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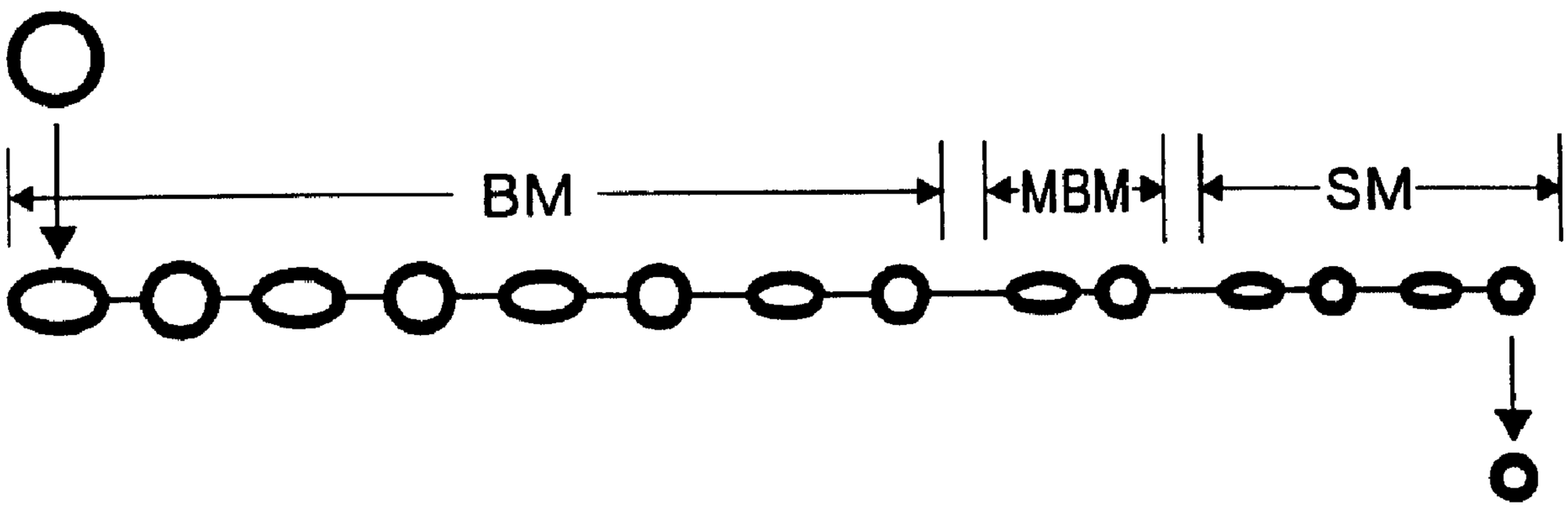
(54) Titre : METHODE DE LAMINAGE DE FIL ET LAMINOIR A FIL
(54) Title: METHOD OF WIRE ROLLING AND ROLLING MILL



(57) Abrégé/Abstract:
[Problems] To enable production of wires of various diameters from one round rod material supplied from rough rolling step without necessity of roller change of block mills, which needs long period of time and much labor. [Solution] In the rolling mill a mini block mill (MBM) is installed between a block mill (BM) and a sizing mill (SM) as a reducer for intermediate rolling. The block mill (BM) is so constructed that it is possible to use both the front group (BM1) and the rear group (BM2) of the rollers, or only the front group by passing the rear group with a dummy pass, or to by-pass both the front and the rear groups. The mini block mill (MBM) is shuntable from the pass line. The sizing mill is so constructed to be two sets of rollers (SM1, SM2) that either both the sets may be used, or only one of the sets (SM1) may be used and the other (SM2), by-passed. By choosing combinations of use and non-use of the rollers it is possible to produce wires of various diameters, maximum 19 different diameters, from a round rod material of one diameter.

[Document] ABSTRACT OF DISCLOSURE

[Abstract]

[Problems] To enable production of wires of various diameters from one round rod material supplied from rough rolling step without necessity of roller change of block mills, which needs long period of time and much labor.

[Solution] In the rolling mill a mini block mill (MBM) is installed between a block mill (BM) and a sizing mill (SM) as a reducer for intermediate rolling. The block mill (BM) is so constructed that it is possible to use both the front group (BM1) and the rear group (BM2) of the rollers, or only the front group by passing the rear group with a dummy pass, or to by-pass both the front and the rear groups. The mini block mill (MBM) is shuntable from the pass line. The sizing mill is so constructed to be two sets of rollers (SM1, SM2) that either both the sets may be used, or only one of the sets (SM1) may be used and the other (SM2), by-passed. By choosing combinations of use and non-use of the rollers it is possible to produce wires of various diameters, maximum 19 different diameters, from a round rod material of one diameter.

[Document] Specification

[Title of the Invention]

Method of Wire Rolling and Rolling Mill

[Detailed Explanation of the Invention]

[0001]

[Technical Field to which the Invention belongs]

The present invention relates to improvement in rolling metal rods, particularly, steel rods, to produce steel wires. According to the present invention it is possible to produce wires of various diameters staring from a rod of one diameter without change rollers.

[0002]

[Prior Art]

Production of wires of diameters in the range of several millimeters to ten and several millimeters by wire rolling of steel rods has been usually carries out by using a material round rod having a diameter of 20 mm or so supplied from rough rolling step, rolling the material in a block mill equipped with eight rollers as intermediate rolling mill, and then, finish rolling the wire with a sizing mill equipped with two rollers. Structure of the rolling mill is as shown in Fig. 1.

[0003]

There is strict requirement to sizes of steel wires depending on use thereof. For example, in the range of diameter 5-10 mm, products having the sizes of each 0.5mm increase are required, and in the range of diameter 10-20 mm, those having the sizes of each

1.0mm increase are required. Recently, it is demanded to supply wire products by hot rolling having various sizes which fully fit the needs.

A conventional method for satisfying this demand is the sequence of the following rolling steps, a typical example of which is illustrated in Fig. 2.

[0004]

- In the range of "very fine" (diameters 5.5, 6.0 and 6.5mm) wire rolling starts from a round rod of diameter 16.4mm supplied from rough intermediate line (Fig. 2). The rod material is first rolled by a block mill (F1-F8) having the first roller group to diameter 6.5mm, then the rolled material is passed to the sizing mill to be rolled by both the front group of the rollers and the rear group of the rollers (5.5mm), or by only the front group of rollers (6.0mm).

