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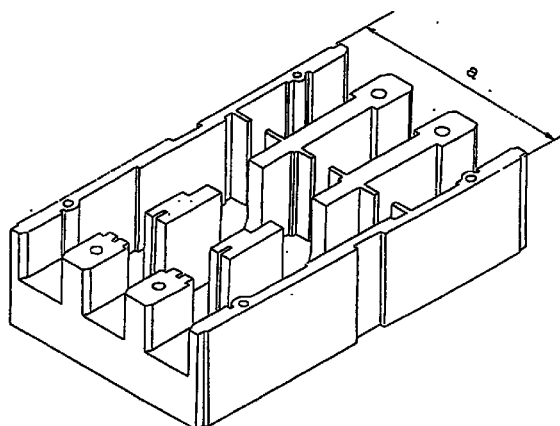
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(54) **SWITCH**

(57) A switch using, for a housing, an insulating structure of a molded product consisting of an organic and inorganic complex composition containing 35 to 50 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40% by weight of magnesium hydroxide. Alternatively, it is also possible to use an organic and inorganic complex composition containing 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement, 30 to 40 % by weight of magnesium hydroxide and 5 to 15 % by weight of inorganic matter, and an inorganic matter may be burned clay or wallastnite.

A coefficient of dimensional change of the molded product constituting the switch is reduced and the rigidity and creeping performance of the molded product are enhanced at the same time. Moreover, the strain of the molded product is reduced, a great surface gloss is obtained and the molded product is scratched with difficulty.

Fig. 1



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DescriptionTechnical Field

5 **[0001]** The present invention relates to a switch having a part thereof constituted by the molded product of an insulating structure. More particularly, the present invention relates to a molded product which has a high rigidity and a high strength, maintains an insulating property after the switch is cut off, and has a flame resistance, less strain and a good surface gross and is scratched with difficulty.

10 Background Art

[0002] For example, conventionally, JP-A-8-171847 has described a switch using a molded product containing a composition consisting of 45 to 80 % by weight of nylon 6, 15 to 50 % by weight of magnesium hydroxide and 5 to 40 % by weight of glass fiber.

15 **[0003]** The switch using the molded product containing the composition has a predetermined rigidity and strength, a predetermined creeping property, an insulating property obtained after the switch is cut off, a flame resistance and the like. However, there has been a problem in that a dimension is changed after the molding to cause an increase in a production fraction defective, the rigidity of the obtained molded product is reduced (the predetermined rigidity is satisfied after the reduction) to further reduce the size and thickness of the molded product with difficulty, and the creeping property of the obtained molded product is deteriorated (the predetermined creeping property is satisfied after the deterioration). It is guessed that the change in a dimension, the reduction in a rigidity and the deterioration in a creeping property are mainly caused by the fact that nylon 6 is a hygroscopic resin and absorbs a water content from an atmosphere or outside air after the molding.

20 **[0004]** It has been known that the molded product obtained immediately after the molding absorbs the water content in the atmosphere and a dimension thereof is varied. The rate of the change in the dimension depends on external causes such as the storage state of the molded product or seasons. Referring to a molded product to be used for assembling and manufacturing the switch, the molding of the molded product and the assembly of the switch are carried out apart from each other, and the assembly is carried out after several hours to several weeks since usual modification in order to enhance a working efficiency. Accordingly, if the external dimension of the molded product is greatly changed for a short period of time of several hours to several weeks after the molding, particularly, gets out of an allowable dimension, the molded product cannot be used as a part for assembly. Consequently, the production fraction defective caused by the assembly efficiency of the switch is affected.

25 **[0005]** The present invention has been made to solve the above-mentioned problems and has an object to provide a switch having a part thereof constituted by a molded product of an insulating structure in which nylon 6 or nylon 6 based alloy, a reinforcement and magnesium hydroxide contained in an organic and inorganic complex composition are distributed at a specific rate, resulting in a high insulating property after cut-off, a small change in a dimension after molding and a low production fraction defective, and to further provide a switch having a part thereof constituted by a molded product of an insulating structure which has an insulating property after the switch is cut off, a flame resistance, a small change in a dimension after the molding, a low production fraction defective, a high rigidity and excellent creeping resistance after the molding.

