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S. G. F. BLOMQVIST

2,612,367

SWITCH CONTACT SPRING

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Fig. 1



Fig. 2

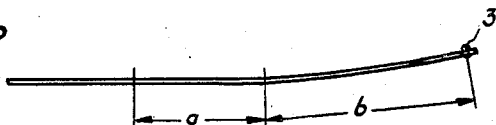


Fig. 3

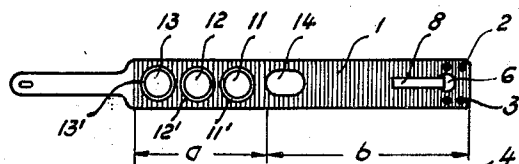


Fig. 4

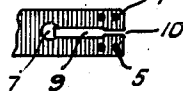


Fig. 5

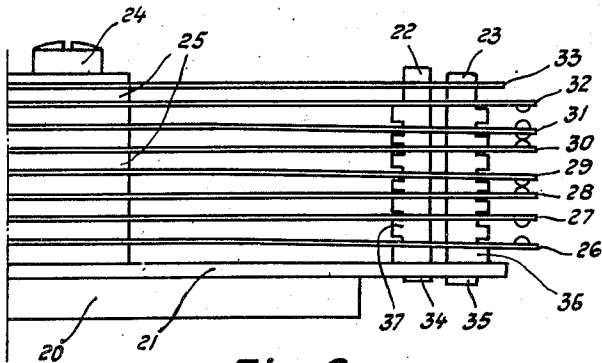
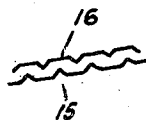


Fig. 6

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ATTYS

UNITED STATES PATENT OFFICE

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SWITCH CONTACT SPRING

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1

The present invention relates generally to articles of stamped and formed elastic sheet material and devices for manufacturing said articles.

The invention can be applied to articles of metal, such as steel, hard-rolled copper, alloys of aluminum, Phosphor bronze, brass, white metal and the like, as well as to articles of non-metal, for example plastics, synthetic resins and the like. Sheet materials as coming from the rolling mills or casting machines generally contain numerous stresses unevenly distributed in the sheet material. In metal rolling mills the unevenly distributed stresses are caused by the fact, that all parts of a big sheet of metal do not have the same thickness or are not equally pressed between the rolls. When such a sheet later on is cut up in small pieces for different purposes, the inherent unevenly distributed stresses will cause the pressed or formed articles to warp, and a uniform product cannot be obtained by merely pressing or forming such a sheet material.

When cutting out variously shaped flat articles from a raw metal sheet, the unevenly distributed stresses will remain along the edges of the cut articles apart from the inherent stresses from the rolling mill.

If articles of elastic sheet material in mass production should have exactly alike qualities, such as exact form, exact tension and so forth, a tedious and expensive manual adjustment work has hitherto been customary and necessary.

One object of this invention is automatically to eliminate all such irregular and unevenly distributed stresses in one operation by means of which all manufactured articles of a certain kind will have the desired exact form and exact tension in desired parts of the article.

Objects of sheet plastic and synthetic resins often present unevenly distributed stresses in the finished product or article, due to the fact that chain molecules in the state of passing from semi-solid into solid state contract more in one direction than in other directions. These stresses later on often cause warping or cracks in the surface. The tensile strength of a finished article of such a material is therefore often not equal in all parts.

This is often the case, when pure synthetic resins of certain hardness is used, for example, polystyrol, vinyl-ethylene, vinyl chloride and the like.

Often plasticising and softening materials are added to avoid these internal stresses, but such additions often spoil other desirable qualities of the synthetic resin, for example, its electric qualities become worse.

2

These uneven stresses can be eliminated according to the present invention by stamping and forming articles of synthetic resins or plastics in a semi-solid state during the process of setting, while passing from semi-liquid or semi-solid to a solid state.

Another object of the invention is to procure the necessary devices for the method of manufacturing the said articles.

The present invention generally refers to an elastic sheet material, in which in desired parts tensile stresses exceeding the limit of elasticity of the material have been simultaneously impressed upon small individual surfaces of said parts, the extension of each of said individual surfaces having been limited in at least one side of the sheet material and in at least one direction to a distance of one and a half to twice the thickness of the said sheet material, whereby uneven distributed stresses caused by a previous process of rolling, cutting, stamping or otherwise have been dispersed in said parts of the sheet material.