[0005]

- In the range of "fine" (diameters 7.0, 7.5 and 8.0mm) a round rod of diameter 20.5mm is used as the material from the rough intermediate line. In order to switch to this range, it is necessary to shut down the line to carry out roller change of all the stands, and form a block mill (F1-F8) having the second roller group. After rolling the round rod material of diameter 20.5mm to 8.4mm, the rolled material is passed to the sizing mill so that it may be rolled by both the front group and the rear group (7.0mm), by only the front group (7.5mm), or by only the front group of changed rollers.

[0006]

- In the range of "intermediate fine" (diameters 8.5, 9.0, 9.5 and 10.0mm), rolling also starts from the same round rod material of diameter 20.5mm as above (Fig. 3). The round rod material is rolled by a part (F1-F6) of the block mill having the second group of

rollers to diameter 10.5mm. For this purpose it is also necessary, after shutting down the line, to remove the rollers of F7 and F8 stands, and to install a dummy guide. The rolled material coming out of the dummy guide is passed to the sizing mill so as to use both the front and the rear groups of rollers (8.5mm), only the front group (9.5mm), or only the rear group (10.0mm).

[0007]

- In the range of "intermediate bold" (diameters 11.0 and 12.0mm), the rolling also starts from the round rod material of 20.5mm (also Fig. 3). The material is rolled by a part (F1-F4) of the block mill having the second group of rollers to diameter 13.5mm. Also in this case the rollers of F5 and F6 stands are removed and replaced with a dummy guide. The rolled material of diameter 13.5mm is passed to the sizing mill, and rolled by both the front group and the rear group of the rollers (11.0mm), or by only the front group (12.0mm).

[0008]

- Production of wires in the thickness range of "bold" (diameters 13.0, 14.0, 15.0 and 16.0mm) starts also from the round rod of diameter 20.5mm, which is first rolled by a part (F1-F2) of the second group of rollers to diameter 16.4mm. Block mill rollers of F3 and F4 stands are also removed. The rolled material of diameter 16.4mm is passed to the sizing mill and rolled by both the front and the rear group of the rollers (23.0mm), or by only the rear group (15.0mm). Alternatively, the rolled material is rolled, after changing rollers, by both the front and rear groups (14.0mm) or by only the rear group (16.0mm).

[0009]

Wires in the thickness range of "very bold" (diameters 17.0, 18.0, and 19.0mm) are produced, also starting from the round rod material of diameter 20.5mm, by not using the block mill but directly using the sizing mill. Both the front and the rear groups of the rollers are used (17.0mm), only the front group is used (19.0mm) or both the front and the rear groups with changed rollers are used (18.0mm).

[0010]

In Fig. 2 to Fig. 4 demarcation with lines indicates that rollers are used in the areas and that no roller is used in the other area. The round forms illustrate that calivers of the rollers (consequently, the sections of the rolled material coming therefrom) are round, and the spindle form, obal sections of the rolled materials. The numerical figures annexed to the round forms show the diameters of the material coming out of the round caliver rollers.

[0011]

Change of sizing mill rollers is easy, and even the whole rollers can be changed. However, because ratios of rotating speeds of the rollers are the same in the block mills, it is necessary to use continued stands. Also, because the roller axes are set fixedly to the passing line, it is necessary to carry out roller changing after interrupting the rolling operation in which the block mill is involved. In regard to the above described examples, in the thickness ranges of "very fine" and "fine" whole the rollers of the block mill are changed. Changes between the thickness ranges of "fine" and "intermediate fine", "intermediate fine" and "medium bold", and "medium bold" and "bold" necessitate mounting and demounting of the rear group rollers.

[0012]

Thus, attempt to produce steel wires of various sizes by the conventional technology requires troublesome preliminary work for roller change, and this lowers efficiency of production. If, however, large scale production of one size at once is done for the purpose of avoiding the above problems, then, too much stock of the wire product must be kept. Additional problems such as scratching at handling and transporting and rusting during storage may occur.

[0013]

[Problems to be solved by the Invention]

The object of the present invention is to solve the above discussed problems relating to wire rolling, and to provide a method of rolling which enables production of wire products having various diameters from a round rod of one diameter without change of block mill rollers, which needs long time and much labor. The invention also provides a rolling mill for carrying out the rolling method.

[0014]

[Means for solving the Problems]

The method of rolling according to the present invention which achieves the above object is a method of rolling wire rods having different selected final diameters from a rod of a single diameter supplied from a roughing mill along a pass line wherein the mill includes an intermediate block mill for receiving rod from the roughing mill, the block mill having rollers arranged in a front group and a rear group, each of which can be dummied, a mini block mill for receiving rod from the block mill and which is shuntable from the pass line, and a sizing mill for receiving rod from the mini block mill, the sizing mill having plural sets of rollers, at

least one of which sets is shuntable from the pass line. The method, one embodiment of which is illustrated in Fig. 5, comprises selecting combinations of the block mill roller groups, mini block mill and sizing roller sets and rolling rod through the selected combination so as to produce a wire rods having the selected final diameters.

[0015]

The rolling mill for carrying out the above described method of rolling is A rolling mill for rolling wire rod having different selected final diameters from a single diameter supplied from a roughing mill along a pass line. The rolling mill, an embodiment of which is illustrated in Fig. 5, comprises an intermediate block mill for receiving rod from a roughing mill, the block mill having a front group of rollers and a rear group, each of which can be independently dummied, a mini block mill for receiving rod from the block mill and which can be shunted between an operative position on the pass line and a non-operative position away from the pass line, and a sizing mill comprising at least two sets of rollers, at least one of which sets is capable of being shunted between an operative position on the pass line and a non-operative position away from the pass line, the rollers of the block mill, mini block mill and sizing mill being selectable in various combinations to produce wire rods of the selected final diameters from a single diameter wire rod supplied by the roughing mill.

The by-passes for the rollers can be provided by installing guides to pass the rolled wires or the material wires to be rolled in suitable positions in close vicinity to the center of the rolling line without interference to the rollers or to changing the rollers.