40 **[0006]** Moreover, the present invention has an object to provide a switch having a part thereof constituted by a molded product of an insulating structure in which nylon 6 or nylon 6 based alloy, a reinforcement, magnesium hydroxide and an inorganic matter having the effect of suppressing the orientation of the reinforcement are distributed at a specific rate, resulting in a smaller change in a dimension after molding and a lower production fraction defective, and a higher rigidity and creeping resistance after the molding.

45 **[0007]** Furthermore, the present invention has an object to provide a switch having a part thereof constituted by a molded product of an insulating structure which has a good surface gross and is scratched with difficulty.

Disclosure of the Invention

50 **[0008]** A switch according to the present invention has a part thereof constituted by a molded product of an organic and inorganic complex composition containing 35 to 50 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide. Therefore, the switch has a high insulating property after cut-off, a small change in a dimension after molding and a low production fraction defective.

55 **[0009]** Moreover, 45 to 50 % by weight of nylon 6 or nylon 6 based alloy, 20 to 25 % by weight of reinforcement and 30 to 35 % by weight of magnesium hydroxide are contained. Therefore, it is possible to easily carry out the molding within a wide molding condition range such as a fused resin temperature or a mold temperature and the deposition of the reinforcement and the magnesium hydroxide on the surface is lessened.

[0010] Furthermore, 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide are contained. Therefore, the change in a dimension and the production fraction defective after the molding can be reduced.

[0011] Moreover, 35 to 40 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide are contained. Therefore, the change in a dimension and the production fraction defective after the molding can be reduced considerably.

[0012] Furthermore, since the molded product is a housing, it is one of the greatest components of a circuit breaker and effectively contributes to a reduction in the production fraction defective.

[0013] Moreover, a part is constituted by a molded product consisting of an organic and inorganic complex composition containing 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement, 30 to 40 % by weight of magnesium hydroxide and 5 to 15 % by weight of inorganic matter having less orientation. Therefore, a high insulating property can be obtained after the cut-off and a change in a dimension and a production fraction defective can be more reduced after the molding.

[0014] Furthermore, since the inorganic matter is burned clay and/or wallastnite, the molded product is scratched with difficulty.

[0015] Moreover, since the molded product is a housing, it is one of the greatest components of the circuit breaker and effectively contributes to a reduction in the production fraction defective.

[0016] Furthermore, since the molded product is the base of the housing, a great surface gloss can be obtained and the surface is scratched with difficulty, which is preferable.

Brief Description of the Drawings

[0017]

Fig. 1 is a perspective view showing the base of a housing of a breaker according to an embodiment of the present invention.

Fig. 2 is a perspective view showing the cover of the housing of the breaker according to another embodiment of the present invention.

Fig. 3 is a front view showing the cover illustrated in Fig. 2.

Best Mode for Carrying Out the Invention

[0018] An embodiment of the present invention will be described below.

[0019] A molded product of an insulating structure constituting a part of a switch according to the present embodiment is obtained by injection molding, into a metal mold, an organic and inorganic complex composition containing 35 to 50 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide. When a black color based molded product is to be molded, a black color based dye or black carbon is added to the organic and inorganic complex composition, for example.

[0020] Examples of the nylon 6 based alloy include nylon 6 and nylon 66, nylon 6 and acrylonitrile-butadiene copolymer (ABS), nylon 6 and denatured polyphenylene oxide (denatured PPO), nylon 6 and MXD 6, and nylon 6, nylon 66 and MXD 6, all of them have lower resin fusing temperatures during molding than the dehydration temperature of magnesium hydroxide. Accordingly, when the nylon 6 or the nylon 6 based alloy and the magnesium hydroxide are to be kneaded and a material obtained by the kneading is to be molded, the magnesium hydroxide is rarely dehydrated. This implies that free carbon generated from an organic composition and an organic and inorganic complex composition which constitute the housing and inner portion of the breaker when switching an electrode (not shown) of the breaker, a sublimated metal generated from a metal part (electrode, contact, trip mechanism) constituting a contact and an inner portion and scattering fused metal droplets can be efficiently insulated by an insulation giving gas generated from magnesium hydroxide which is contained in the molded product and causes dehydrogenation at a temperature of approximately 250°C or more.

