

[54] **FORWARD AND REVERSE YARN FEEDING DEVICE FOR WITHDRAWING AND PIECING YARN IN A SPINNING APPARATUS**

[75] Inventor: **Ernst Roethke**, Schorndorf, Germany

[73] Assignee: **Zinser-Textilmaschinen Gesellschaft mit beschränkter Haftung**, Ebersbach, Germany

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[58] Field of Search.....**57/34 R, 58.89-58.95, 57/80, 81**

[56] **References Cited**

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Attorney—Edwin E. Greigg

[57] **ABSTRACT**

In a spinning apparatus there is provided a yarn device which has two continuously and oppositely spaced rollers (a withdrawing roller and a reversing roller) and a pinch roller shiftable, in response to the tension of the spun yarn, into engagement with either withdrawing to advance the yarn forward from a spinning device to a winding device, or the reversing reversing to return the yarn, in case of breakage, to the spinning device for piecing. In either operative position, the pinch roller projects the space between the withdrawing roller and the reversing roller.

10 Claims, 2 Drawing Figures

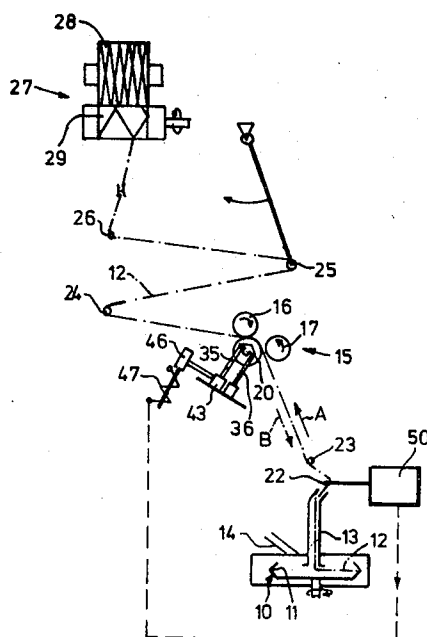
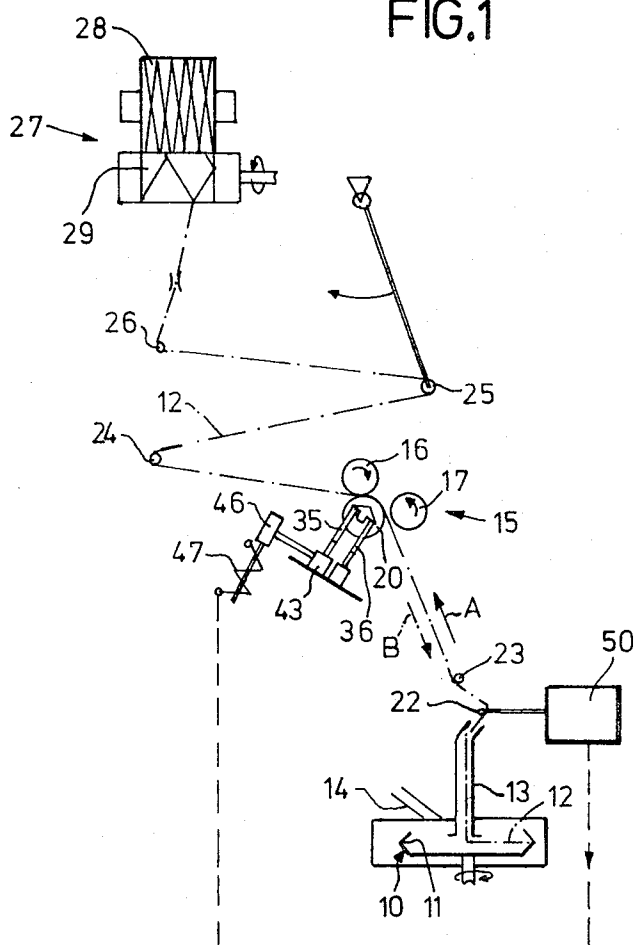


