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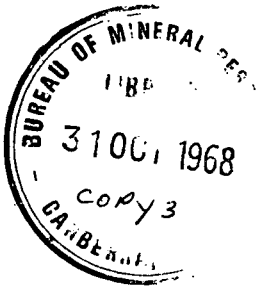
DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1968 / 91

Design of a Pneumatic Core Holder



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SUMMARY

The author has designed a pneumatic core-holder at the Bureau's Core and Cuttings Laboratory, Fyshwick, A.C.T. The use of this device on a masonry saw permits fast, safe slabbing of cores and the method has proved superior to other available types of rock-holding attachments.

The pneumatic core-holder is mounted on the carriage of the saw, and consists of two brass cylinders and pistons which are operated by compressed air or water or, with simple modifications, by vacuum. The pistons are tipped with serrated edges to grip the core firmly, and act independently to permit slabbing of cores with uneven ends, and also of thin pieces of core. The system is controlled by a three-way switch, and reversal of the pistons is almost instantaneous.

INTRODUCTION

Various types of automatic and semi-automatic rock-cutting machines are marketed, but an exhaustive investigation has failed to find a machine of high through-put satisfactory for the slabbing of cores. Most automatic machines have disadvantages for slabbing in that they are slow, and the loss of power in systems employing mechanical feeds through pulleys, belts, gears and Archimedes screws, places undue strain on many components. Also, the clamping devices usually prevent longitudinal slabbing of cores into equal sectors.

Experience at the Core and Cuttings Laboratory has shown that the best of the semi-automatic machines, for slabbing purposes, are manually-operated masonry saws. On these machines the blade is usually attached to the axis of the motor, and carriage movement is controlled manually, so that energy losses are minimised. The saws have the advantages of portability, strong construction and durability, and fast operation; segmented blades are available and they improve cutting speed because the cut is cleaned between bites of successive segments.

The main disadvantage of masonry saws is that the machines are equipped with attachments designed to hold objects, e.g. masonry blocks, which have flat surfaces, so that in slabbing circular cores no effective clamping, either from the sides or from above, is possible. In practice, it is necessary for the operator to hold the core in his hands, and at the same time he uses one foot to operate a pedal regulating the level of the cut. The slabbing is fast but the practice is dangerous, and an additional hazard is a spray of mud which continually drenches the operator, who is forced to stand in front of the blade.

To overcome these hazards, numerous investigations were made to find or manufacture a core-holding attachment which would free the operator from holding the core in his hands, and would also permit the slabbing of segments and sectors from cores of any size. Several ideas were considered and rejected, and eventually the manufacturer of the saw in use at the Laboratory designed a V-shaped frame. This held the core by friction but proved unsatisfactory because although it held a core successfully for most of the time it failed to do so when the core was almost cut through. At this point the forward and down action of the blade exceeded the frictional forces and the loose, partly-cut cores acted as wedges and jammed the blade.

After this failure, the author designed a pneumatic core-holder which was manufactured locally and has proved very satisfactory.

THE PNEUMATIC CORE-HOLDER

The pneumatic core-holder is shown in Figure 1. It is mounted on the carriage of the masonry saw, and moves independently of the motor and blade. The assembly consists of a three-way switch and two brass cylinders and pistons, and the system operates on a compressed air supply already available at the Core and Cuttings Laboratory. The same system can work hydraulically, and can be adapted easily to work on vacuum. The pistons have serrated ends which are cut-outs from wood files, and similar cut-outs are welded on the front of the carriage frame opposite each piston.

The operating method is:

(a) Switch Position No. 1

With the switch in this position, the compressed air activates the pistons to move forward to grip the irregular core surfaces by means of the serrated tips. The pistons operate independently but each is strong enough (80 lb/sq. in. design strength) to act on its own if necessary, and to facilitate the slabbing of very thin core segments.

(b) Switch Position No. 2

The switch in this position directs air pressure to the front of the cylinders, causing the pistons to retract and release the core. Immediate reversal of the piston movement is ensured because the rear of the cylinders are now open to the atmosphere.

(c) Switch Position No. 3

Pressure is released from all compartments and interconnecting pipes.

Advantages of the pneumatic core holder are:

(1) Versatility

The assembly has been designed to permit operation of the pistons by air or by water. A satisfactory test of hydraulic operation has been made at the Core and Cuttings Laboratory, by connecting the assembly to the water pump which lubricates the blade of the particular type of saw in use.

With simple modification the core holder could operate on a vacuum system. The modifications involve the insertion of an ordinary Venturi-type aspirator into the water pump system, the provision of a small reserve tank, and the exchange of interconnecting pipes between the cylinders and the switch. A few minutes idle run before slabbing would create sufficient vacuum to operate the pistons from then on.