[0017]

Combinations of paths through which the material rods and the rolled wires run are tabulated below. In the table, "Case A" contains the cases with use of the block mill, and "Case B", without use. The abbreviations in the table have the following meanings:

BM block mill

BM1 front group of rollers of the block mill

BM2 rear group of rollers of the block mill

MBM mini block mill

SM1, 2sizing mills

BP by-pass

DP1-3 dummy pass

a-t roller pair of the sizing mill

Case A

Case	Block	Mills	Reducer	Sizing	Mills
1	BM1	BM2	MBM	SM1 (a)	SM2 (b)
2	BM1	BM2	MBM	SM1 (a)	DP3
3	BM1	BM2	DP2	SM1 (c)	SM2 (d)
4	BM1	BM2	DP2	SM1 (e)	DP3
5	BM1	BM2	DP2	SM1 (f)	SM2 (g)
6	BM1	BM2	DP2	SM1 (f)	DP3
7	BM1	BM2	MBM	SM1 (h)	SM2 (i)
8	BM1	BM2	MBM	SM1 (h)	DP3
9	BM1	BM2	MBM	SM1 (j)	SM2 (k)
10	BM1	BM2	MBM	SM1 (j)	DP3
11	BM1	BM2	MBM	SM1 (l)	SM2 (m)
12	BM1	BM2	MBM	SM1 (l)	DP3
13	BP1		MBM	SM1 (o)	SM2 (p)
14	BP1		MBM	SM1 (o)	DP3
15	BP1		MBM	SM1 (q)	SM2 (r)
16	BP1		MBM	SM1 (q)	DP3
17	BP1		DP2	SM1 (r)	SM2 (s)
18	BP1		DP2	SM1 (r)	DP3
19	BP1		DP2	SM1 (s)	SM2 (t)

Case B

Case	Intermediate		Block	Mills	Reducer	Sizing	Mills
1	H21	V22	BM1	BM2	MBM	SM1 (a)	SM2 (b)
2	H21	V22	BM1	BM2	MBM	SM1 (a)	DP3
3	H21	V22	BM1	BM2	DP2	SM1 (c)	SM2 (d)
4	H21	V22	BM1	BM2	DP2	SM1 (e)	DP3
5	H21	V22	BM1	BM2	DP2	SM1 (f)	SM2 (g)
6	H21	V22	BM1	BM2	DP2	SM1 (f)	DP3
7	H21	V22	BM1	DP1	MBM	SM1 (h)	SM2 (i)
8	H21	V22	BM1	DP1	MBM	SM1 (h)	DP3
9	H21	V22	BM1	DP1	MBM	SM1 (j)	SM2 (k)
10	H21	V22	BM1	DP1	MBM	SM1 (j)	DP3
11	H21	V22	BP1		MBM	SM1 (l)	SM2 (m)
12	H21	V22	BP1		MBM	SM1 (f)	DP3
13	H21	V22	BP1		DP2	SM1 (o)	SM2 (p)
14	H21	V22	BP1		DP2	SM1 (o)	DP3
15	H21	V22	BP1		DP2	SM1 (q)	SM2 (r)
16	H21	V22	BP1		DP2	SM1 (q)	DP3
17	DP1		BP1		DP2	SM1 (r)	SM2 (s)
18	DP1		BP1		DP2	SM1 (r)	DP3
19	DP1		BP1		DP2	SM1 (s)	SM2 (t)

[0018]

[Examples]

Round rods of a carbon steel having diameter 20.5mm were used as the starting material, and rolling was carried out in accordance with the sequences shown in Fig. 6, Fig. 7 and Fig. 8 to obtain wire products having diameters as shown in the Figures. In these Figures the parts demarcated with lines, round circles and spindle shapes, and the numerical figures added thereto have the meanings as explained in regard to Fig. 2 to Fig. 4.

[0019]

[Merits of the Invention]

By wire rolling in accordance with the present invention, which uses reducers and by-passes, it is possible to produce wires having various diameters from one starting material without changing rollers of the block mill. Because changing rollers of the block mill requires, as noted before, considerable time and labor, elimination of the necessity of changing rollers results in not only increased production efficiency but also decreased number of rollers to be used.

[0020]

The fact that the product sizes can be easily changed covers drawback of the conventional technology that it is forced to produce, once the rollers are changed, a considerable quantity of products at once, and realizes "many grades-small quantity" production without undesirable increase of costs. This merit contributes also to lighten the problems of scratching at handling and rusting during storage mentioned before.

[Brief Explanation of the Drawings]

[Fig. 1] A schematic diagram showing roller distribution in a conventional wire rolling mill.

[Fig. 2] Explanation for rollers used, sections and diameters of the material in the process of rolling when wires of various sizes are produced by using the wire rolling mill shown in Fig. 1.

[Fig. 3] Explanation like Fig. 2 for the steps subsequent to Fig. 2.

[Fig. 4] Explanation like Fig. 2 for the steps subsequent to Fig. 3.

[Fig. 5] Schematic diagram corresponding to Fig. 1 showing roller distribution in the wire rolling mill according to the present invention.

[Fig. 6] Explanation like Fig. 2 for rollers used, sections and diameters of the material in the process of rolling when wires of various sizes are produced by using the wire rolling mill shown in Fig. 5.

[Fig. 7] Explanation like Fig. 5 for the steps subsequent to Fig. 5.

[Fig. 8] Explanation like Fig. 5 for the steps subsequent to Fig. 7.

WE CLAIM:

1. A method of rolling wire rods having different selected final diameters from a rod of a single diameter supplied from a roughing mill along a pass line wherein the mill includes an intermediate block mill for receiving rod from the roughing mill, the block mill having rollers arranged in a front group and a rear group, each of which can be dummied, a mini block mill for receiving rod from the block mill and which is shuntable from the pass line, and a sizing mill for receiving rod from the mini block mill, the sizing mill having plural sets of rollers, at least one of which sets is shuntable from the pass line, said method comprising selecting combinations of the block mill roller groups, mini block mill and sizing roller sets and rolling rod through the selected combination so as to produce a wire rods having the selected final diameters.

2. A rolling mill for rolling wire rod having different selected final diameters from a single diameter supplied from a roughing mill along a pass line, said rolling mill comprising an intermediate block mill for receiving rod from a roughing mill, the block mill having a front group of rollers and a rear group, each of which can be independently dummied, a mini block mill for receiving rod from the block mill and which can be shunted between an operative position on the pass line and a non-operative position away from the pass line, and a sizing mill comprising at least two sets of rollers, at least one of which sets is capable of being shunted between an operative position on the pass line and a non-operative position away from the pass line, the rollers of the block mill, mini block mill and sizing mill being selectable in various combinations to produce wire rods of the selected final diameters from a single diameter wire rod supplied by the roughing mill.

