March 22, 1960 E. G. FISCHER 2,929,245

MOVING STRAND FLAW DETECTOR

Filed Dec. 20, 1956 2 Sheets-Sheet 1

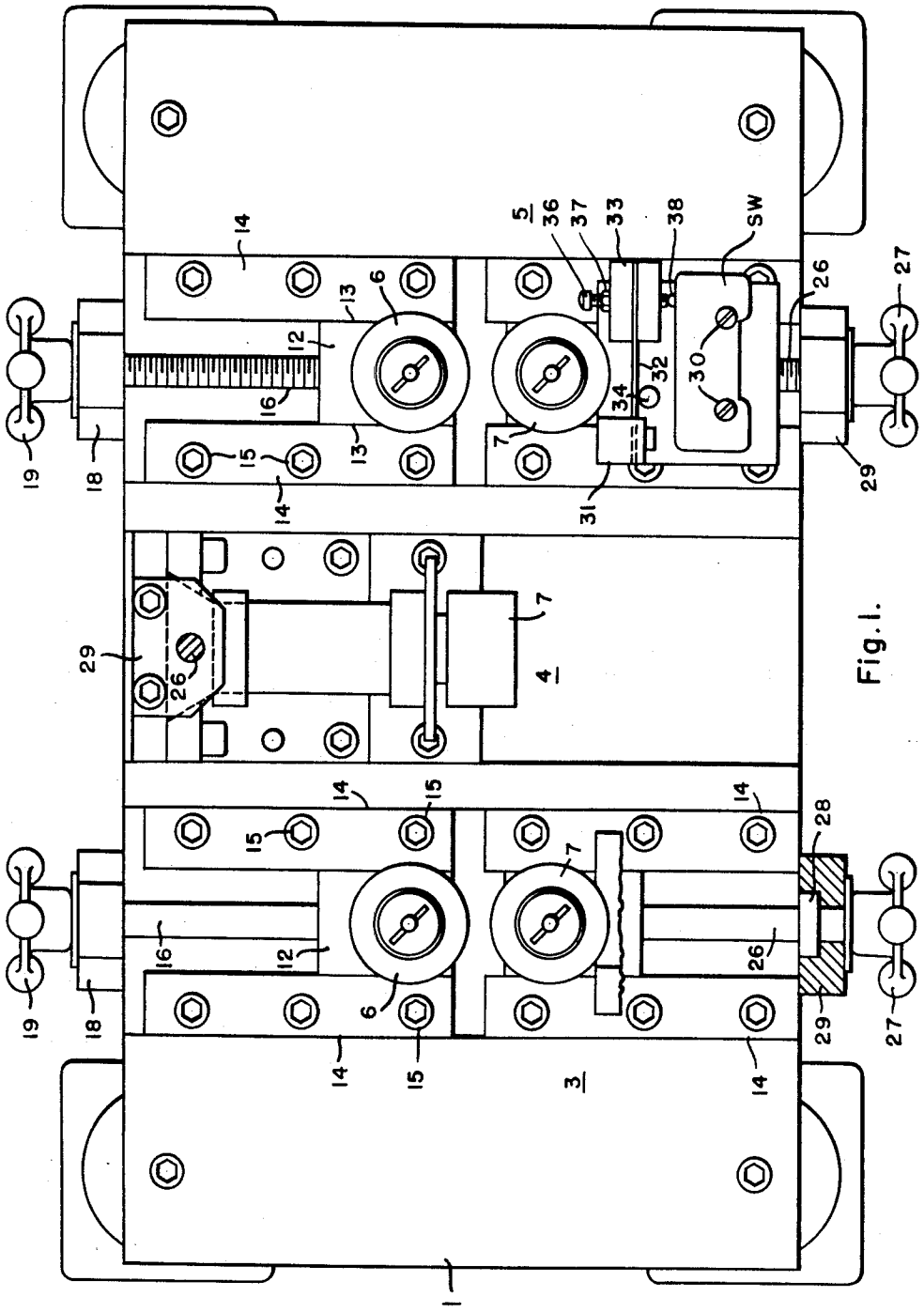


Fig. 1.