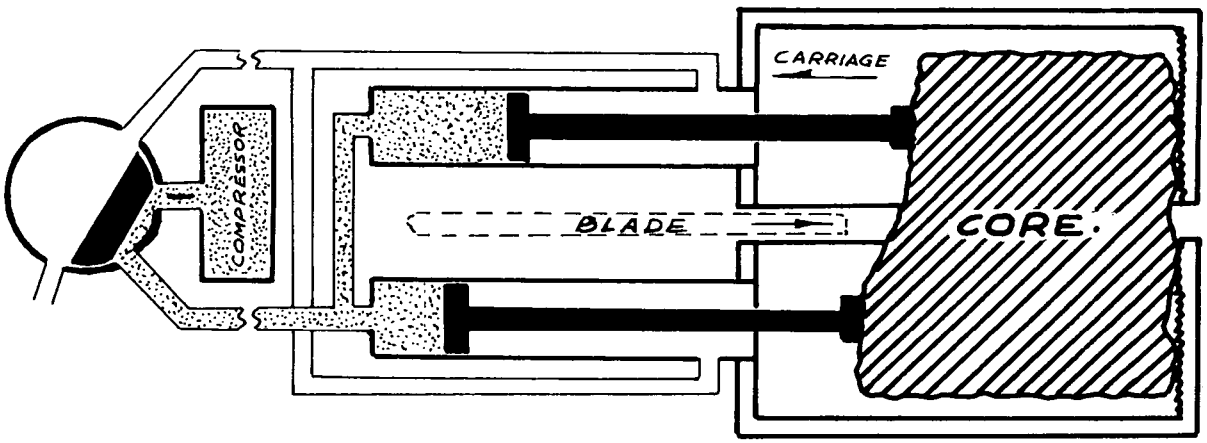
(2) Safety

During cutting, the operator has to control feeding speed only, and he can do this by pushing the carriage with one hand, meanwhile standing aside from the mud spray. Because the core is no longer held in the hand, protective guards can now be inserted near the blade to reduce spray and to minimise the possibility of injury from shattered core or blade. The blade height can now be pre-set and this removes the necessity of raising one foot to operate the pedal controlling vertical movement of the blade.

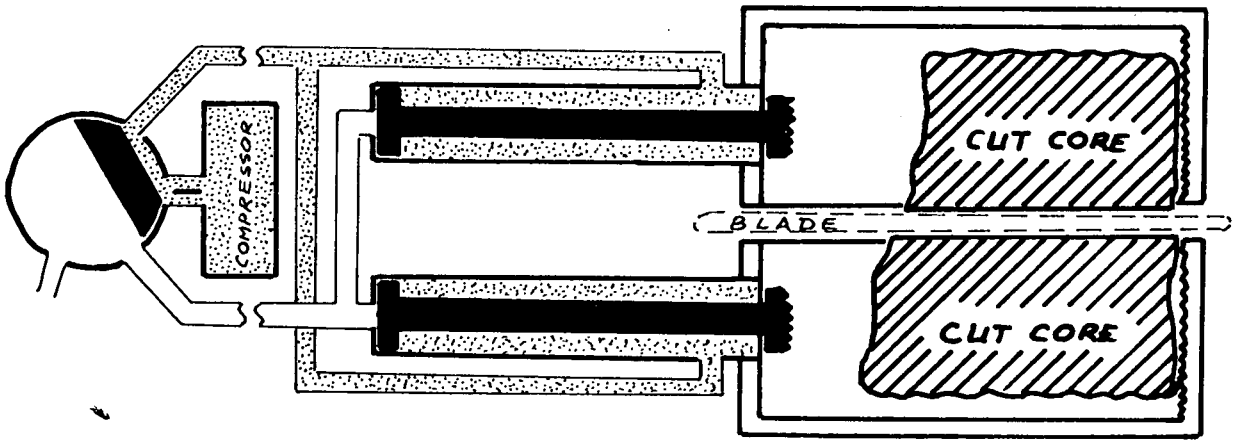
(3) Speed

Mass production of slabbed core is possible. The piston operation by compressed air is almost instantaneous; the vacuum system is generally slightly slower, depending on the size of the reserve tank and the efficiency of the aspirator.

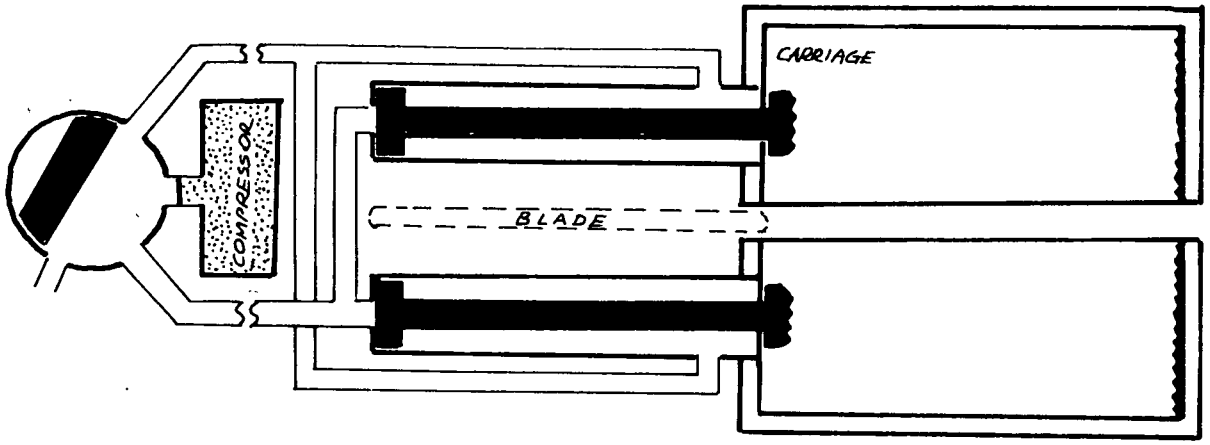
Fig.1



a. CORE HOLDING POSITION.



b. RELEASE CORE POSITION



c. SYSTEM AT REST

PNEUMATIC CORE HOLDER.

SCHEMATIC DIAGRAM - NOT TO SCALE.

To accompany B.M.R. Record 1968/91