The said stresses for exceeding the limit of elasticity are according to the invention accomplished by providing the elastic sheet material with indentations to such a depth, for example to about half the thickness of the sheet material, that the limit of elasticity of the material will be exceeded upon the formation of said indentations.

The general idea of the invention is a method completely and uniformly to re-distribute the stresses in an elastic sheet material by exposing the individual minute parts of the sheet material to substantial tensile stresses by simultaneously impressing indentations in one or both surfaces of the sheet material.

Another object of the invention is simultaneously to form an article, while re-distribution or unifying of the stresses in the elastic sheet material takes place, whereby a double technical effect is obtained, as will later be exemplified.

The invention can be used generally in a great number of fields, where uniformity of stresses throughout the material is important and particularly when at the same time the form of the article must be exact.

The invention is particularly useful in the manufacture of contact springs for electrical switching apparatus, such as manual keys and switches, contact sets in telephone subscribers' instruments, buzzers, relays, selectors, crossbar switches and the like.

It is well known that a lot of manual adjustment work must now be applied to contact springs before and/or after mounting in its defi-

nite position in a set of contact springs on account of non-uniformity of the springs, which must be straightened or given a certain pre-tension to fit the particular position of the spring in the set.

It has been proposed to make contact springs with a certain pre-tension by providing the spring with a permanent transverse bend dividing the spring in two parts, said two parts being inclined with respect to each other for subsequent pretensioning of the said contact spring.

The object of such a procedure was to save or at least to simplify the adjustment work of the springs in a set for obtaining the desired contact pressure of the individual springs. This method has, however, in practice proved somewhat unsatisfactory, particularly in cases when the limits for respective contact pressure were narrow. The reason for this difficulty consists in the fact that the contact springs, which must have good spring qualities cannot be bent in a press by means of a tool by a single bending action for obtaining an exact angle between the two parts of a contact spring due to the fact, that all springs do not have exactly the same thickness. It has further been very difficult to give a perfectly plane form to those parts of the spring which were located on each side of the bend.

In cases where so-called pretensioned springs have been used, for example in crossbar switches, manufacturers have resorted to the method of hammering in order to obtain an exact angle between the two parts of the contact spring.

The present invention eliminates all these inconveniences, whereby a contact spring can be given an exact angle for a desired degree of pre-tension, and those parts of the spring, which are located on each side of the bent part can be given any desired form in the plane of the leaf spring. These parts can thus be made perfectly plane, if desired.

According to the invention the leaf spring is stamped and formed between a pair of dies adapted simultaneously to impress a plurality of indentations in the spring and to give desired form to same, whereby one or both dies are provided with indentations of a saw-tooth shaped cross section, the depth of said indentations and the distance between them being so limited that the limit of elasticity of the material will be exceeded upon the formation of said indentations in order to disperse unevenly distributed stresses in the sheet material.

If indentations are provided on both sides of the spring and if they are running, for example, at right angles to the longitudinal axis of the spring, the ridges of the indentations at one side of the spring should be parallel with and located in front of the grooves of the indentations on the other side of the spring. The indentations can, however, be arranged in directions crossing each other, so that a square or honeycomb pattern is obtained. The indentations can further have a non-rectilinear direction, for example wave form.

When indentations are made according to the present invention so as efficiently and uniformly to rearrange the stresses in the material, I have found that good results have been obtained, when the distance between two ridges of the indentations is about 1.5 times the thickness of the material, which distance in certain circumstances can vary somewhat, for example up to 1.75 or twice the thickness of the material. The distance should, however, preferably be less.

The depth of the indentations can be about 0.5 times the thickness of the material.

Applicant has found that leaf springs treated with indentations according to the invention at right angles to the axis of the spring show about 15% greater stiffness compared with untreated leaf springs.

This extra technical effect can be utilized in obtaining a higher contact pressure in a set of contact springs, or the bending angle for pre-tensioning can be made smaller, or a leaf spring of less thickness can be used compared to contact springs used heretofore.

Other novelties and details relating to the invention will be described and explained in connection with the accompanying drawings showing an embodiment of the invention, and in which:

Fig. 1 shows a warped and irregularly bent contact spring before stamping and forming.