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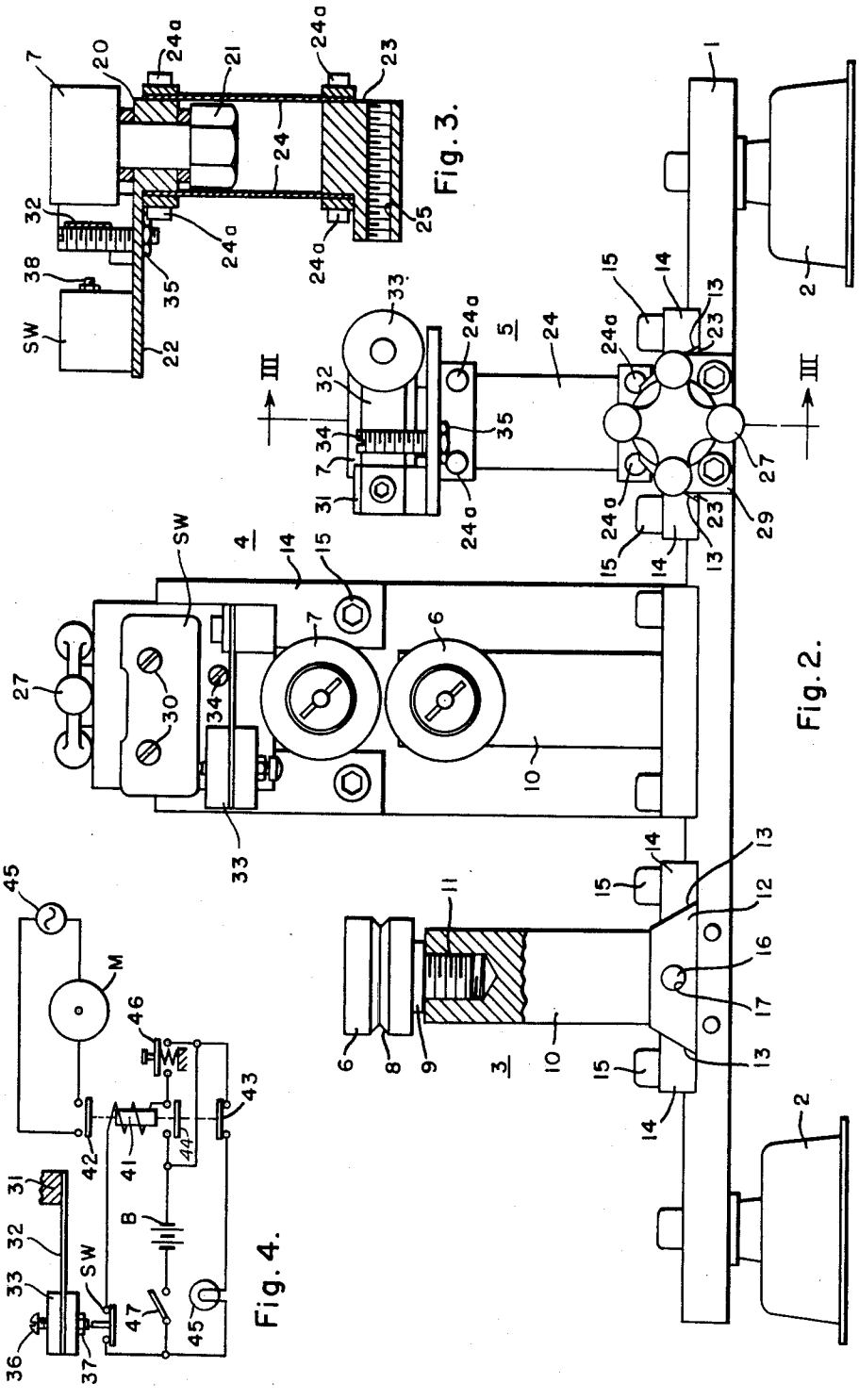


Fig. 2.

Fig. 3.

