member 22 of the probe 2 mentioned above. The pipe member 22C is such a member having a slit 22g in the cylindrical part 22b of the pipe member 22 mentioned above. The slit 22g is provided from the end part of the cylindrical part 22b that is on the opposite side to the side continuous to the tip part 22a, to the end part of the flange part 22c on the tip part 22a side. In this manner, for example, at the time of insertion of the probe 2C into the holder hole 39 of the probe holder 3B shown in the fifth modification, when the cylindrical part 22b and the flange part 22c come near the second small-diameter part 39c, the outer diameters of the cylindrical part 22b and the flange part 22c will be reduced. Due to reduction of the outer diameter of the pipe member 22C, the probe 2C can be inserted into the holder hole 39 more easily. The length of the spring member 23 of the probe 2C in the natural state thereof in the central axis (axial line N) direction is preferably made larger than the length of the cylindrical part 22b in the central axis (axial line N) direction in order to reduce the diameter of the pipe member 22C.

[0055] (Seventh modification of first embodiment)

FIG. 12 is a partial sectional view illustrating a configuration of a chief part of a probe unit according to a seventh modification of the first embodiment of the present invention. A probe 2D according to the seventh modification includes a plunger 21A instead of the plunger 21, and further includes a sleeve 24, as compared with the configuration of the probe 2 mentioned above. The rough wound part 23a of the spring member 23 and the small-diameter part 33a of the probe holder 3 have small diameters so as to conform with the plunger 21A.

[0056] The plunger 21A is such a plunger in which the

[0068] When a load from the semiconductor integrated circuit 100 and the circuit board 200 is applied, the probe 2E mentioned above operates in the same manner as the probe 2 illustrated in FIG. 4A and FIG. 4B. A test signal that is supplied from the circuit board 200 to the semiconductor integrated circuit 100 at the time of test on the semiconductor integrated circuit 100 reaches the connection electrode of the semiconductor integrated circuit 100 from the electrode of the circuit board 200 via the second pipe member 22 and the first pipe member 25 of the probe 2E. In this manner, since conduction is made through the first pipe member 25 and the second pipe member 22 in the probe 2E, a conduction path of the electrical signal can be minimized.

[0069] According to the second embodiment mentioned above, in the probe 2E including the first pipe member 25, the second pipe member 22, and the spring member 23A, the spring member 23A is arranged inside the cylindrical part 22b having a uniform diameter, and the spring member 23A is coupled with the first pipe member 25. Thus, the probe 2E can be created without requiring swaging of the second pipe member 22, and a diameter can be reduced in the configuration using the pipe member. In the probe 2E according to the second embodiment, one end part of the spring member 23A is held by the cylindrical part 25b, and the other end part is held by the cylindrical part 22b. Thus, the spring member 23A prevents the first pipe member 25 from being detached from the second pipe member 22.

Industrial Applicability

[0070] As described above, a contact probe and a probe unit according to the present invention are suitable in reducing a diameter in a configuration using a pipe member.

Reference Signs List

CLAIMS

1. A contact probe that is conductive and capable of expanding/contracting along an axial line direction, the contact probe comprising:

a first contact member configured to contact one contact target;

a second contact member configured to contact another contact target, and to house at least a portion of the first contact member; and

a spring member configured to couple the first contact member and the second contact member in a manner capable of expansion/contraction with both end parts of the spring member, wherein

the spring member is wound in a helical shape, and at least a diameter of an outer circumference in one of the end parts held by the second contact member is larger than diameters of other portions, and

a diameter of an inner circumference of an end part of the second contact member on a side housing the first contact member is equal to or larger than a maximum diameter of the first contact member.

2. The contact probe according to claim 1, wherein

the first contact member comprises:

a first tip part configured to contact the one contact target;

a first flange part provided at a base end of the first tip part; and

a boss part configured to couple with the spring member by fitting into the spring member, and

the second contact member comprises:

a second tip part configured to contact the other contact target,

a cylindrical part extending from the second tip part and having a cylindrical shape with an inner circumference having a uniform diameter, cylindrical part housing at least a portion of the spring member; and

a second flange part provided in an outer circumference of the cylindrical part.