Fig. 2 and Fig. 3 show the same spring in side and top view respectively after stamping and forming according to the invention. The spring is of movable kind for a set of contact springs.

Fig. 4 shows a top view of part of a contact spring of the fixed kind for a set of contact springs.

Fig. 5 is a magnified side view of part of a contact spring provided with indentations according to the invention, whereby formation of a continuous bend simultaneously has been obtained.

Fig. 6 shows a side view of a set of contact springs for a relay, in which contact springs of exact pre-tensions and forms according to the invention are used.

In Figs. 1-6 spring 1 is shown to have a straight, fixed and plane part *a* and a pre-tensioned movable part *b* at the free end of which contacts 2 and 3 or 4 and 5 are located. If desired, the free end part of the spring, which is provided with contacts, can be made straight and perfectly flat.

The movable contact spring is provided with a hole 8 for freely letting through the stud 23 and stud 22 and further provided with a seat 6 free from indentations for freely engaging a lifting tooth, for example 36 of stud 23.

The fixed contact spring is provided with a hole 9 for freely letting through the studs 22 and 23 and further provided with a seat 7 for engaging a tooth, for example 37 of the fixed stud 22, upon which the fixed spring normally rests. The spring is further provided with holes 11, 12 and 13 for fixing the straight part of the spring to a fixed support 20 by means of screws 24, whereby insulators 25 are spaced between the different springs. If desired, and if the pretension of a spring should be low, a hole 14 can be provided in the movable part near to the fixed part of the spring.

In a small narrow zone around the holes 11-12 there should be no indentations, as otherwise the ridges might be pressed into the holes and interfere with the free passage of the fastening screws 24 or with washers around same, when fastening the different springs of a set.

In Fig. 5 it is shown that the teeth of the dies have gripped the flat leaf spring and have made clear impressions in same, while due to the stiffness of the spring material the ridges between the grooves have not been filling the grooves of the dies.

In Fig. 6 is shown a set of make contact springs 26-27, a set of break contact springs 28-29 and a set of make and break contact springs 30-32.

5

The fixed supporting member or stud 22—34 is supported by a fixed stiff spring 21, which also serves to guide the movable member 23—35, while the fixed and movable members 22—34 and 23—35 respectively are guided at the top by a flexible spring 33.

The tension of the different springs can be varied at will by giving different pre-tensions to different kinds of springs. Thus the tension of the various springs can be varied for example from 10 to 30 or more grams at the respective contacts, depending on contact pressure desired in a break or make contact.

According to the invention any exact pre-tension can now be given, and after assembling a set of contact springs as shown in Fig. 6, each individual spring will be in correct position in the set and have the desired exact contact pressure, without any posterior manual adjustment whatsoever.

I claim:

1. A contact spring having a minimum of internal stresses for electric switches comprising a strip of resilient material having indentations pressed in both surfaces spaced sufficiently closely so that the material between adjacent indentations on opposed surfaces of said strip is stressed beyond the initial natural elastic limit of said material, said strip surfaces comprising alternate planar and depressed areas.

2. A contact spring as set forth in claim 1, wherein said indentations are approximately half the thickness of said strip in depth and spaced apart by a distance of less than twice the thickness of said strip.

3. A contact spring as set forth in claim 1, wherein the spacing of distance is of the order of 1.5 times the thickness of the material.

4. A contact spring having a minimum of internal stresses for electric switches comprising a strip of resilient material having indentations pressed in both surfaces, the indentations in one surface being staggered with respect to the in-

6

dentations in the other surface, said indentations being spaced closely so that the strip material in the area of said indentations is stressed beyond the initial natural elastic limit of said material, said strip surfaces comprising alternate planar and depressed areas.

5. A contact spring as set forth in claim 4, wherein said indentations are approximately half the thickness of said strip in depth and spaced apart by a distance of less than twice the thickness of said strip.

6. A contact spring having a minimum of internal stresses for electric switches comprising a strip of resilient material having indentations pressed in both surfaces spaced sufficiently closely so that the material between adjacent indentations on opposed surfaces of said strip is stressed beyond the initial natural elastic limit of said material, said indentations being approximately half the thickness of said strip in depth and spaced apart by a distance of less than twice the thickness of said strip.

SVEN GUSTAF FILIP BLOMQUIST.

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