Fig. 4.

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MOVING STRAND FLAW DETECTOR

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5 Claims. (Cl. 73—160)

This invention relates to a moving strand flaw detector and, more particularly, to a moving strand flaw detector capable of monitoring the entire surface of the moving strand.

In previous flaw detecting systems, the operation was handled by the operator scanning the surface of the moving strand through the use of his sense of touch. This was accomplished by passing the strand through his fingers to detect any flaw in the surface thereof. This system, however, becomes slow and tedious as well as being dangerous to the operator involved, since the nature of the flaws varies from depressions, and rounded projecting burrs and surface inclusions to sharp projecting burrs, slivers, splays, and splinters.

It is, therefore, an object of this invention to provide an automatic moving strand surface flaw detector capable of high speed moving strand surveillance.

It is another object of this invention to provide a moving strand flaw detector that is adjustable in sensitivity to be selective in the severity of the flaw to be detected.

It is still another object of this invention to provide a flaw detector capable of monitoring moving strands of non-symmetrical cross-section.

Another object of this invention is to provide a moving strand flaw detector that is capable of adjustment for accommodation of different strand size.

Another object of this invention is to provide a moving strand flaw detector that is simple in construction and inexpensive to manufacture.

Other objects, purposes and characteristic features will become clear as a description of this invention progresses.

In practicing this invention there is provided a moving strand flaw detecting device having a plurality of opposing detecting members. These detecting members are resiliently biased toward each other to provide firm contact with the surface of the moving strand. Associated with one of the detecting members of each opposing group of detecting members is a circuit controller that is responsive to movement of opposing detecting members away from each other. In practice, this movement occurs only when an irregularity or flaw passes between the opposing detecting members as the moving strand is monitored.

Figure 1 is a plan view of one embodiment of this invention with certain parts broken away to better illustrate certain other parts.

Fig. 2 is an elevational view of the embodiment of this invention with certain parts sectioned and other parts removed to better illustrate the structure.

Fig. 3 is a sectional view taken along the line III—III of Fig. 2 to illustrate the construction of one of the resiliently mounted detector members.

Fig. 4 is a circuit diagram of a typical circuit controlled by the detecting device of this invention.

Throughout the specification and drawings similar parts bear like reference numerals.

The flaw detector of this invention comprises a mounting base 1 of generally rectangular configuration with

shock absorbing support members 2 positioned adjacent the corners of the rectangular base member 1. The base member 1 has secured thereto, three sets of detecting members capable of contacting the entire surface of a moving strand not shown. The three sets of detecting members are similar and generally designated 3, 4 and 5, and are positioned in closely cooperating adjacent relationship.

The flaw detecting sets 3, 4 and 5 each comprise a pair of flaw detecting rollers 6 and 7 positioned in adjacent opposing relationship. In the detecting sets 4 and 5 each roller 6 is provided with a smooth peripheral surface for engagement of the flat surface of a passing strand. Each roller 6 of each detecting set is rotatably supported on a spindle 9 secured to a support pedestal 10 by a securing bolt 11. Each supporting pedestal 10 is provided with a base portion 12 having beveled edges 13 engaged by the tracks 14 also having cooperating beveled edges. In detecting sets 3 and 5 the tracks 14 are secured to the base member 1 by suitable bolts 15, and in detecting set 4 the tracks 14 are secured to an upstanding base extension 1*a* by suitable bolts 15. Each base portion 12 of each upstanding pedestal 10 of detecting sets 3 and 5 is movable longitudinally of its track members 14 and securely held in any selected position by an associated threaded screw 16 received within each threaded opening 17 in each base portion 12. Each threaded screw 16 is secured against longitudinal motion by a bearing block 18 fastened to the base member 1 in any suitable manner. The outwardly extending end of each threaded screw or member 16 is provided with an integral handle 19 capable of being grasped by an operator for rotation of each threaded member 16 in order to reposition each pedestal 10 and its cooperating roller 6.