FIG. 1

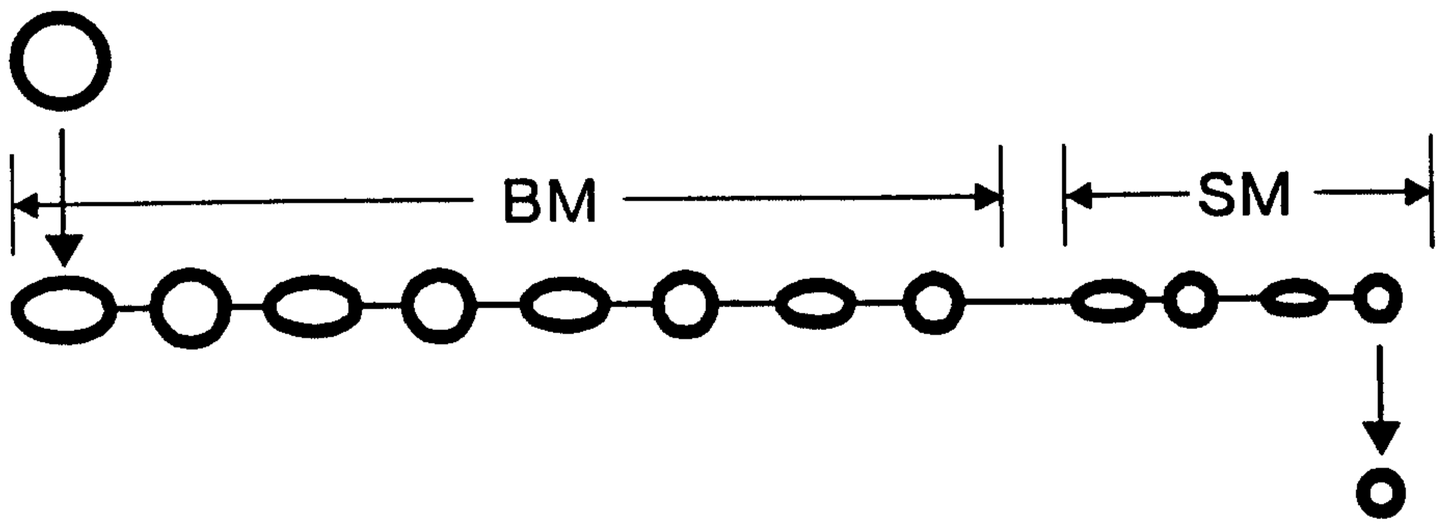


FIG. 5

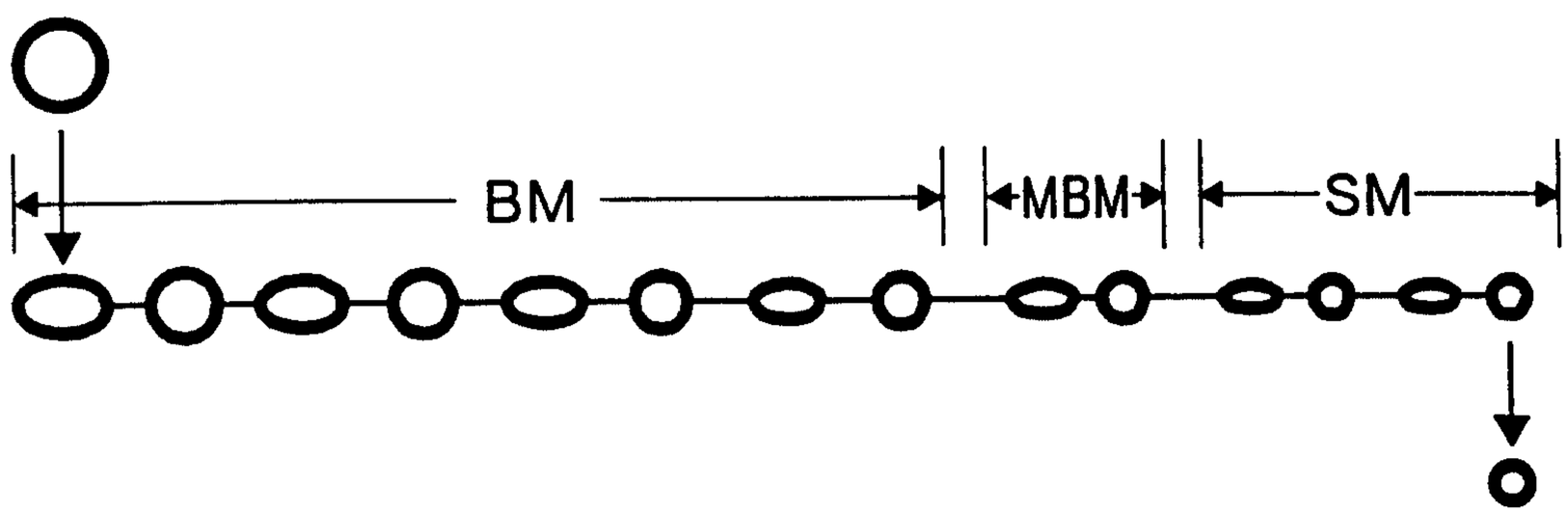


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