[0021] The reinforcement includes one or more selected from a group consisting of glass fiber or ceramic fiber. In respect of a rigidity and a strength, it is preferable that the glass fiber has a diameter of 1 to 15 μm and an aspect ratio of 10 or more.

[0022] Next, description will be given to a change in a dimension after the molding depending on the compounding ratio of the organic and inorganic complex composition.

[Dimension Change Test after Molding]

[0023] First of all, a molded product for a test will be described. Fig. 1 is a perspective view showing the base (a

width of 90 mm X a length of 155 mm X a height of 40 mm) of a housing of a breaker. In Fig. 1, a denotes an external dimension in a cross direction and a dimensional tolerance is 89.5 to 90.0 mm.

[0024] After the molded product is molded (an external dimension a_0 in a cross direction of 89.5 mm to 89.6 mm is obtained immediately after the molding), it is held for 240 hours in a thermohygrostat bath maintained at 30°C and a humidity of 90 %. After the molded product is taken out of the thermohygrostat bath, the external dimension a in the cross direction is measured. If the dimension a ranges within the dimensional tolerance, acceptance is given. If the dimension a does not range within the dimensional tolerance, rejection is given. In other words, acceptance is given to a dimensional difference Δa (= dimension a - dimension a_0) within a predetermined range (0 to 0.4 mm) and it is preferable that the dimensional difference should be reduced.

[0025] As a comparative example 1, a molded product having a composition consisting of 70 % by weight of nylon 6, 20 % by weight of magnesium hydroxide and 10 % by weight of glass fiber as a reinforcement was used.

[0026] Table 1 shows the results of the test. In the table, X represents rejection, ○ and ⊙ represent acceptance, and ⊙ implies that the dimensional difference Δa is very small, the dimension a belongs to almost the center of the dimensional tolerance and a change in the change is more preferred.

Table 1

Item	Composition			Dimension change test after molding Comparative example
	Nylon 6 or nylon 6 based alloy	Magnesium hydroxide	Reinforcement	
Comparative example 1	Nylon 6 (70 % by weight)	Magnesium hydroxide (20 % by weight)	Glass fiber (10 % by weight)	Rejection X (89.86-90.06)
Sample 1	Nylon 6 (50 % by weight)	Magnesium hydroxide (30 % by weight)	Glass fiber (20 % by weight)	Acceptance ○ (89.75-89.95)
Sample 2	Nylon 6 (45 % by weight)	Magnesium hydroxide (35 % by weight)	Glass fiber (20 % by weight)	Acceptance ○ (89.72-89.92)
Sample 3	Nylon 6 (40 % by weight)	Magnesium hydroxide (40 % by weight)	Glass fiber (20 % by weight)	Acceptance ⊙ (89.70-89.90)
Sample 4	Nylon 6 (35 % by weight)	Magnesium hydroxide (40 % by weight)	Glass fiber (25 % by weight)	Acceptance ⊙ (89.67-89.87)

[0027] As shown in the Table 1, the dimension a does not range within the dimensional tolerance in the molded product of the comparative example 1, while the dimension a ranges within the dimensional tolerance and good results of the change in the dimension were obtained after moisture absorption in the samples 1 to 4.

[0028] Even the molded product of the comparative example 1 can be normally assembled if it is used for assembling a switch immediately after the molding, for example. As described above (see the Background Art), the molded product cannot be stored for a short period of time of several hours to several weeks (240 hours in the test) after the molding and is not preferable in respect of productivity.

[0029] As a result of the test, the following has been found. As the ratio of the nylon 6 or the nylon 6 based alloy is reduced, the change in the dimension after the moisture absorption tends to be reduced. If the nylon 6 or the nylon 6 based alloy is less than 35 % by weight, the reinforcement and the magnesium hydroxide tend to be kneaded with difficulty during material kneading. On the other hand, if the nylon 6 or the nylon 6 based alloy exceeds 50 % by weight, a coefficient of moisture absorption of the molded product made of the organic and inorganic complex composition tends to be raised, the change in the dimension after the molding tends to be increased, the rigidity of the molded product tends to be reduced and creeping performance tends to be deteriorated.

[0030] Accordingly, it is preferable that 35 to 50 % by weight of nylon 6 or nylon 6 based alloy should be contained.