Each flaw detecting roller 7 positioned in opposition to each previously mentioned roller 6 is secured to a support member 20 by a suitable bolt 21 as shown in Fig. 3. The roller 7 and its support structure of detector set 3 have been removed from Fig. 2 in order to show the support for the roller 6. Each support block 20 is provided with an outwardly extending shelf 22 capable of supporting a circuit controller switch SW as shown in Fig. 3 and Fig. 1. Each support block 20 is resiliently secured to a traveling support block 23 by suitable leaf springs 24 secured by suitable bolts and pressure plates 24*a*. Each traveling support block 23 is similar to each base portion 12 of the previously mentioned support pedestal 10. That is, each movable support block 23 is secured in place by suitable tracks 14 with each block 23 and the tracks 14 having cooperating beveled surfaces, as described in connection with the lower portion 12 and tracks 14 of the support pedestal 10. Each movable block 23 also is provided with a threaded opening 25 for receiving a cooperating screw 26 similar to the previously described screw 16 cooperating with the support pedestal 10. The screw 26 is provided with a control handle 27 and thrust bushing 28 held within a support block 29.

It should be clear that rotation of each handle 19 acts to reposition each detecting roller 6 to any desired position. Likewise, rotation of each handle 27 acts to reposition each roller 7 to any desired position opposite each roller 6. Each roller 7, however, being resiliently supported on the leaf springs 24 is capable of being displaced away from the roller 6 by the introduction of the strand therebetween. The purpose of this resilient mounting will be described hereinafter. For the present, however, it is sufficient to note that for any one size strand each roller 6 will maintain its selected position while each roller 7 is resiliently displaced.

Each switch SW may be of any suitable commercial type in which circuit controller contacts are opened and closed through a very short stroke actuator, and each

switch is secured to a platform 22 by suitable screws 30. Each platform 22 is provided with an upstanding support 31 at a position spaced from its associated switch SW. Supported at one end, on each upstanding support 31, is a resilient leaf spring 32 having its other end secured to a mass or weight 33 which is free to move in a plane parallel to the surface of its associated platform 22. Each mass 33 is biased to a neutral position by the resilience of its leaf spring 32. Associated and in contact with each leaf spring 32 is an eccentric adjusting member 34. Each adjusting member 34 is secured to its base 22 and held in proper adjustment by a lock nut 35. Since each eccentric member 34 can be rotated about its support point on its platform 22, it can be seen that the deflection of the resilient member 32 can be varied by this eccentric member and at the same time the weight or mass 33 is placed in any selected position to the limits of the eccentric member with respect to the switch SW.

Each mass 33 has positioned therethrough an adjusting screw 36 provided with a lock nut 37. Each adjusting screw 36 cooperates with its associated switch SW detent 38 of its actuating linkage (not shown). Through adjustment of each eccentric 34 and each adjusting screw 36 the normal bias tension of the linkage (not shown) within the switch SW can be nearly balanced causing the switch contacts to be capable of movement in response to extremely light actuating pressures.

The circuit diagram shown in Fig. 4 is a typical diagram for the purposes of illustrating how the action of each of the switch SW contacts might be used to automatically control a moving strand driving motor M and a flaw warning light 40 or other suitable warning device. As seen here the circuit diagram comprises the contacts of any one of the control switches SW, shown associated with the detecting devices of this invention, connected into a circuit comprising a source of voltage B and a stick relay 41. As shown here the circuit is in its inoperative condition, that is, with the stick relay 41 deenergized. The stick relay 41 is provided with two operating contacts 42 and 43 in addition to its stick contact 44. The contact 42 when in its closed position completes a circuit for the moving strand drive motor M provided with a suitable source of power 45. The contact 43 of the stick relay 41 completes the circuit for the warning light 40 which when closed is placed across the previously mentioned source of voltage B. In addition, the stick relay 41 is provided with an associated start reset button 46 which is capable of bypassing the stick contact 44 for initiating operation of the stick relay 41. To provide complete shutdown of the circuit, during periods of equipment shutdown, an on-off switch 47 is provided to interrupt the control stick relay 41 source of power B.