3. The contact probe according to claim 2, wherein a length of the spring member in a natural state thereof in the axial line direction is smaller than a length of the cylindrical part in the axial line direction.

4. The contact probe according to claim 2, wherein a length of the spring member in a natural state thereof in the axial line direction is larger than a length of the cylindrical part in the axial line direction.

5. The contact probe according to claim 2, further comprising a sleeve into which the first flange part is fit, an outer surface of the sleeve slidably contacting the cylindrical part.

6. The contact probe according to any one of claims 2 to 5, wherein

the spring member comprises:

a rough wound part wound with a previously set gap, an inner circumference of the rough wound part contacting the first contact member; and

a dense wound part extending from the rough wound part, an outer circumference of the dense part contacting the cylindrical part, and

a diameter of the dense wound part is larger than a diameter of the rough wound part.

7. The contact probe according to claim 1, wherein

the first contact member comprises:

a first tip part configured to contact the one contact target;

a first cylindrical part extending from the first tip part in a cylindrical shape; and

a first flange part provided in an outer circumference of the first cylindrical part,

the second contact member comprises:

a second tip part configured to contact the other contact target;

a second cylindrical part extending from the second tip part and having a cylindrical shape with an inner circumference having a uniform diameter; and

a second flange part provided in an outer circumference of the second cylindrical part, and

the spring member is positioned in a hollow space formed with the first and the second cylindrical parts.

8. The contact probe according to claim 7, wherein

the spring member comprises:

a first dense wound part, an outer circumference of the first dense wound part contacting the first cylindrical part;

a rough wound part wound with a previously set gap, the rough wound part extending from the first dense wound part; and

a second dense wound part, an outer circumference that of the second dense wound part contacting the second cylindrical part, and the second dense wound part being provided at an end part of the rough wound part on an opposite side of the first dense wound part,

a diameter of the first dense wound part is smaller than a diameter of the second dense wound part, and

a diameter of the rough wound part is smaller than the diameter of the first dense wound part.

9. The contact probe according to claim 2 or 7, wherein the end part of the first flange part on an opposite side of a side continuous to the first contact member has a tapered shape.

10. A probe unit comprising:

contact probes, each of which is conductive, and capable of expanding/contracting along an axial line direction, each of the contact probes comprising:

a first contact member configured to contact one contact target;

a second contact member configured to contact another contact target, and to house at least a portion of the first contact member; and

a spring member wound in a helical shape and configured to couple the first contact member and the second contact member in a manner capable of expansion/contraction with both end parts of the spring member,

wherein a diameter of an outer circumference in the end part held by at least the second contact member being larger than diameters of other portions, and

a diameter of an inner circumference of an end part of the second contact member on a side housing the first contact member is equal to or larger than a maximum diameter of the first contact member; and

a probe holder including holder holes configured to hold the respective contact probes.

11. The probe unit according to claim 10, wherein

the first contact member comprises a flange part having a maximum diameter of the first contact member, and

when the contact probe is held by the probe holder, at least a portion of the flange part is positioned inside the second contact member.

12. The probe unit according to claim 10, wherein

the first contact member comprises a flange part having a maximum diameter of the first contact member, and

when the contact probe is held by the probe holder, the flange part is positioned outside the second contact member.

13. The probe unit according to claim 10, wherein the probe holder is made of a single plate.

14. The probe unit according to claim 13, wherein

the second contact member comprises:

a tip part configured to contact the other contact target;

a cylindrical part extending from the tip part and having a cylindrical shape with an inner circumference having a uniform diameter; and

a flange part provided in an outer circumference of the cylindrical part, and

a slit extending from the end part of the cylindrical part on an opposite side of the tip part is formed in the cylindrical part.