

March 15, 1960

W. WOCKENFUSS
WIRE PRINTING MECHANISM

2,928,338

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FIG. 2

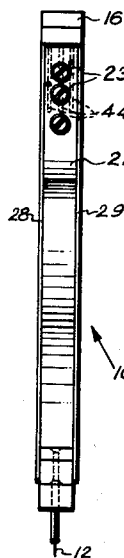


FIG. 1

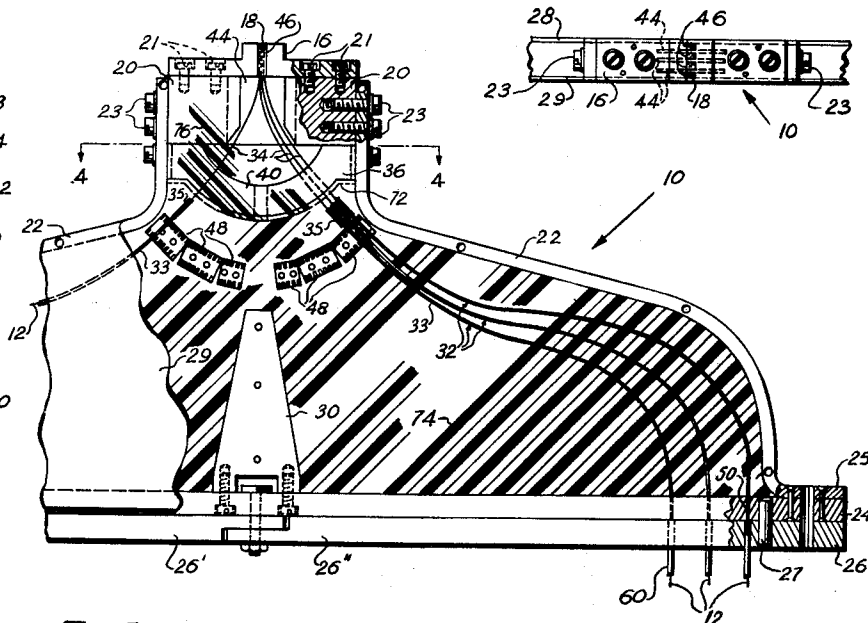


FIG. 3

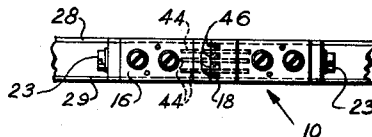


FIG. 5

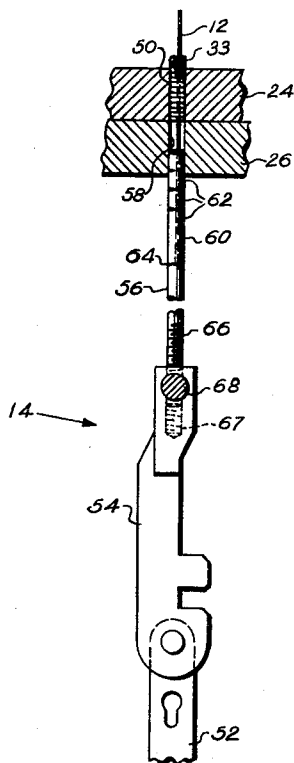


FIG. 4

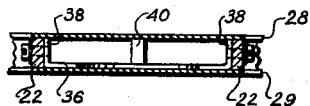


FIG. 7

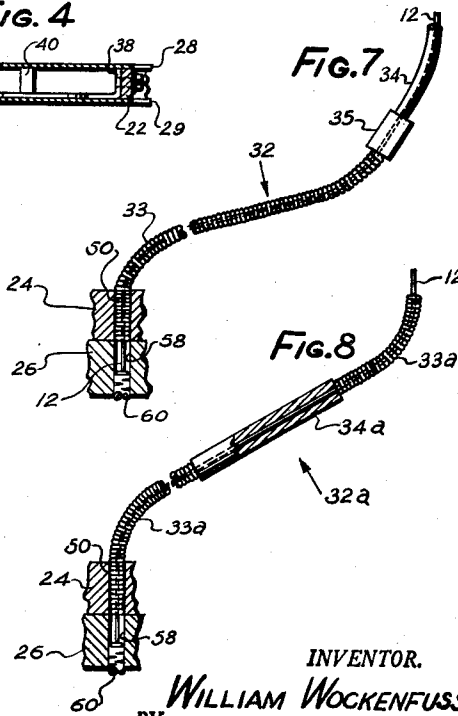


FIG. 6

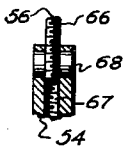
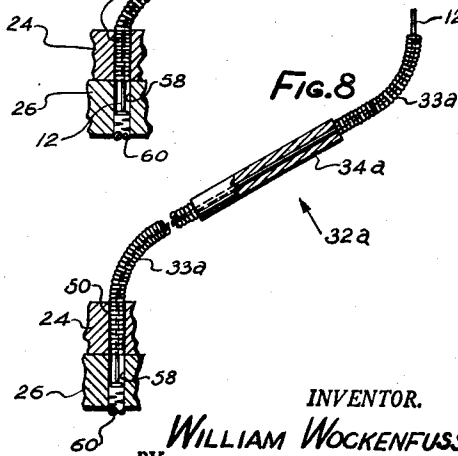


FIG. 8



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2,928,338

WIRE PRINTING MECHANISM

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7 Claims. (Cl. 101—93)

The present invention relates to recording devices of the type in which wires or like recording elements are moved selectively into and out of engagement with a record medium.

Examples of recording machines in which such devices are employed are disclosed in United States Patent No. 2,632,386, issued on March 24, 1953, to John J. Hyland (reissued on July 6, 1954, as Re. 23,847), and in the pending United States application of Frederick Q. Rast, Serial No. 118,063, filed September 27, 1949 (issued on June 22, 1954, as Patent No. 2,681,614). In these machines each recording device comprises a number of wires having their outer ends arranged in mosaic fashion. Selective actuation of the wires in each mosaic will form a pattern or matrix of the character which is to be recorded. The recording wires are individually connected to power-driven actuating members which are operated selectively in accordance with the character or data to be recorded. For at least a portion of its length, each of these wires is enclosed by a guide sheath made of flexible material. Thus, for instance, one may employ the central wire of a Bowden cable as a recording element, said wire being extended from the end of the flexible cable sheath into a recording mosaic or into a rigid guide member leading to the recording mosaic.

