEIGHT HIGH-FORCE PRESS

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THE QUINTUS PRESS – A LOW-WEIGHT HIGH-FORCE PRESS

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The article describes a new low-weight, high-force press, the Quintus press, which is capable of developing a press force of 10,000 tons or more and has an extremely low weight. The design of the press stand, pressure cylinder and hydraulic equipment of both slow-acting and rapid-acting types is discussed. Possible fields of application within industry and laboratory research are listed.

In the 1930's the well-known Swedish inventor Baltzar von Platen became interested in methods for synthesising diamonds. Extremely high pressures on large volumes are essential features in this process. No suitable means for obtaining these conditions, however, were available at that time. It was therefore necessary to invent and design the appropriate apparatus, and, in addition, a hydraulic press capable of producing the correspondingly large forces, which in this case amount to 10,000 tons or more.

The first press fulfilling the above requirements was built in 1937 and had an unconventional and quite unique design, characterised by an extremely low weight relative to the press force. Since then, Asea have further developed and improved the design, and it has now been decided to market presses of this type, which have been given the name of *Quintus presses*, for industrial, laboratory and research purposes.

THE PRESS DESIGN

The Quintus press (Fig. 1) consists basically of three parts:

1. Press stand with blocks
2. Pressure cylinder
3. Hydraulic equipment

The press stand with blocks

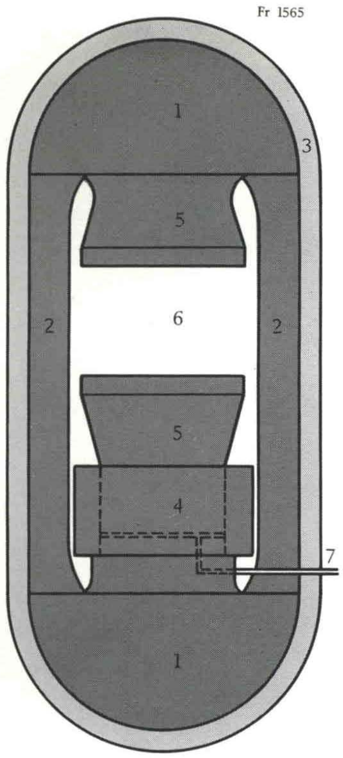
The press stand is built up essentially of two forged or cast semi-cylindrical yokes (1) of steel held apart by two similarly forged columns (2). The stand is wound in a machine, specially designed for the purpose, with about 150 miles of high-strength steel wire (3) under tension. This tension is adjusted to a predetermined value in such a way that the stress is less for the outer turns than for the inner ones. The mantle of stressed wire formed in this manner presses the yokes against the columns with a force slightly greater than the maximum compressive force that the oil pressure in the pressure cylinder (4) exerts via the blocks (5) on the workpiece (6). Because of the pre-stressed wire, contact is maintained between the opposing surfaces of the yokes and the columns up to the maximum press force. At the same time, the high strength of the forgings and wire imparts to the stand the desired characteristics, i.e., it can withstand very high forces despite small dimensions and low weight.

In the case of the press stands constructed or planned up to now, the maximum compressive force lies within the range of 10,000–14,000 tons. The press stands including the press blocks weigh from 14 to 30 tons depending upon the dimensions of the workpiece and upon the selected hydraulic pressure. As an example, the principal dimensions of a press stand now under construction are shown in Fig. 2. The compressive force and the principal dimensions can be varied, however, within very wide limits to suit different individual applications. The winding facilities now available limit the height to about 6 m (20 ft) and the weight to 50 tons.

The geometrical shape of the press blocks and columns is of great importance for the strength of the press stand, and patents have been applied for this. The friction conditions between the wire turns as well as between the inner wire turns and the yokes are also of vital importance, and these features too have been patented in a large number of countries.

The pressure cylinder

If the exceptional strength characteristics of the press stand are to be fully utilised, an unconventionally high pressure must be applied in the pressure cylinder. At present, pressure cylinders for 1,000–4,000 atmospheres are being built, and the corresponding plunger diameters are 1,160–600 mm (45.7–23.6 in.).