FIG. 1



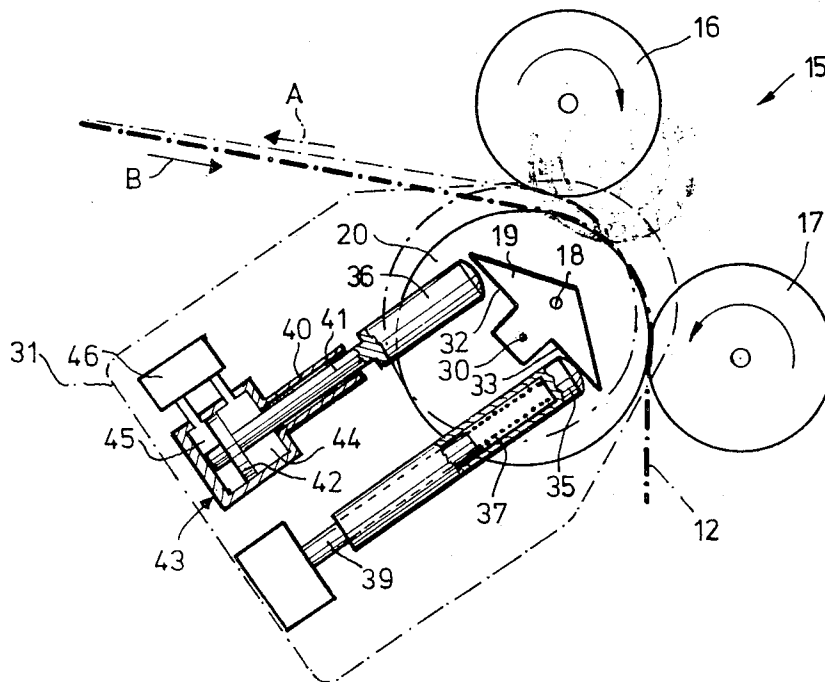


FIG. 2

FORWARD AND REVERSE YARN FEEDING DEVICE FOR WITHDRAWING AND PIECING YARN IN A SPINNING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to a device which, in an opened spinning apparatus, effects, on the one hand, the withdrawal of the spun yarn from the spinning turbine by means of a continuously driven withdrawing roller and, on the other hand, in case of yarn breakage, the return of the yarn into the spinning turbine by means of a continuously driven reversing roller for permitting the piecing-up of the broken yarn in the spinning turbine. The withdrawing roller and the reversing roller are rotatably supported in stationary bearings. They alternately cooperate with a common, shiftable, idler pinch roller supported on a carrier which, in turn, is swingably held on a fixed pivotal shaft and which may be automatically swung thereabout by means of a control system responsive to the yarn tension. Thus, the pinch roller, as a result of yarn breakage, is brought automatically into an operative engagement with the reversing roller and, after the piecing-up is completed, it is automatically brought into an operative engagement with the withdrawing roller. The rotational axis of the pinch roller and the pivotal axis of the carrier are arranged axially parallel to one another and to the rotational axes of the reversing roller and the withdrawing roller.

In a known device of the aforementioned type, the pinch roller is radially movably held on the carrier with respect to the pivotal axis of the latter and is continuously urged, solely by a spring, in a direction away from the pivotal axis of the carrier. The pivotal axis of the carrier is disposed on that side of the rotational axis of the pinch roller which is remote from the withdrawing and reversing rollers. The distance between the pivotal axis of the carrier and the rotational axis of the pinch roller is several times greater than the diameter of the latter. The angle between the two work positions of the pinch roller relative to the pivotal axis of the carrier is, in this known device, greater than the angle between the rotational axes of the withdrawing and reversing rollers relative to the pivotal axis of the carrier. By virtue of the resilient radial support of the pinch roller on the carrier, the former is continuously pressed against the withdrawing roller or the reversing roller, as the case may be, even during its swinging motion from one work position into the other. Further, the rotational axis of the pinch roller, as the latter is moved from one work position into the other, has to be shifted through a distance which corresponds approximately to that between the rotational axes of the withdrawing and reversing rollers. Also, by virtue of the resilient support of the pinch roller, disadvantageous oscillations thereof may occur during the shift from one work position into the other. It is a particular disadvantage of the aforeoutlined device that the reversal of yarn feed necessary in the event of a yarn breakage requires a relatively long period of time since, on the one hand, the distance to be traveled by the pinch roller is relatively large and, on the other hand, the yarn is continued to be fed in the original direction through about one-half the distance between the two work positions of the pinch roller. This is so because in that distance range the yarn remains clamped continuously between the pinch roller and the withdrawing or reversing roller, as the case may be. Further, because of its resilient support the pinch

roller may be moved from one work position into the other only with relatively low speed since otherwise there appears the danger of very substantial and steep load peaks which may lie well beyond the permissible operational pressures assigned to the pinching roll.