In this type of a machine, once the recording elements have been installed, it is highly desirable that the flexible guide sheaths of these elements be held against any transverse or longitudinal movements thereof throughout their respective lengths, and it is also desirable that the friction between each recording wire and its sheath be kept down to a negligible amount. In the past these conditions have been extremely difficult to achieve, because the recording elements necessarily must occupy circuitous paths and be in close proximity to each other, and they are subjected to considerable stress and impact while in service. Any loose play or friction will tend to make the recording elements function inaccurately or inefficiently. Another problem which is likely to be encountered is that the recording wires will tend to work loose from their actuating members while under stress. This problem is not confined to the character-forming type of recording machine but may exist also in other forms of recording apparatus where it is necessary to operate wire-like recording elements under appreciable stress.

An object of the present invention is to provide an improved recording device of the type mentioned above in which the guide portions of the recording elements are firmly secured throughout their respective lengths, and in which the parts of the recording wires enclosed by these guide portions are kept adequately lubricated, despite the crowded relation of the recording elements and the circuitous manner in which these elements are arranged.

A further object is to provide novel connecting means for insuring a positive connection between each record-

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ing wire and its actuating member at all times and under all conditions of service.

A further object of the invention is the provision of a novel guide means to guide the recording elements throughout their normally bent and unbent portions.

Still a further object of the invention is the provision of novel recording element guide and positioning means which cooperate to securely position, guide and lubricate the recording elements during their selective operation.