If we assume that the on-off switch 47 is closed and the operator now wishes to place the equipment in operation, the start reset button 46 is depressed completing a pick-up circuit for the stick relay 41. The pick-up circuit can be traced from the source of power B over the on-off switch 47 through the contacts of the switch SW, the winding of the stick relay 41 and the start reset switch 46 back to the source of power B. The relay 41 upon becoming energized picks up its contacts closing its front contact 42 and thus energizing the moving strand drive motor M. At the same time a back contact 43 of the stick relay 41 interrupts the energizing circuit for the warning light 40. The stick contact 44 is also closed forming a stick circuit for the stick relay 41 so that the start reset button 46 can now be released without interrupting the circuit for the relay 41.

The energized condition just described is maintained until such time contacts of the switch SW are interrupted as by a flaw passing between any two of the detector rollers 6 and 7. At this time the relay 41 energizing circuit is interrupted causing the relay contacts 42, 43 and 44 to move downwardly interrupting the circuit for the drive motor M, maintaining the stick relay 41 pick-up circuit interrupted and closing the energizing circuit for the warning light 40.

After observing and correcting the flaw which caused actuation of the contacts of the switch SW, the system can be reenergized by again depressing the start reset switch 46.

In Fig. 4, only one set of switch SW contacts are shown in the circuit. It should be clear that all of the contacts of the switch SW detector sets 3, 4 and 5 would necessarily have to be placed in series in order to have any one of the switches (SW) interrupt the control circircuit upon detection of a flaw.

Operation of the detector rollers 6 and 7 as they pass along the flaw of a moving strand will now be explained. With each detecting roller 7 mounted on resilient leaf springs 24 it can be seen that any flaw along the surface of a strand passing between the rollers 6 and 7 would cause movement of each roller 7 away from its associated roller 6 against the bias of its leaf springs 24. This rapid movement of each roller 7 outwardly away from each roller 6 is delivered to each platform 22 and the body of each switch SW. Each mass 33, however, being mounted on a leaf spring 32, is not immediately effected by the movement of its associated platform 22. Each switch SW therefore lags platform 22 movement and allows its detent 38 to move outwardly causing actuation of its contacts. The action of each switch SW in response to a flaw on a strand passing between the rollers or detectors 6 and 7 can be adjusted by each eccentric 34 and adjusting screw 36 to cause detent 38 operation on very minor or on more severe flaws only.

Adjustment of the screws 26 by the handles 27 can be made to a pressure bias level capable of providing a smoothing of minor flaws within the moving strand to the extent desired by the operator. Each eccentric 34 and adjusting screw 36 can then be adjusted to allow such minor flaws to pass between the wheels or rollers 6 and 7 without detection.

The rollers 6 and 7 of the detector set 3 are provided with grooves 8, of suitable shape such as V-shape, for the purpose of spanning the width of a rectangular strand or wire passing through the flaw detecting device. In this manner, the rollers 6 and 7 of the detector set 3 can detect any flaws on the corners of a square or rectangular conductor passing therebetween.

The rollers 6 and 7 of the detector sets 4 and 5, however, are (as previously stated) provided with smooth surfaces, and with the detector 4 positioned 90° to the detetcor 5 these rollers can detect flaws on the four surfaces of a rectangular moving strand.

As shown in the particular environment set forth in this disclosure, the detector device 4 is not provided with an adjustable spindle for its rigid supported roller 6. This exists merely as a matter of convenience since the adjusting mechanism would either have to be of a complicated nature or the adjusting handle would have to be positioned underneath the platform 1.

As shown here the detecting rollers 6 and 7 are provided with smooth or grooved surfaces to accommodate a particular style of moving strand. It should be clear, however, that the surfaces of these rollers may be varied to accommodate different shapes and styles of moving strands. In some circumstances, it may also be desirable to angle the pivot point of each of the rollers 6 and 7 to accommodate non-symmetrical moving strands.

Although there is shown only one embodiment of this invention, it should be clear that modifications may be made within the spirit and scope of the invention.

