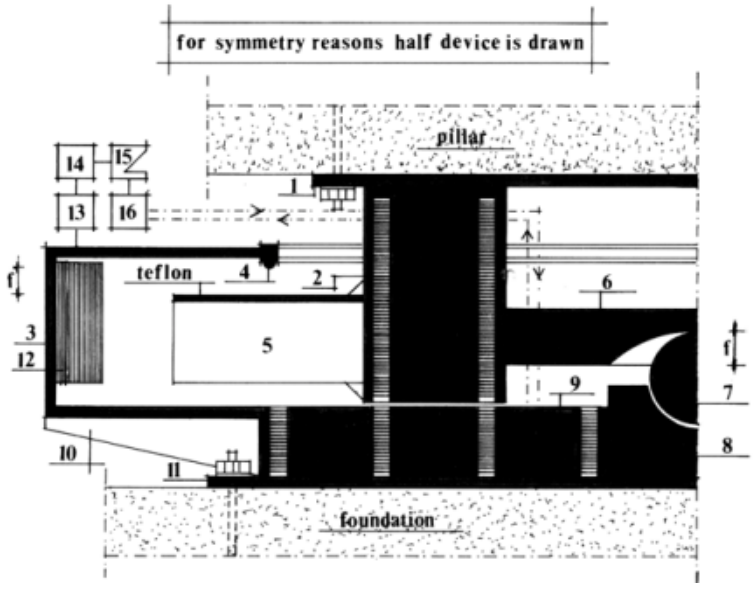
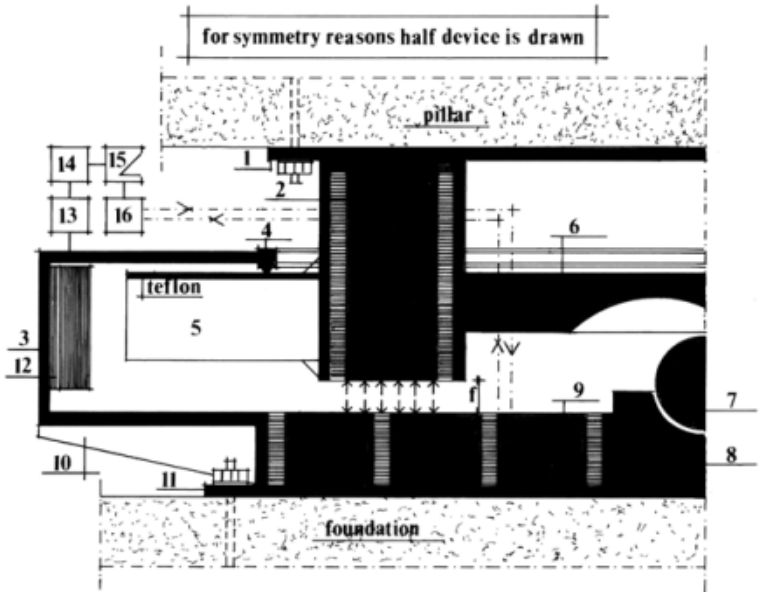
Bearing with Magnetic Insulators

Figures



State of rest



State of motion

Constitution

The bearing consists of:

a. circular or square steel plate (1) connected to the overhanging platform of the base of the building;
b. four electromagnets (2) linked to steel plate (1). They are positioned facing in two directions perpendicular to one another;

c. one single uninterrupted electromagnet (9) connected to the lower steel plate (11) and to the foundation. It completely occupies a circular-shaped surface and faces the four electromagnets (2) with the same polarity;
d. four steel brackets (5), laterally linked to the electromagnets (2). A spherical Teflon covered cap lies above each rectangular vertical section bracket. The function of these caps is to maintain the building verticality unchanged during an earthquake, remaining in contact with the device (4);
e. steel device (3) consisting of two horizontal and one vertical walls, connected to the electromagnets (9) all round the external perimeter. It has a fixed steel device (4) at the free end, consisting of an linear arrangement of movable steel balls inside the cavity of a semitubular casing;
f. stiffening steel bracket (10), linked to the device (3) and to the electromagnet (9);
g. movable steel ball (7) and relative housing (8), connected to the plate (11);
h. sliding circular steel surface (6), linked to the system of electromagnets (2);
i. protective rubber layer (12);
j. device consisting of:
   - sensor (13)
   - electronic control station (14)
   - current generator (15)
   - magnetic flux regulator (16)

Operating principle

When an earthquake starts, sensor (13), directly connected to the foundation, records the vibration and electronic station (14) closes the circuit of current generator (15). The current activates electromagnets (2) and (9), which are reciprocally facing each other with the same polarity. The magnetic flux supplied immediately detaches the building from the foundation-soil complex and gradually raises it by means of magnetic flux regulator (16), until it reaches a constant height with respect to the foundation.

The constancy of this height is guaranteed both by the size of the magnetic flux planned and by the contact of brackets (5) with fixed steel device (4). In this way, the building maintains its verticality during the earthquake. The layer of air between the two systems of electromagnets (2) and (9) allows the rigid horizontal translation of the foundation-soil complex with respect to the building, which remains motionless. The horizontal inertial force in the building is negligible, because the contact between the building and the foundation-soil complex, occurring between the upper part of the Teflon-coated brackets (5) and the steel balls of device (4), causes negligible friction.

Moreover, any eventual sub-undulatory shock will not change the verticality of the building. Its immobility, remaining unchanged with respect to the horizontal translation, could on the other hand change slightly with respect to the vertical translation of the foundation-soil complex, due to the indirect contact between the building and the foundation-soil complex by devices (4) and (5). At the end of the earthquake, electronic station (14) opens the circuit of current generator (15), the magnetic flux, regulated by device (16), gradually stops and the building returns to its initial rest state, after any eventual horizontal eccentricity of the building with respect to the foundation has been annulled by circular steel surface (6) sliding on ball (7). In this case, the building self-centres perfectly.

N.B. The bearing needs accurate experimental tests