A further object of the invention is the provision of an adjustable recording element actuator having a novel arrangement of connections which facilitate proper adjustment of the recording elements connected thereto and enable equal and positive guided operation of the recording elements to and from recording position.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings which disclose by way of example, the principle of the invention and the best mode which has been contemplated of applying that principle.

In the drawings:

Fig. 1 is a partial front elevation of a recording device constructed in accordance with the principles of my invention,

Fig. 2 is a side view of the device shown in Fig. 1, Fig. 3 is a partial plan view of the device shown in Fig. 1,

Fig. 4 is a sectional view of the device shown in Fig. 1, taken along the line 4—4 in Fig. 1,

Fig. 5 is a side view of the recording element actuator, Fig. 6 is a partial longitudinal section of the adjustable connection of the actuator shown in Fig. 5,

Fig. 7 is a partial, enlarged view of an individual recording element and its guide of the type shown in Fig. 1,

Fig. 8 is a partial, enlarged view showing a modified recording element and its guide.

Reference is made to Figs. 1, 2 and 3 which disclose a recording device constructed in accordance with the principles of my invention. This recording device consists of a frame, generally designated by the numeral 10, a plurality of recording elements 12 housed in the frame 10, actuator means generally designated by the numeral 14 (Fig. 5), for actuating the recording elements 12, and means 74 (Fig. 1) comprising a body of thermoplastic material for positioning and lubricating the recording elements 12, as will be explained later.

The frame 10 encloses the recording elements 12 and supports them with their upper ends grouped closely together in a plurality of recording units or mosaics 18 (Fig. 3). At the top of the frame 10 a mounting member 16, Fig. 1, is secured to a pair of blocks 20 by bolts 21. The blocks 20 are connected respectively to side members 22, which diverge downwardly from each other to define a flared enclosure for the recording elements 12. The bottom of the frame 10 is closed by a clamp member 24 which is secured to the horizontally extending lower legs 25 of the side members 22. The lower ends of the recording elements 12, which are spaced relatively far apart, pass through suitable openings in the clamp member 24, and the upper ends of these recording elements 12 converge toward openings 46 in the mounting member 16.

Connected to the clamp member 24 is an actuator guide member 26. Alignment of the members 24 and 26 is facilitated by the guiding pins 27. The guide member 26 is formed in two sections 26' and 26'' (see Fig. 1). The frame 10 is closed on its opposite ends by the end plates 28 and 29, as shown in Figs. 2, 3 and 4. To properly support the sides 28 and 29, a support block 30 is suitably connected to the clamp member 24 and to the two sides. The clamp member 24 is, in turn, suitably

fastened to the guide member 26 in the area of separation of the members 26' and 26''.

The recording elements 12, housed in the member 16 of the enclosed recording frame 10, are combined at their upper recording ends to form the recording units 18, as previously noted. Disposed about the length of each one of the recording elements 12 is a guide means, generally designated 32 (see Figs. 1 and 7). Each guide means 32 is composed of two aligned guide members 33 and 34 interconnected by a connection member 35. Connected members 33 and 34 thereby form the complete guide 32. Guide member 33 is positioned about a portion of the recording element 12 remote from the recording end, and it is made of flexible, porous material for the purpose to be described. For purposes of illustration the guide member 33 is represented herein as the flexible sheath of a Bowden wire. On the other hand, the guide member 34 is rigid and non-porous. The positioning of the guide members 33 and 34 is such that the rigid guide 34 is disposed about the recording end portion of the recording element 12, which is straight or nearly straight; whereas the flexible guide 33 is positioned along the remainder of the recording element 12, of which the major portions are normally bent along arcs of relatively small radius.

At those places where the recording elements have very little curvature, it is feasible to employ rigid guides such as 34. (By "rigid" it is meant that each of these guide members will retain the configuration to which it is formed, without external support.) The rigidity of the guides 34 facilitates their assembly in the recording heads. Any slight amount of bend which must be imparted to one of these rigid guides will not appreciably constrict the guide opening therein. In those places where the curvatures of the recording elements are pronounced, it is preferable to use flexible guides made of material which does not collapse when it is bent (such as Bowden cable sheaths, for example), so that the bent configurations of these guide members will not cause any constriction of the guide passages therein. It is at the points of greatest curvature that the problem of lubricating the recording elements becomes most acute. The exact manner in which the present invention takes care of this difficulty will be explained shortly.

