column exceeding above-mentioned height. By the way, let us mention here the very long columns, once placed by Amagat in a shaft no more used for mining work and by Cailletet in the "Tour Eiffel". The pressures, which may be counterbalanced by a unique column are thus relatively very small. One has tried to extend the scale of the standard manometer either by connecting several columns in series or by using one column submitted at the top to a known counterpressure. By doing so, the correct measuring of pressures is rather complicated.

Therefore, the pressure balance, which is robust, relatively simple and handy is a device, which theoricians and builders take much interest in. By means of a pressure balance, reaching a high level of perfection, it is actually possible, to mesure pressures up to 13 kb.

The essential part of the pressure balance is a piston-cylinder assembly mounted vertically, which piston is pulled down by weights and by the atmospherical pressure and pulled up by the thrust engendered by a compressed fluid. Either the piston in most cases or sometimes the cylinder rotates or oscillates with a view to reducing to almost nil the friction metal on metal. The dry friction is practically eliminated, when the piston speed reaches a critical level and this fact has been evidenced by applying a difference of potential between the piston and the cylinder. A constant pressure being maintained under the piston, the fluid slowly flows along the piston, which in its turn moves down. The fluid leakage simultaneously increases with the pressure, because of the progressive distortion of the parts, unless the clearance is controlled by a counterpressure, applied outside the cylinder, so that the leakage may be practically reduced to nil. The viscous friction causes the piston to move upwards. It may be asked whether an accessory thrust is caused by the rotation of a piston, which bears helicoïdal traces of tools or not. This thrust can be evidenced by reversing the direction of rotation. From this brief description we gather, that a pressure balance is a piston-cylinder-fluid assembly, the correct working of which is on one side, but not necessarily, limited by the leakage of the fluid and on the other side, and this necessarily, by the viscosity, which can become extraordinarily high and in any way by the mechanical resistance of the piston-cylinder assembly.

The simplest type, which takes up the least amount of space, is the hand-rotated pressure balance with weighty disks, piled up on a plate, surmounting the piston. An other hand-rotated type, which is nearer to perfection comprises a long cap, of which the head rests on the piston and on the lower brim of which holed disks are piled up. But the pressure balances, which are nearest to perfection have an impressing superstructure,

which is necessary for keeping either the piston or the cylinder permanently and regularly rotating or oscillating and for charging said balances with weights, which are normally placed lower than the piston and preferably by means of a mechanical device.

There are various types of piston-cylinder assemblies. The simplest is the one shown by fig. 5a, the piston of this assembly being not necessarily terminated by a stop. fig. 5b shows a differential piston, the annular shoulder

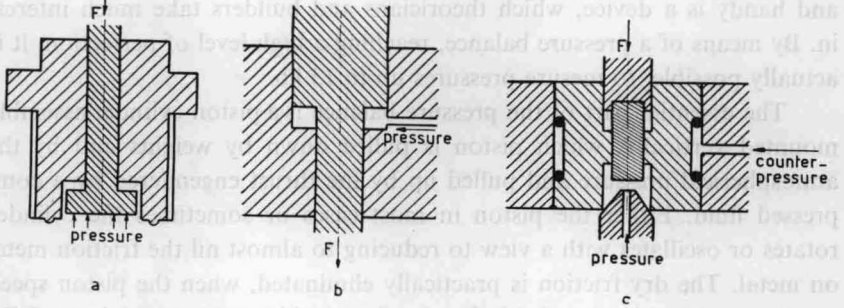

Fig. 5.

of which is submitted to a thrust, which decreases accordingly, as the shoulder becomes narrower. The pressure balance with differential piston has been particularly developed at the National Physical Laboratory (Teddington) and by Michels at the "Van der Waals Laboratorium" (Amsterdam). This pressure balance can correctly measure pressure up to 3 kb. The assembly piston-cylinder with controlled clearance, shown at fig. 5c is constructed in the USA. The normal model, measuring pressures up to 7 kb is very handy. Provided that an appropriate fluid may be found, a pressure balance of that type is capable of measuring pressures up to 13 kb. An interesting study, which we refer the reader to and which deals with this subject has been published by JOHNSON and NEWHALL [1957]. Fig. 5c shows how it is possible to adjust the clearance to a suitable value, by applying outside the cylinder a counterpressure proportionate to the pressure which is to be measured.

Precision machine tools can now be used for machining a piston, which is sufficiently cylindrical so that, assuming that the piston of a balance would remain rigid and work without being affected by the friction of the fluid, the value of the pressure prevailing under the piston can be obtained by the formula $p = (F/A_0) + P_{atm}$, in which F denotes the total of the weights