[0031] Moreover, it has been found that the strength of the molded product made of the organic and inorganic complex composition tends to be reduced if the content of the reinforcement is less than 15 % by weight and that the orientation of the reinforcement tends to become greater and the strain of the molded product tends to be increased if the content of the reinforcement is equal to more than 25 % by weight. Accordingly, it is preferable that 15 to 25 % by weight of the reinforcement should be contained.

[0032] It has been found that insulation performance might be deteriorated after cut-off if the content of the magne-

sium hydroxide is less than 30 % by weight and that the molded product becomes fragile and a rigidity and a mechanical strength tend to be reduced if the content of the magnesium hydroxide exceeds 40 % by weight. Accordingly, it is preferable that 30 to 40 % by weight of magnesium hydroxide should be contained.

[0033] When 45 to 50 % by weight of nylon 6 or nylon 6 based alloy, 20 to 25 % by weight of reinforcement and 30 to 35 % by weight of magnesium hydroxide are contained, more preferably, the samples 1 and 2 are used, that is, 45 to 50 % by weight of nylon 6 or nylon 6 based alloy, 20 % by weight of reinforcement and 30 to 35 % by weight of magnesium hydroxide are contained, the molding condition range such as a fused resin temperature or a mold temperature was increased and the deposition of the reinforcement and the magnesium hydroxide on the surface of the molded product was lessened after the molding when the organic and inorganic complex composition is to be kneaded and the kneaded composition is to be then injection molded. Therefore, the molded product can be molded easily and can have a smooth surface. Moreover, when a black color based dye is added to the organic and inorganic complex composition, a black color based molded product is obtained. If the organic and inorganic complex composition has the same composition, the deposition of the reinforcement and the magnesium hydroxide on the surface of the molded product is lessened. Therefore, it is possible to obtain the molded product having less whitening and good appearance. In particular, since the appearance of housing is important, it is preferable that the molded product should be applied to the housing. Furthermore, the molding condition range such as a fused resin temperature or a mold temperature is wide. Therefore, it is possible to easily obtain the base and cover of a housing having a more complicated structure than a handle, particularly, the complicated shape of the base. Moreover, the base and cover of the housing are greater than parts such as a handle or a cross bar. Therefore, a great temperature gradient is generated before and after the molding. If the composition has the wide molding condition range such as the fused resin temperature or the mold temperature, the degree of freedom of the molding conditions such as temperature control can be increased, resulting in contribution to the base and the production efficiency of the base.

[0034] When 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide are contained, more preferably, the samples 2 to 4 are used, that is, 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 20 to 25 % by weight of reinforcement and 35 to 40 % by weight of magnesium hydroxide are contained, the change in a dimension after the molding is more reduced, the change in the dimension after the molding is reduced and the production fraction defective is lower. In particular, when 35 to 40 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide are contained, more preferably, the samples 3 and 4 are used, that is, 35 to 40 % by weight of nylon 6 or nylon 6 based alloy, 20 to 25 % by weight of reinforcement and 40 % by weight of magnesium hydroxide are contained, the change in the dimension after the molding is very reduced and the production fraction defective is very low.

[0035] While the case of the nylon 6 has been described as the nylon 6 or the nylon 6 based alloy in the explanation of the samples 1 to 4 in the test, almost the same results for the change in the dimension after the molding can be obtained in the case of the nylon 6 based alloy. The features of the nylon 6 and the nylon 6 based alloy will be described below. Since the nylon 6 based alloy is made of a material having a lower hygroscopic property than that of the nylon 6, it is more effective in the change in the dimension after the moisture absorption than the nylon 6. On the other hand, it has been found that the nylon 6 and an alloy of the nylon 6 and nylon 66 have higher insulation performance after cut-off than the nylon 6 based alloy (excluding the alloy of the nylon 6 and the nylon 66).

[0036] As described above, in the switch having a part thereof constituted by the molded product made of an organic and inorganic composition according to the present embodiment, the nylon 6 or nylon 6 based alloy contained in the organic and inorganic complex composition, the reinforcement and the magnesium hydroxide are distributed at a specific rate. Therefore, a high insulating property can be obtained after the switch is cut off, a flame resistance can be obtained, a change in a dimension after molding can be reduced, a production fraction defective is low, a high rigidity can be obtained after the molding, and a creeping resistance can be enhanced. Moreover, the molded product does not use a halogen or phosphorus based additive as a flame retardant. Therefore, there is no possibility that dioxin or phosphine might be generated during combustion. Thus, the molded product is nontoxic and preferable.