I claim as my invention:

1. An elongated moving member flaw detecting device comprising; a pair of opposing rollers, a base, one of said pair of rollers being firmly supported on said base, spring means resiliently supporting the other of said rollers

on said base, means for adjusting said one roller on said base to vary the relative position of said one roller with respect to said other roller, and circuit controller means secured to said resiliently mounted roller for response to resilient mounted roller movement due to a passing flaw, said circuit controller means comprising contacts, a mass resiliently mounted to actuate said contacts, said mass being operated in response to said roller movement.

2. An elongated moving member flaw detecting device comprising; a pair of opposing rollers, a base, one of said pair of rollers being firmly supported on said base, spring means resiliently supporting the other of said rollers on said base, means for adjusting said one roller on said base to vary the relative position of said one roller with respect to said other roller, and circuit controller means secured to said resiliently mounted roller for response to resilient mounted roller movement due to a passing flaw, said circuit controller means comprising contacts, a mass resiliently mounted to actuate said contacts in response to relative movement of the circuit controller and mass, and means for regulating the sensitivity of said pair of contacts for response to said relative movement of the circuit controller and mass.

3. A flaw detector for a moving elongated strand of quadrangular cross section comprising; a plurality of pairs of opposing rollers, each pair of opposing rollers being provided with one rigidly supported roller and an opposing roller resiliently biased toward its opposing rigidly supported roller, means for adjusting the bias between said opposing rollers of said plurality of pairs of rollers, a V-shaped groove in the periphery of each of the opposing rollers of one pair of said plurality of opposing rollers, each said V-shaped groove being sufficiently wide to span adjacent corners of said moving strand, the remaining pairs of said plurality of opposing rollers being positioned to contact opposing surfaces of said moving strand, and controller means responsive to said plurality of pairs of opposing rollers for detecting a passing flaw in said moving strand, said controller means comprising a circuit controller with each said pair of opposing rollers, control mass means on each said circuit controller for causing actuation of each said circuit controller in response to a passing flaw.

4. A flaw detector for a moving elongated strand of quadrangular cross section comprising, a plurality of pairs of opposing rollers, each pair of opposing rollers being provided with one rigidly supported roller and an opposing roller resiliently biased toward its opposing rigidly supported roller, means for adjusting the bias between said opposing rollers of said plurality of pairs

of rollers, a V-shaped groove in the periphery of each of the opposing rollers of one pair of said plurality of opposing rollers, each said V-shaped groove being sufficiently wide to span adjacent corners of said moving strand, the remaining pairs of said plurality of opposing rollers being positioned to contact opposing surfaces of said moving strand, and controller means responsive to said plurality of pairs of opposing rollers for detecting a passing flaw in said moving strand, said controller means comprising a circuit controller with each said pair of opposing rollers, control mass means with each said circuit controller for striking and causing actuation of each said circuit controller in response to a passing flaw, resilient mounting for each said control mass means to allow each said control mass means to remain relatively fixed upon movement of its cooperating circuit controller during flaw passage.

5. A flaw detector for a moving elongated strand of quadrangular cross section comprising, a plurality of pairs of opposing rollers, each pair of opposing rollers being provided with one rigidly supported roller and an opposing roller resiliently biased toward its opposing rigidly supported roller, means for adjusting the bias between said opposing rollers of said plurality of pairs of rollers, a V-shaped groove in the periphery of each of the opposing rollers of one pair of said plurality of opposing rollers, each said V-shaped groove being sufficiently wide to span adjacent corners of said moving strand, the remaining pairs of said plurality of opposing rollers being positioned to contact opposing surfaces of said moving strand, and controller means responsive to said plurality of pairs of opposing rollers for detecting a passing flaw in said moving strand, said controller means comprising a circuit controller with each said pair of opposing rollers, control mass means adjacent each said circuit controller for striking and causing actuation of each said circuit controller in response to a passing flaw, resilient mounting for each said control mass means to allow each said control mass means to remain relatively fixed upon movement of its adjacent circuit controller during flaw passage, adjustable drive means on each of said control mass means for properly adjusting the sensitivity of each said circuit controller.

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