The duration of the delay from the moment of yarn breakage until the reversal of the yarn feed has to be as short as possible for the reasons now to be discussed. In the spinning turbine a suction is generated which continuously seeks to draw the spun yarn back into the spinning turbine. This phenomenon permits an automatic piecing of the yarn subsequent to a yarn breakage. This suction is, however, effective only in a relatively short tube through which the yarn passes as it emerges from the inner chamber of the spinning turbine. When the trailing end of the broken yarn leaves the said tube, an automatic piecing of the yarn cannot be effected. The solution of making the tube longer is at variance with several other considerations, according to which the aforementioned tube should be as short as possible. Thus, the shorter the tube, the faster the reversal of the yarn feed has to be subsequent to breakage.

Also, to ensure a secure piecing of the yarn and a small thickness of the pieced-up location on the yarn, it is necessary that, after the broken yarn is reintroduced into the fiber groove of the spinning turbine, the yarn feed is again reversed as fast as possible.

In order to permit a reintroduction of the yarn into the spinning turbine subsequent to breakage, it is further necessary to form a yarn reserve in the form of a longitudinally adjustable yarn loop between the reversing roller and the winding bobbin. The reserve yarn permits the performance of several, immediately successive piecing attempts. Thus, to ensure that the length of the reserve yarn for this operation is as short as possible, the delay between the start of the reverse feed of the yarn and the subsequent switching to its forward feed, should be very short.

OBJECT, SUMMARY AND ADVANTAGES OF THE INVENTION

It is an object of the invention to provide a structurally simple and operationally safe device of the aforementioned type, which permits a particularly rapid, yet gentle reversal of the yarn feed both after a yarn breakage and following the subsequent piecing of the yarn and which is free from the discussed disadvantages inherent in known devices.

Briefly stated, according to the invention, the rotational support of the pinch roller is stationarily affixed on the swingable carrier and further, the pincher roller in both of its work positions, projects into the space between the withdrawing roller and the reversing roller.

The aforementioned structural arrangement makes it possible that the extent of shift of the rotational axis of the pinch roller between its two work positions is very small, preferably not more than 5 mm, and may be as little as only slightly more than the thickness of the yarn.

Further, the pinch roller is disengaged from its associated withdrawing or reversing roller during each change from one work position into the other immediately after beginning of its switching motion and is moved freely towards the other cylinder, so that immediately after the beginning of a switching motion to re-

verse the yarn feed, there is no clamping action on the yarn.

With an arrangement according to the invention it is further possible to advantageously maintain the transversal motion of the yarn during the switch-over of the pinch roller at a very small value. The yarn may be trained about the pinch roller through a quite substantial angle without the appearance of an undesirably significant increase in the aforementioned transversal motion of the yarn.

Further, without any disadvantage, the pinch roller may be caused to apply relatively large pressures on the engaged driven rollers to ensure a secure, non-slip yarn feed in either direction and also to expedite the reversal of the yarn feed by rapidly reversing the rotation of the pinch roller by virtue of the substantial engaging pressure between the pinch roller and the withdrawing or reversing roller.

The device according to the invention permits an overall simplification of significant portions of the entire open-end spinning apparatus. The yarn reserve may be of reduced length, or, if its length is given, more immediately successively automatic piecing attempts may be made than it has been possible in devices known heretofore.

The invention will be better understood, as well as further objects and advantages of the invention become more apparent, from the ensuing detailed specification of a preferred, although exemplary, embodiment of the invention taken in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic side elevational view of an open-end spinning apparatus incorporating the invention and

FIG. 2 is an enlarged, more detailed side elevational view of a component shown in FIG. 1 and constituting a preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to FIG. 1, the apparatus schematically shown therein serves for the open-end spinning of a yarn and comprises a conventional driven spinning turbine 10 having fiber grooves 11 into which opened fibers are continuously fed through a supply tube 14. The fibers are continuously spun into a yarn 12 which is withdrawn at a constant speed through a tube 13 from the housing of the spinning turbine. The yarn passes through a feeding device 15 which is constructed according to the invention and which withdraws the yarn with a constant speed from the spinning turbine 10 in direction A and which also can feed the yarn in a reverse direction B back into the spinning turbine 10.