Referring now to Figs. 1 and 4, an arcuately shaped bridge 36 is connected at its two legs 38 to the side members 22 of the frame 10 to lend support to these members, while the bridge is supported along its center by the center support post 40. The two blocks 20, Figs. 1, 2 and 3, are slotted to receive the recording element unit spacing plates 44. Both of the blocks 20 have three slots (not numbered) which are horizontally disposed and aligned. A spacing plate 44 slides into a pair of horizontally aligned slots in the blocks 20 and thereby divides the width between the end plates 28 and 29 of the frame 10 into four spaces. The four spaces coincide in alignment with the recording element mounting openings 46 provided in the mounting member 16, to separate the recording elements 12 into four recording units 18.

Beyond the bridge 36 and the guide connection members 35 is a series of combs 48 (Fig. 1) which may be fastened to either one of the end plates, 28 or 29. For illustrative purposes only, Fig. 1 of the drawings shows the combs 48 fastened to the plate 28. Each one of the flexible guide members 33 is held between four fingers (not numbered) of the combs 48. The comb fingers thereby serve to accurately separate and position the intermediate portions of the recording elements 12 and their respective guides 32 relative to each other and to the frame 10. Guides 32 extend in the direction away from the recording ends of their recording elements 12 and are securely positioned and guided at their opposite ends in openings 50 of member 24, (Figs. 1, 5 and 7). There is an opening 50 for each recording element 12 and guide 32. The end of the flexible guide 33 is pressed into the

opening 50 so as to be fixedly clamped to the member 24 and the frame 10.

Situated below, but cooperating with the recording element 12 positioned in the frame 10, is the actuator means 14 (Fig. 5). An individual actuator means such as the one illustrated is associated with each of the recording elements 12. Each actuator means 14 is connected to a selecting mechanism of the recording machine by a pivotable interposer line 52. For examples of the actuator selecting mechanism, reference may be had to the previously mentioned United States patent to John J. Hyland and to the United States application of Frederick Q. Rast. Actuator member 54 is connected to the pivotable link 52 at its one end and adjustably connected with the connector rod 56 at its other end.

The lower end of the recording element 12 extends beyond the clamped end of its guide 33 and into the aligned opening 58 of the member 26, see Figs. 1, 5, 6 and 7. Guided in the aligned opening 58 is the drive means 60. Drive means 60 is the topmost connection of the actuator means 14 and will be referred to as a drive rod tip. It is a cylindrical member with a hollow interior. The end of the recording element 12 is inserted into the top end of the hollow of the drive rod tip 60 until it extends flush with the bottom end of the tip. The drive rod tip 60 is then staked, as at 62, about its outer periphery to form a tight connection with the recording element 12 therein.

A welded connection, as at 64, joins the drive rod tip 60 to the adjustable connector rod 56. Although the recording element 12 is not included in the welded connection 64, its end is in the area of the connection. This connection has been found to work very well in practice. It was found that the staked connection 62 alone was unsatisfactory. Very frequently during operation of the recording elements 12, the staked connection alone would not hold, and after a period of time the elements 12 would work loose and move within the hollow of the drive rod tip 60. Any such movement of the recording element 12 relative to the tip 60, after the parts had been permanently set for operation, would result in recording errors due to the unwanted projection of the recording element 12 beyond the plane of the recording mosaic.

It has been found that the present welded connection 64 provides the desired resistance against relative movement between the recording element 12 and the tip 60. This is so in spite of the fact that the end of the recording element 12 is not specifically included in the welded connection 64. However, because it does extend into the area of the welded connection 64, an adhering bond is set-up between the end of the recording element 12, the tip 60 and the connector rod 56.