[0037] Since the nylon 6 or nylon 6 based alloy itself has a comparatively high decomposition temperature as a resin, it can contribute to an enhancement in the insulation performance after the cut-off.

[0038] Moreover, since the compositions of the samples 1 and 2 have wide molding condition ranges such as a fused resin temperature or a mold temperature and the deposition of the reinforcement and the magnesium hydroxide on the surface is lessened, they are more preferable for productivity and appearance.

[0039] Since the compositions of the samples 3 and 4 have a very small dimensional difference Δa and the a dimension a belonging to almost the center of the dimensional tolerance, it is more preferable for a change in the dimension after moisture absorption.

[0040] While the base of the housing of the breaker has been described as the molded product, other parts, for example, a cover, a handle and a cross bar may be used. A housing constituted by the cover, the base or the cover and base is one of the parts having the greatest whole length constituting the switch. Therefore, the influence of the change in a dimension after the molding can be reduced and the production fraction defective can be reduced efficiently by

using the molded product having the composition according to the present embodiment, which is preferable.

[0041] Moreover, the change in the dimension of the molded product rarely affects the performance of the switch after the assembly because the molded product has a part thereof fixed by other parts through the assembly.

[0042] Next, description will be given to another embodiment of the present invention.

5 [0043] A molded product of an insulating structure constituting a part of the switch according to the present embodiment is obtained by injection molding, into a metal mold, an organic and inorganic complex composition containing 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement, 30 to 40 % by weight of magnesium hydroxide and 5 to 15 % by weight of inorganic matter having less orientation.

10 [0044] Examples of the inorganic matter having less orientation include alumina, burned clay, unburned clay, silica, calcium silicate, magnesium oxide, calcium carbonate, magnesium carbonate, talc, mica and wallastnite. One or more of the inorganic matters may be used.

[0045] Because of the excellent surface gloss of the molded product, the burned clay, the silica, the calcium carbonate and wallastnite are preferred. Furthermore, the burned clay and the wallastnite are preferred because they are scratched with difficulty.

15 [0046] Next, description will be given to the strain of the molded product depending on the compounding ratio of the organic and inorganic complex composition and the fraction defective obtained during the delivery of the part.

[Measurement of Strain of Molded Product]

20 [0047] First of all, a molded product for a test will be described. Fig. 2 is a perspective view showing the cover (a width of 90 mm X a length of 155 mm X a height of 28 mm) of a housing of a breaker. Fig. 3 is a view showing the cover illustrated in Fig. 2 seen in the A direction of Fig. 2, that is, a front view. In Fig. 3, b represents a strain.

[0048] The molded product was molded (an external dimension a_0 in a cross direction of 89.5 mm to 89.6 mm is obtained immediately after the molding), and was then left for 24 hours at an ordinary temperature and moisture and a strain b of the molded product was measured. For each example (including comparative examples), the strain was measured for 100 molded products in total. Acceptance is given to 97 or more molded products having a strain of 0.5 mm or less, and rejection is given to 96 or less molded products having a strain of 0.5 mm or less. In the following Table 2, X represents the rejection and ○ and ⊙ represent acceptance. ⊙ is the most preferable because a variation in the strain is very small (the standard deviation of the strain is small).

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[Fraction Defective during Delivery of Part]

[0049] For a molded product (part) passing through a normal producing process comprising a step of fetching a molded product from a metal mold by means of an automatic fetch machine and putting the molded product on a belt conveyor, a step of packing the molded product on the belt conveyor into a box, a step of delivering the molded product packed in the box and a step of fetching the molded product packed in the box to be assembled, an external surface was checked and a fraction defective obtained during the delivery of the part was calculated. In Fig. 2, rejection was given to the case in which the external surface (design surface) has three or more scratches having a length of 2 mm or more, and acceptance was given to the case in which the external surface has two or less scratches having a length of 2 mm or more. In Fig. 2, the external surface is seen from side surfaces ① and ② and a top surface ③ in Fig. 2. The fraction defective obtained during the delivery of the part was measured for 1000 molded products in total.