FIG. 2

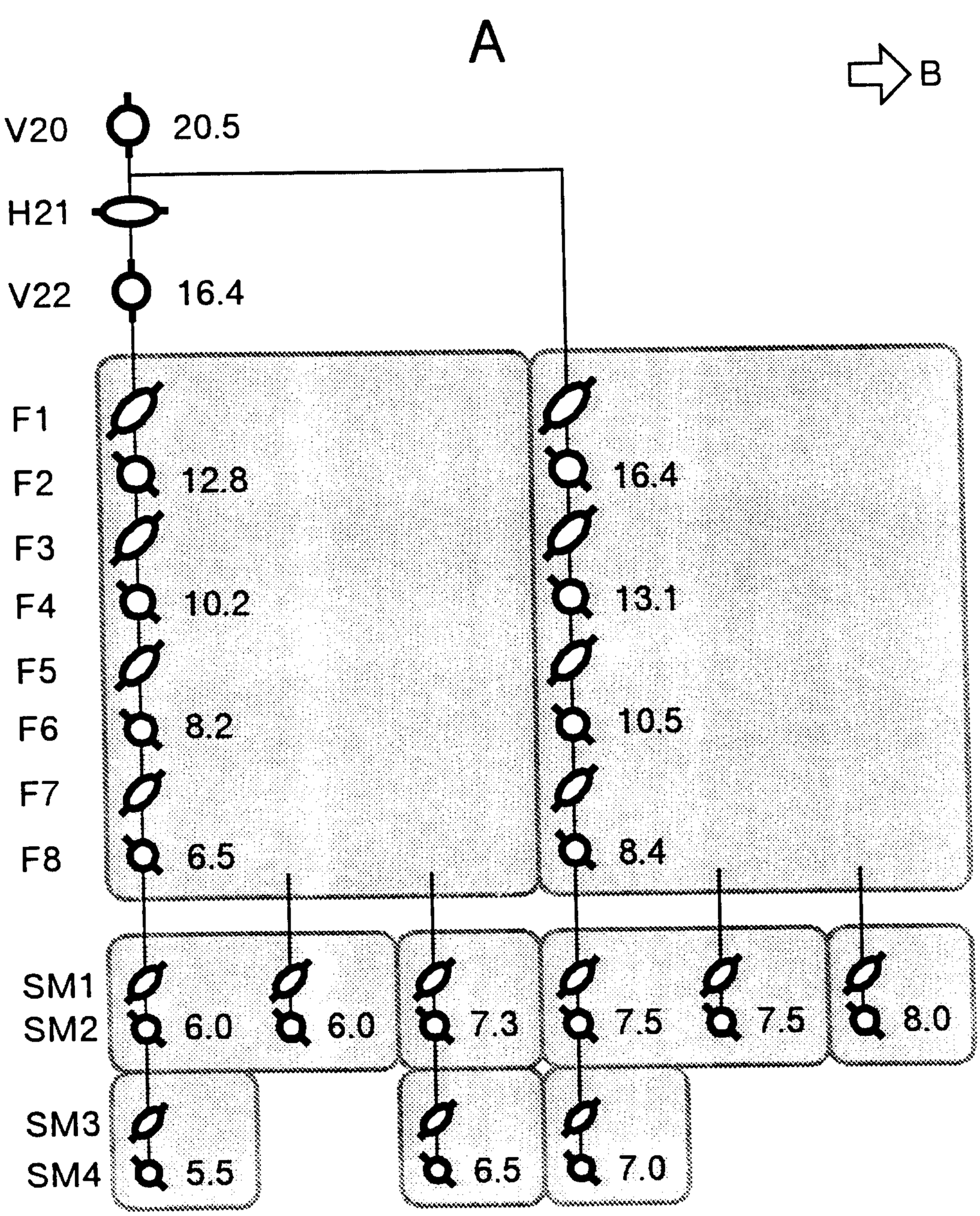

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FIG. 3