At the top of the member 54 there is provided a tapped hole 67, Figs. 5 and 6. Crosswise to the member 54 is an aperture in which a nylon plug 68 is pressed, Figs. 5 and 6. The plug 68 has a hole (not numbered) equal in diameter to the root diameter of the thread 66 on the rod 56. The hole in the plug 68 is aligned with the tapped hole 67 in the top of member 54.

As connector rod 56 is threaded into the tapped hole 67, the thread portion 66 cuts its own thread into the nylon plug 68. Rod 56 is adjusted in the member 54 until the recording end of the element 12 is flush with the ends of the other recording elements which form the unit 18. Due to the elastic nature of the plug 68, it locks and retains the rod 56 in position after it is threaded to adjust the recording element 12 to its desired height.

To readjust the height of the associated recording element 12 it is merely necessary to thread the rod 56 either into or out of the member 54 according to the desired direction of adjustment. The nylon plug 68 permits manual adjustment of the rod 56 relative to the member 54, however, its normal tendency is to resist any relative movement in the threaded connection; it functions as an elastic stop nut.

The recording device is assembled by first putting together the recording frame 10 without attaching the plate 29, until the recording device is completely assembled. A forming wire (not shown) slightly larger in diameter than the recording element 12 is placed in each guide 32. The guides 32 are arranged in the frame 10, positioned and guided therein by the member 16, separator plates 44, bridge 36, combs 48 and clamp 24. After the guides 32 have been secured in position a thermo-setting material, generally identified by shading 76 (see Fig. 1), is poured into the top recording end portion of the frame 10, and is allowed to set. When the thermo-setting material 76 is poured into the frame 10 it is permitted to flow about the guides 34, the bridge 36, the blocks 20 and the spaces between the plates 44. After setting the matter 76 adheres to the parts with which it comes in contact, thereby securing the rigid guides 34 in position in the frame 10. The thermo-setting material 76 extends about the rigid guides 34 from the base of the member 16 to the dash line 72 (see Fig. 1) short of, and above the guide connections 35.

After the thermo-setting material 76 has hardened, an oil exuding thermo-plastic material 74, Fig. 1, is poured into the frame 10 to fill the remaining portion of the frame 10 extending from the base 72 of the thermo-setting material to the clamp member 24. The thermo-plastic material 74 is poured into the frame 10 while in a liquid state. It flows about the frame 10, the guides 32 and between the porous turns of the flexible Bowden wire guides 33 to fill the interior space between each guide 33 and the oversized forming wire inserted therein. The material 74 is permitted to cool and to change from its liquid to its plastic state. When in its plastic condition, the material 74 has a tendency to adhere to the parts with which it comes in contact and, as a consequence, securely positions the guides 32 in the frame 10, and with respect to each other.

The oversized forming wires placed in the guides 32 during the pouring of the thermo-setting and thermo-plastic positioning materials 76 and 74 respectively are withdrawn therefrom, after the materials have cooled. Withdrawal of the oversized forming members from their guides 32 and the surrounding material 74, leaves an opening within the interiors of each of the guides 33 of a diameter slightly larger than that of the recording elements 12.

Before inserting the recording elements 12 into the oversized openings left in each of the guides 32, the recording elements are connected to the actuator 14 (Figs. 5, 6 and 7), in the manner previously described. The recording elements 12, when inserted into their guides 32, slide smoothly and freely. The thermo-plastic 74, being impregnated with an oil, exudes the oil onto the surface of the recording elements 12. Thus, when the actuator 14 is selectively operated to move the recording elements 12 to and from recording position, the movement of the elements 12 in the material 74 leaves a light film of oil on the surface of the elements, sufficient to provide the desired lubrication. Although many types of oil exuding thermo-plastic materials may be employed, it has been found that an alkyl cellulose ester, particularly a lower alkyl cellulose mixed ester such as an ethyl cellulose acetate butyrate formulation impregnated with oil, produces excellent results.