[0050] As a comparative example 2, there was used a molded product having a composition consisting of 50 % by weight of nylon 6, 25 % by weight of magnesium hydroxide and 25 % by weight of glass fiber as a reinforcement. As a comparative example 3, there was used a molded product having a composition consisting of 50 % by weight of nylon 6, 40 % by weight of magnesium hydroxide and 10 % by weight of glass fiber as the reinforcement. In the following Table 2, X represents rejection and ○ and ⊙ represent acceptance. ⊙ implies the case in which the fraction defective is very good (a fraction defective of 0.6 % or less).

[0051] The results of the test are shown in the Table 2.

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Table 2

Item	Composition				Strain measurement	Fraction defective during part delivery
	Nylon 6 or nylon 6 based alloy	Magnesium hydroxide	Reinforcement	Inorganic matter		
Comparative example 2 (% by weight)	Nylon 6 (50)	Magnesium hydroxide (25)	Glass fiber (25)	-	Rejection X	Acceptance ☉ (0.6)
Comparative example 3 (% by weight)	Nylon 6 (50)	Magnesium hydroxide (40)	Glass fiber (10)	-	Acceptance ☉	Rejection X (4.5)
Sample 5 (% by weight)	Nylon 6 (45)	Magnesium hydroxide (30)	Glass fiber (20)	Wollastnite (5)	Acceptance ○	Acceptance ○ (0.8)
Sample 6 (% by weight)	Nylon 6 (45)	Magnesium hydroxide (30)	Glass fiber (15)	Wollastnite (10)	Acceptance ○	Acceptance ☉ (0.5)
Sample 7 (% by weight)	Nylon 6 (40)	Magnesium hydroxide (30)	Glass fiber (15)	Wollastnite (15)	Acceptance ☉	Acceptance ☉ (0.3)
Sample 8 (% by weight)	Nylon 6 (35)	Magnesium hydroxide (35)	Glass fiber (15)	Wollastnite (15)	Acceptance ☉	Acceptance ☉ (0.4)

[0052] As shown in the Table 2, the molded product of the comparative example 2 has a good fraction defective obtained during the part delivery and a great strain, while the molded product of the comparative example 3 has a small strain and a high fraction defective during part delivery which does not range within a tolerance.

[0053] On the other hand, the samples 5 to 8 had strains ranging within an allowable maximum value of 0.5 mm and a fraction defective during part delivery of 1.0 % or less. Thus, good results were obtained. For the samples 7 and 8, that is, 35 to 40 % by weight of nylon 6 or nylon 6 based alloy, approximately 15 % by weight of glass fiber (reinforcement), 30 to 35 % by weight of magnesium hydroxide and approximately 15 % by weight of wallastnite (an inorganic matter having less orientation) are contained, it was found that the strain and the fraction defective during part delivery are very excellent.

[0054] Moreover, if 5 % by weight or less of inorganic matter is used for the composition of the organic and inorganic complex composition, the strain of the molded product is reduced insufficiently. If more than 15 % by weight of inorganic matter is used, the mechanical strength of the molded product thus obtained tends to be reduced. In the Table 2, also in the case in which the burned clay is used for the inorganic matter, almost the same result as that of the wallastnite is obtained.

[0055] For the dimension change test after the molding which has been described in the above-mentioned embodiment, all the molded products related to the samples 5 to 8 according to the present embodiment having the inorganic matter with less orientation for the composition have a very small dimensional difference Δa and a dimension a belonging to almost the center of a dimension tolerance, which are more preferred results for a change in the dimension.

[0056] As described above, in the switch having a part thereof constituted by the molded product made of an organic and inorganic composition according to the present embodiment, the nylon 6 or nylon 6 based alloy, the reinforcement, the magnesium hydroxide and the inorganic matter having less orientation which are included in the organic and inorganic complex composition are distributed at a specific rate. Therefore, a high insulating property can be obtained after the switch is cut off, a flame resistance can be obtained, a change in a dimension after molding can be reduced, a production fraction defective is low, a high rigidity can be obtained after the molding, a creeping resistance can be enhanced, and the fraction defective during part delivery can be decreased. As compared with a molded product which does not use the inorganic matter having less orientation according to the above-mentioned embodiment, particularly, the molded product according to the present embodiment can have considerably excellent strain and fraction defective during part delivery and production fraction defective can be reduced rapidly.