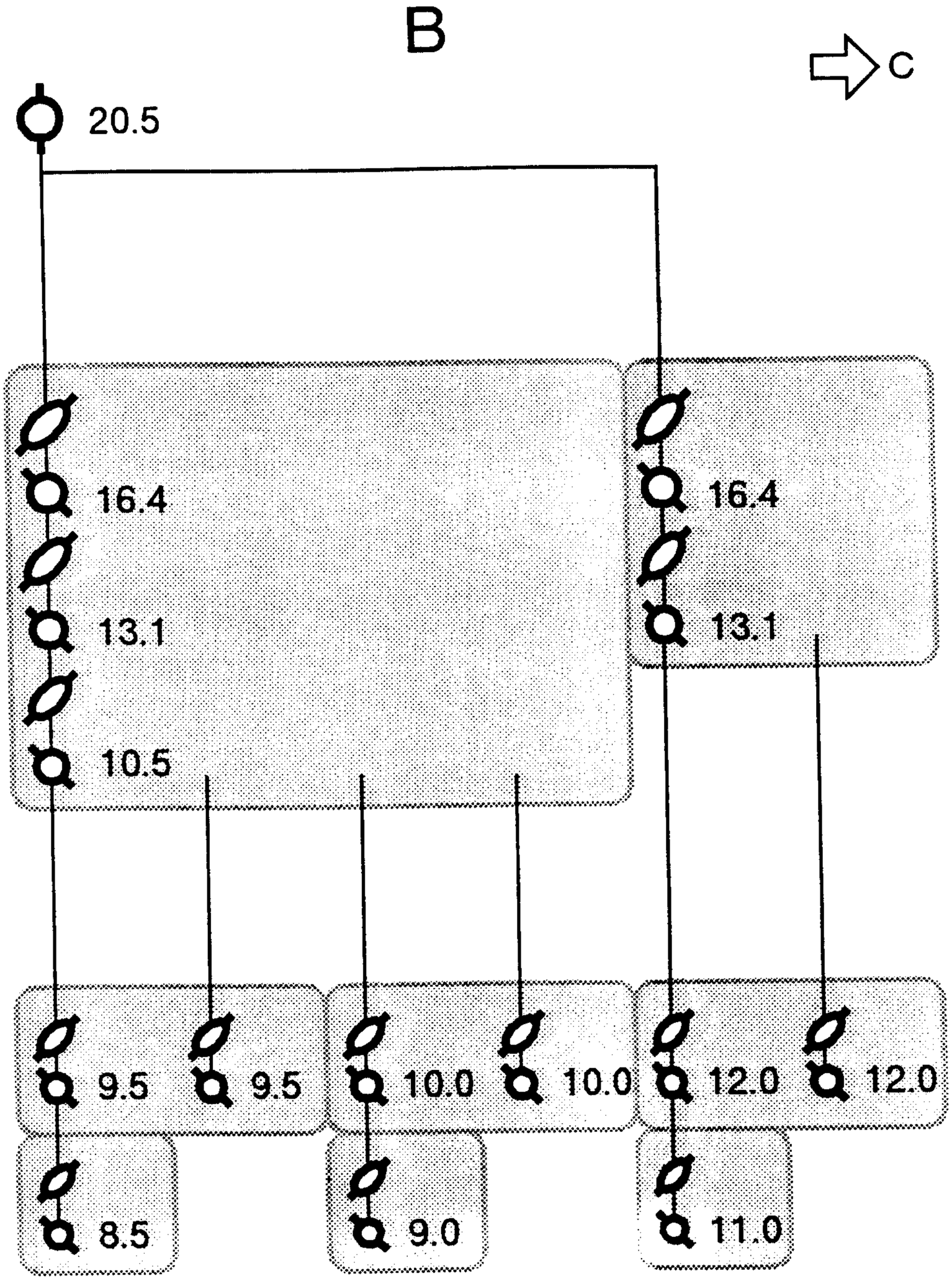

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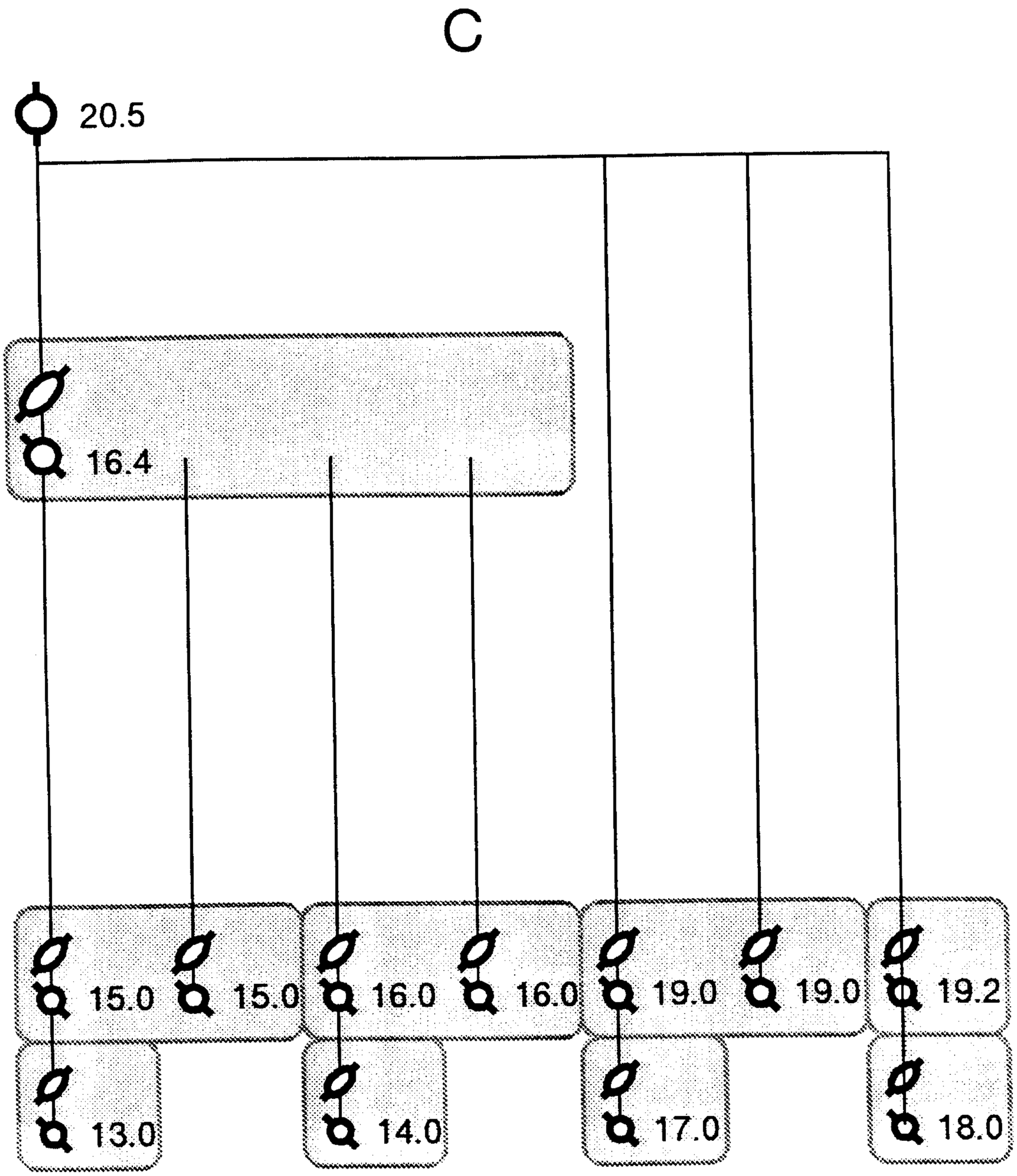
FIG. 4