Material 74 performs two functions. It positions the recording elements 12 and their guides 32 in the frame 10 and it also lubricates the recording elements. It is for the latter reason that the flexible guide 33 is porous; to allow the material 74 to flow into the interior of the guide 32 while in its fluid state. The thermo-plastic positioning and lubricating means 74 performs still another important function. At times repairs are required on certain parts of the recording device. Previously, if any one of parts of the recording device were defective or in need of repair, there was no easy way of locating and

correcting the defect. However, material 74 may be either a clear or translucent compound which is easily heated, liquified and removed from the frame 10. Thus, since it is either clear or translucent, defects in the recording device may be spotted visually without probing. After the defect is found, the material 74 may be heated, liquified and poured out of the frame 10 to release the recording elements 12 and their guides for proper repairs or repositioning within the frame.

Fig. 8 shows a modified guide 32a which may be employed in the recording device of the instant invention. The structural elements of the guide 32a in Fig. 8, being similar in some respects to that of Figs. 1 and 7 are, therefore, similarly numbered, but with the addition of the distinguishing suffix letter "a."

The guide 32a (Fig. 8) comprises a plurality of interconnected and interspersed rigid and flexible guide members 34a and 33a respectively. The rigid guide members 34a are straight and unbent to guide the portions of the recording element 12 which are normally unbent. Flexible guide members 33a, capable of being bent without causing undue distortion of their inside configurations, may be utilized as guides along the normally bent portions of the recording elements 12. For illustrative purposes, only one rigid and two flexible guide members have been shown. However, it should be clear that wherever along the length of the recording element 12 there is in a normally bent condition, a flexible guide 33a will be provided. Similarly, there will be as many rigid guides 34a along the recording element 12 as there are portions along the elements 12 which are normally straight and unbent.

The guide 32a may be securely positioned in the recording frame 10 in the same manner as the guide 32 (Figs. 1 and 7). However, when the guide 32a is utilized, the thermo-setting positioning material 76 may be eliminated. The oil exuding thermo-plastic positioning material 74 may be poured into the frame 10 to cover the whole interior, completely lubricating the recording elements 12 and adhering to the parts fixed to the frame to secure the elements 12 and their guides 32a in position.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

The invention is claimed as follows:

1. In a recording device, a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, a thermo-plastic member that exudes a lubricant, and guide means pervious to the lubricant exuded by said member supported by said member and coupled to channel said recording elements.

2. In a recording device, a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, an alkyl cellulose ester member impregnated with oil, and guide means pervious to the oil in said member supported by said member to pass the oil to the recording elements and coupled to channel said recording elements.

3. In a recording device, a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, an oil impregnated ethyl cellulose acetate butyrate member, and guide means pervious to the oil in said member contacting said

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member to pass the oil to the recording elements and coupled to channel said recording elements.

4. In a recording device, a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, a thermo-plastic member that exudes a lubricant, and a flexible guide means pervious to the lubricant exuded by said member positioned within said thermo-plastic member to pass the lubricant to the recording elements and coupled to channel said recording elements.

5. In a recording device, a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, porous guide members coupled to channel said recording elements, a support member, a thermo-setting member coupled to anchor one end of said guide members to said supporting member, and a thermo-plastic member that exudes a lubricant coupled to said supporting member and to said porous guide members to lubricate said recording elements through said porous guide members.

6. In a recording device, a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, flexible porous guide members coupled to channel said recording elements, a supporting frame, a thermo-setting member coupled to anchor one end of said flexible porous guide members to said supporting frame, and an oil impregnated alkyl cellulose ester member coupled to said supporting frame and surrounding the unanchored portion of each

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flexible porous guide to feed the oil through said flexible porous guide members to lubricate said recording elements.

7. In a recording device, a plurality of elongated character-forming recording elements adapted to be operated selectively for moving their recording ends into and out of engagement with a record medium, a Bowden cable sheath positioned around each of said recording elements, a supporting frame, means to anchor one end of said Bowden cable sheath to said supporting frame, and an alkyl cellulose ester member impregnated with oil positioned around each Bowden cable sheath to lubricate said recording elements through said Bowden cable sheath.

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