[0057] Moreover, if burned clay, silica, calcium carbonate and wallastnite are used for the inorganic matter, the surface gloss of the molded product is great. Furthermore, if the burned clay and the wallastnite are used, the molded product is scratched with difficulty. Accordingly, the molded product according to the present embodiment is considerably excellent in that it has a great surface gloss and is scratched with difficulty as compared with the molded product which does not use the inorganic matter having less orientation according to the above-mentioned embodiment.

[0058] While the cover of the housing of the breaker has been described as the molded product, other parts, for example, a base, a handle and a cross bar may be used. The housing such as the cover or the base is a part having the greatest whole length. Therefore, the strain can be decreased and the production fraction defective can be reduced efficiently by using the molded product having a composition according to the present embodiment, which is preferable. Furthermore, if the molded product having the composition according to the present embodiment is used for the cover of the housing, the surface is scratched with difficulty, which is preferable.

Industrial Applicability

[0059] As described above, the switch according to the present invention can be applied to a switch having a small size and a high breaking capacity.

Claims

1. A switch comprising a part thereof constituted by a molded product having an organic and inorganic complex composition containing 35 to 50 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide.
2. The switch according to claim 1, wherein 45 to 50 % by weight of nylon 6 or nylon 6 based alloy, 20 to 25 % by weight of reinforcement and 30 to 35 % by weight of magnesium hydroxide are contained.
3. The switch according to claim 1, wherein 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide are contained.
4. The switch according to claim 1, wherein 35 to 40 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement and 30 to 40 % by weight of magnesium hydroxide are contained.
5. The switch according to claim 3, wherein the molded product is a housing.

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6. A switch comprising a part thereof constituted by a molded product having an organic and inorganic complex composition containing 35 to 45 % by weight of nylon 6 or nylon 6 based alloy, 15 to 25 % by weight of reinforcement, 30 to 40 % by weight of magnesium hydroxide and 5 to 15 % by weight of inorganic matter having less orientation.

5 7. The switch according to claim 6, wherein the inorganic matter is burned clay and/or wallastnite.