1 Forged or cast semi-cylindrical yoke
2 Forged column
3 Mantle of high-strength steel wire
4 Pressure cylinder
5 Block
6 Space for work-piece
7 Oil supply

Fig. 1. The basic design of the Quintus press.

The pressure cylinder is either constructed as a single thick-wall unit, or is of shrunk design. The plungers (one lower, stationary; one upper, movable) are either of forged or rolled construction and are provided with seals of different types, depending on the magnitude of the pressure.

The hydraulic equipment

In the case of slow-acting presses, where the maximum pressure is attained only a few times per day, the hydraulic system can be made rather simple. Well-tried high-pressure, low-capacity pumps have been available on the market for a long time. In the case of rapid-acting presses, high-capacity pumps must be adopted and more complicated control devices will have to be incorporated. Piping, flanges, pipe fittings and various types of valve suitable for the high pressures involved are commercially available. The hydraulic equipment as such is not constructed by Asea, but is obtained from well-known manufacturers of hydraulic machinery.

APPLICATIONS

Because of the low weight and compact design of the Quintus press relative to the large compressive force, the space requirements for the press are rather limited and the foundation problems are much simpler than for conventional designs of press stand.

The Quintus press should therefore be ideally suited, for example, for those applications where conventional press stands have been considered to be far too heavy and bulky for the compressive forces that are of interest in this connection. With regard to the design of the press stand and hydraulic equipment, the Quintus press can be suitably divided into two groups:

1. Industrial presses
2. Laboratory and research presses

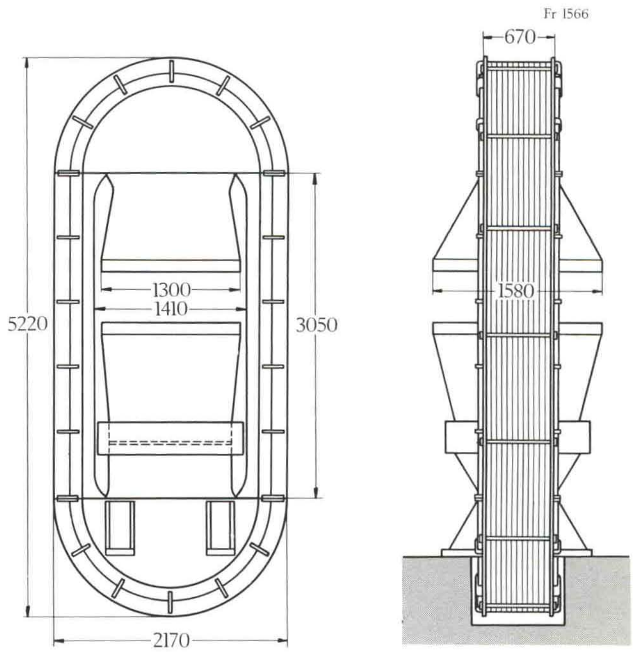
Industrial presses

A characteristic feature of these presses is that they generally have a rapid working cycle that is repeated over long periods. This means that both the press stand and other components are subjected to fatigue stresses, and thus their design must take this factor into consideration.

Special requirements must be made on the reliability of the hydraulic equipment and on the simplicity of operation, even though this may often present considerable difficulties from the control viewpoint.

Quintus presses of this type can be used for many industrial applications such as: embossing, forging pressing, drop forging, blanking, upsetting, powder metallurgy, cold extrusion, die casting, workshop pressing, bulk reduction, diamond synthesis.

Fig. 2. Principal dimensions, in mm, of a Quintus press for a max. compressive force of 10,000 tons, weighing about 30 tons.



Laboratory and research presses

A characteristic feature of these presses is that the plunger movements often take place relatively slowly and a carefully determined pressure is maintained at a constant value over long periods. The fatigue problems are consequently of less importance for such presses. The hydraulic equipment can often be simplified and automatic controls are replaced to a large extent by manual operation, whereas the precision of the controlling devices frequently has to be high.

Quintus presses of this type are particularly suitable for high-pressure research in such fields as: solid-state physics, nuclear physics, organic and inorganic synthesis, geochemistry, geophysics, mineralogy, petrochemistry, polymer chemistry, metallurgy. Other applications include: material testing, calibration.

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