13.0～19.0mm ϕ GROUP

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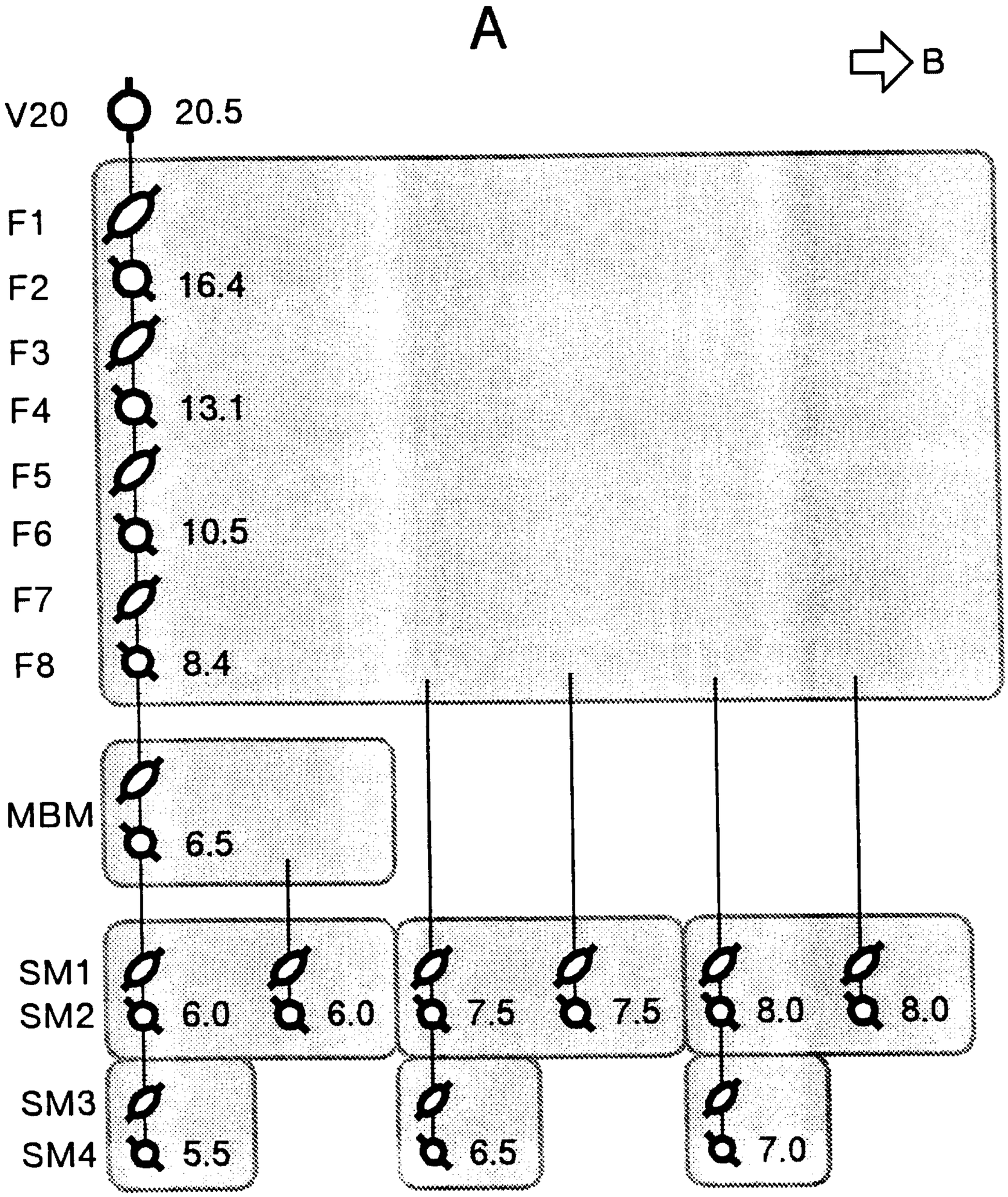
FIG. 6



5.5～8.0mm φ GROUP

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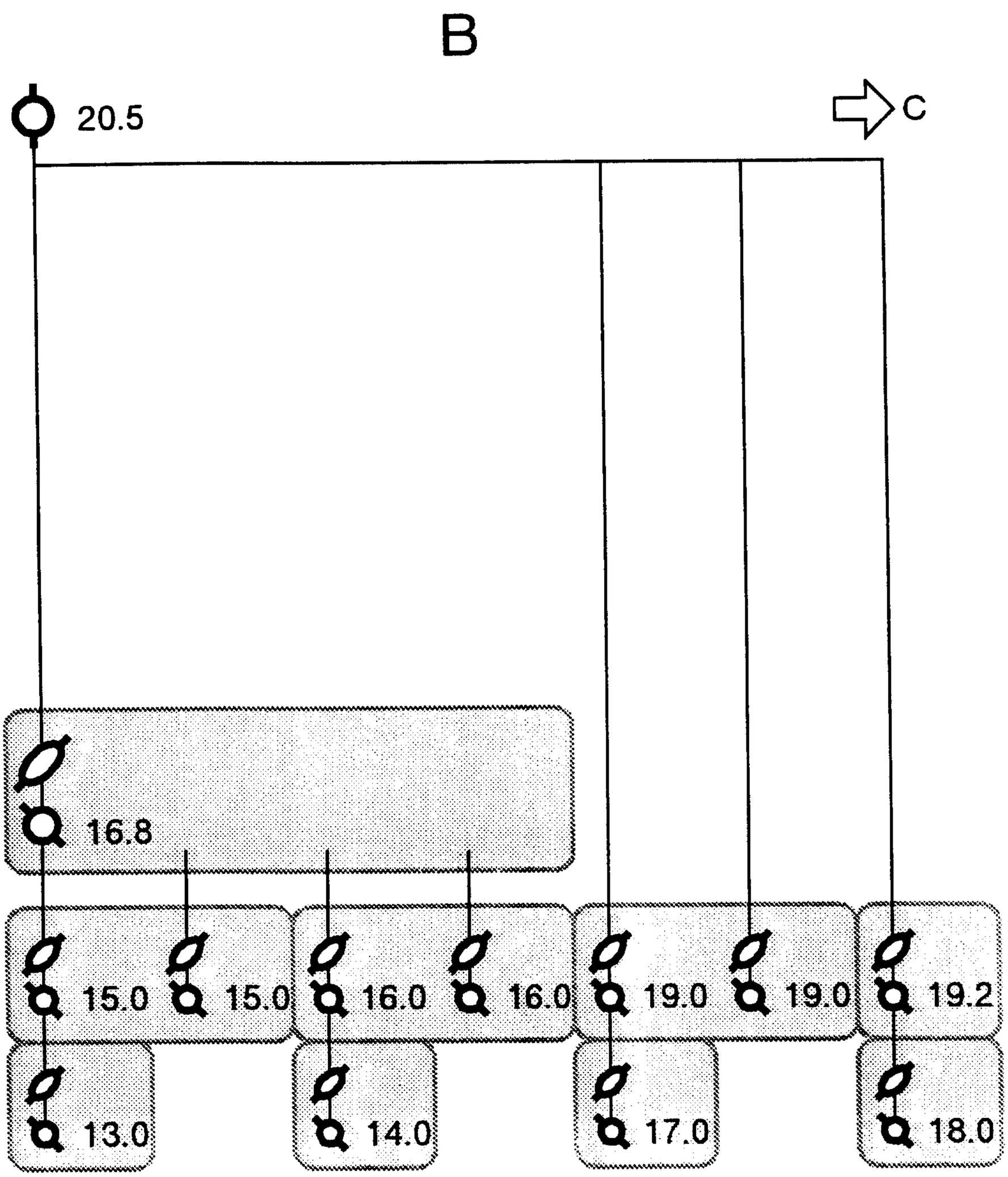
FIG. 7