8. The switch according to claim 6, wherein the molded product is a housing.

9. The switch according to claim 8, wherein the molded product is a base of the housing.

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Fig. 1

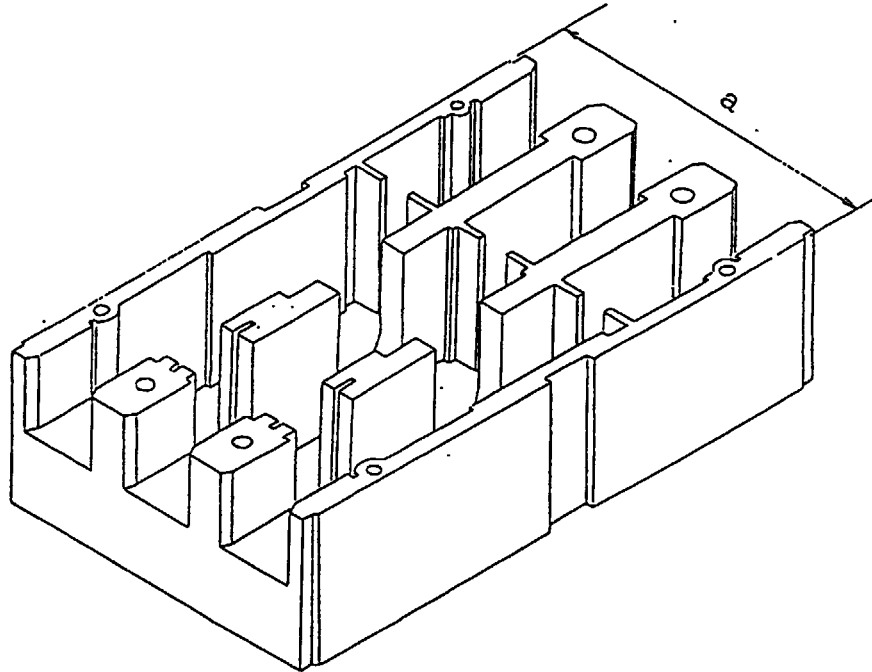


Fig. 2

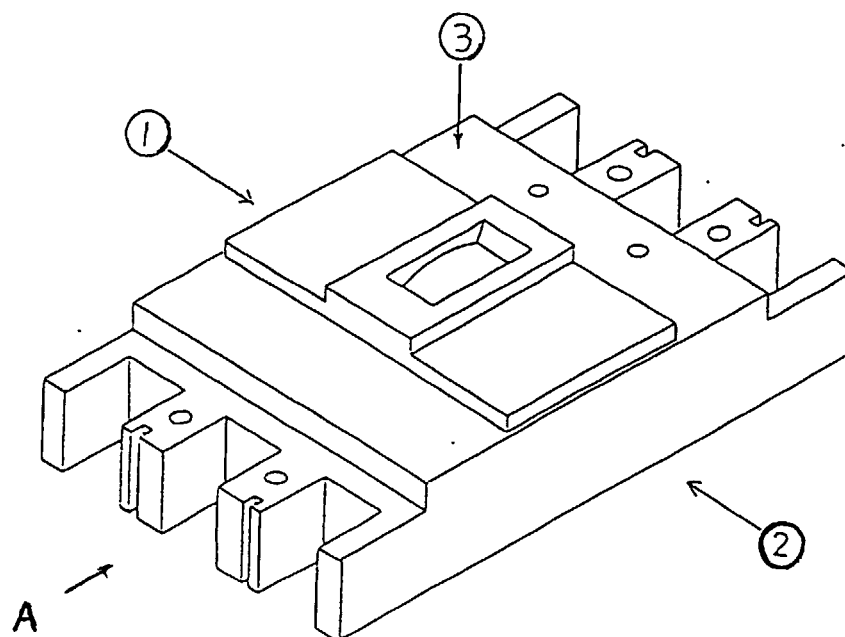
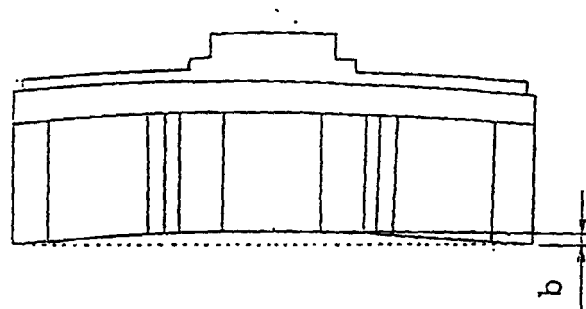


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/00121

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁶ C08L77/02, C08K3/22, H01B3/30, H01H33/53 // B29C45/00, B29K77:00, B29L31:34 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁶ C08L77/00-77/12, C08K3/00-3/40, H01B3/30, H01H33/53 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 8-171847, A (Mitsubishi Electric Corp.), 2 July, 1996 (02. 07. 96), Claims 9, 13, 14 ; page 4, column 6, lines 33 to 49 ; page 5, column 7, line 34 to column 8, line 29 ; page 7, column 12, lines 20 to 23 & EP, 718356, A2	1-9
A	JP, 6-290637, A (Hitachi Cable, Ltd.), 18 October, 1994 (18. 10. 94), Claims (Family: none)	1-9
A	JP, 7-003152, A (BASF AG.), 6 January, 1995 (06. 01. 95), Claims ; page 5, column 7, lines 25 to 31 ; page 8, column 13, lines 30 to 36 & EP, 614933, A2 & US, 5482985, A	1-9
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 29 March, 1999 (29. 03. 99)		Date of mailing of the international search report 6 April, 1999 (06. 04. 99)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.		Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, 6-240135, A (Bayer AG.), 30 August, 1994 (30. 08. 94), Claims ; page 3, column 3, lines 22 to 28, column 4, line 7 & EP, 605861, A2 & US, 5378750, A	1-9
A	JP, 6-234913, A (Bayer AG.), 23 August, 1994 (23. 08. 94), Claims ; page 3, column 3, lines 10 to 15, 39, 40 & EP, 605861, A2 & US, 5378750, A	1-9

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