13.0～19.0mm ϕ GROUP

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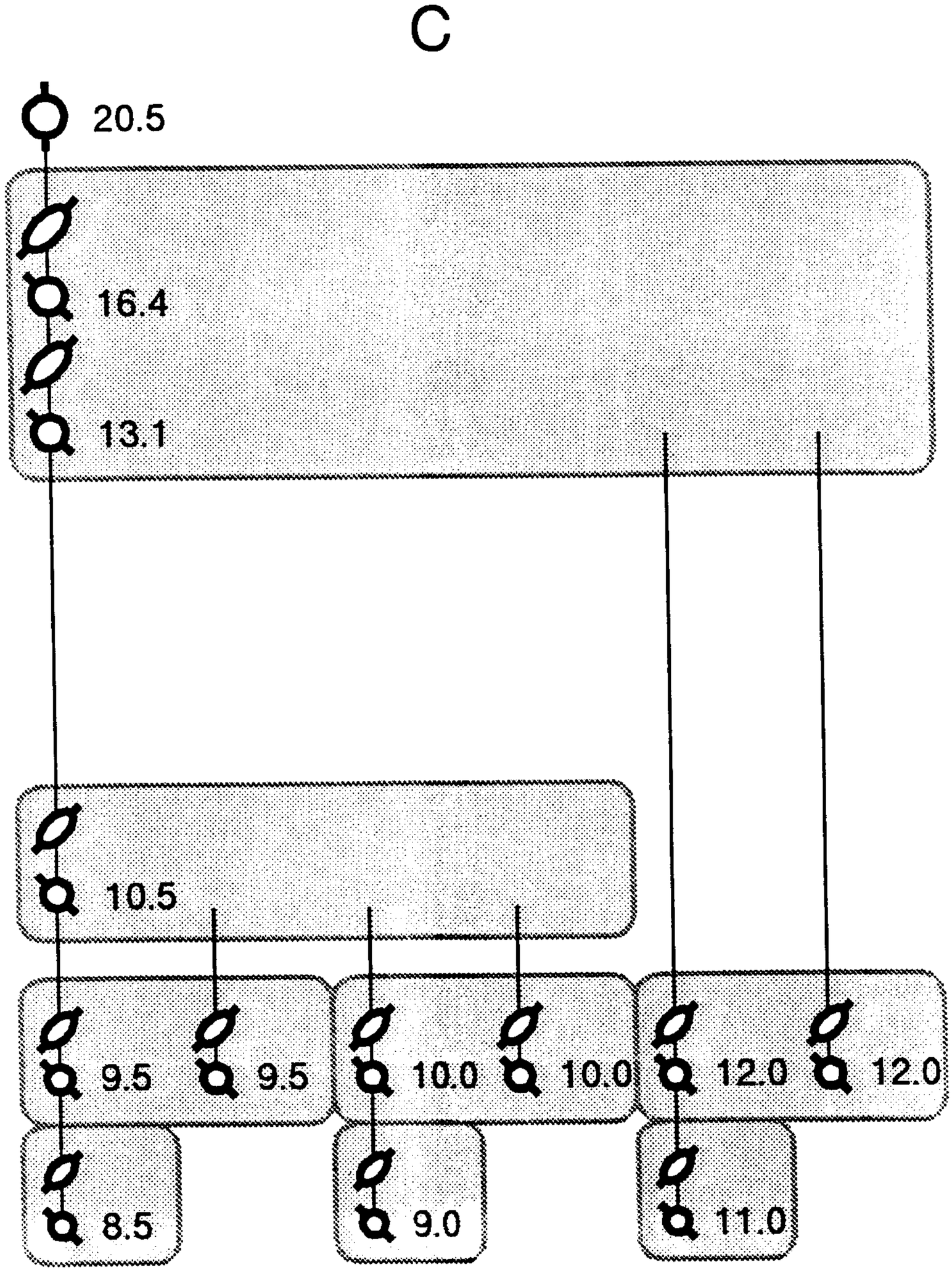
FIG. 8



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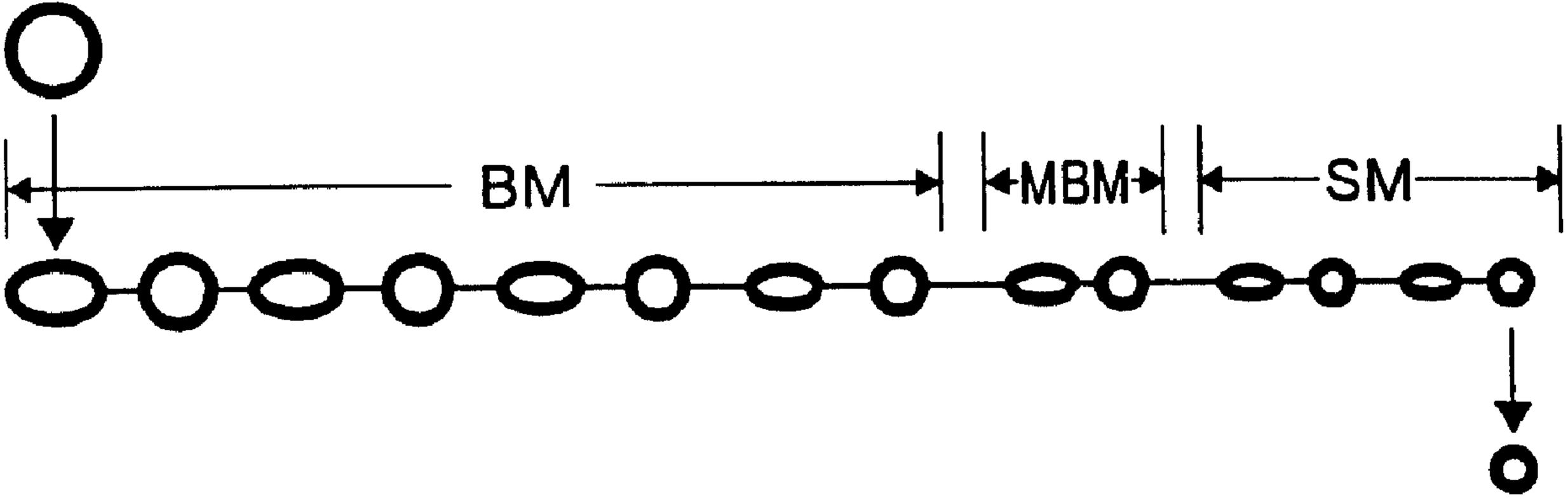
BM
MBM
SM