The yarn feeding device 15 has two stationarily supported, continuously and oppositely driven rollers: a withdrawing roller 16 and a reversing roller 17. As best seen in FIG. 2, the device 15 further has a carrier 19 which is swingable about a stationary pivot 18 and which carrier 19 supports by means of a rotary bearing integral therewith, an idling pinch roller 20. By swinging the carrier 19 selectively into the one or the other direction, the pinch roller 20 may be pressed either against the withdrawing roller 16 or the reversing roller 17, so that the yarn 12 is clamped either between the pinch roller 20 and the withdrawing roller 16, in which

case it is fed in the withdrawing direction A, or it is clamped between the pinch roller 20 and the reversing roller 17 in which case the yarn is advanced in the direction of arrow B. The pinch roller 20, as well as the withdrawing roller 16 and the reversing roller 17 may be rubber-coated.

Turning once again to FIG. 1, the yarn, downstream of the outlet opening of the tube 13, passes through a continuously operating yarn tension sensor 22. Thereafter, the yarn passes through a yarn guide 23 and is then introduced into the yarn feed device 15. Then the yarn 12 is successively deflected by a stationary yarn guide 24, a resiliently and displaceably supported yarn guide 25 and a further stationary yarn guide 26. Subsequently, the yarn enters a winding device 27 which, in the presently described embodiment, is formed of a cross bobbin 28 and an associated grooved drum 29. The latter is, in a known manner, continuously driven with regulated rpm's. The rpm regulation is effected as a function of the position of the yarn guide 25 in such a manner that, at all times, the yarn guide 25 is automatically reset in its position shown.

The purpose for deflecting the yarn by means of the movable yarn guide 25 between the two stationary yarn guides 24 and 26 is to form a yarn loop constituting a yarn reserve. As soon as the yarn, after the piecing operation, is again withdrawn normally from the spinning turbine 10 by device 15, the yarn loop automatically builds up to its original extent while the grooved drum 29 temporarily rotates with a somewhat smaller rpm.

The structure and operation of the yarn feeding device 15 will now be described with particular reference to FIG. 2.

In the present embodiment, the radii of the withdrawing roller 16 and the reversing roller 17, driven continuously and with a constant rpm, are of equal magnitude. Expediently, the rpm of the reversing roller 17 may be greater than that of the withdrawing roller 16, so that a reverse feed of the yarn back into the spinning turbine 10 may be effected with an increased speed for the purpose of shortening its duration. The diameter of the pinch roller 20 is, in this embodiment, larger than those of the rollers 16, 17. As it may be well observed in FIG. 2, the pinch roller 20, regardless of its position, continuously projects into the space which extends between the reversing roller 17 and the withdrawing roller 16 and which is bounded by two planes, each in itself being tangential to both rollers 16, 17. The distance between the rotational axis 30 of the pinch roller 20 and the pivotal axis 18 of the carrier 19 is approximately one-third of the radius of the pinch roller 20 and is of a magnitude of approximately 1 cm. It may be generally said that the last-named distance is preferably smaller than one-half of the radius of the pinch roller 20. Further, it is also preferred if the last-named distance is smaller than the radius of either the withdrawing roller 16 or the reversing roller 17.

In FIG. 2 the pinch roller 20 is shown in a position in which it is pressed against the reversing roller 17 for effecting a reverse feed of the yarn 12.

The carrier 19 is supported in a stand 31 shown in dash-dotted lines and may be swung about its pivotal axis 18. It is preferred that the pivotal angle of the axis 30 related to the axis 18 be not greater than one-half the angle between the axes of the withdrawing and reversing rollers 16, 17, related to the axis 18. The last-named angle may be relatively large and is preferably

60-120°. The carrier 19 has coplanar abutment faces 32 and 33 which are situated at opposite sides of a plane defined by axes 18 and 30 and which are engageable by pusher rods 36 and 35, respectively, for causing a swinging motion of the carrier 19 and thus pressing the pinch roller 20 either against the withdrawing roller 16 or the reversing roller 17. The push rods 35 and 36 are linearly guided in parallel arranged guide means 39, 40. The push rod 35 is continuously urged by a precompressed spring 37 towards the abutment face 33. The magnitude of the spring bias is such that the pinch roller 20 is pressed against the reversing roller 17 with a clamping force necessary for clamping the yarn 12, as long as the other push rod 36 is in its withdrawn position.

The push rod 36 is fixedly attached to a piston rod 41 of a piston 42 forming part of a pneumatic power cylinder assembly 43. Both chambers 44 and 45 of the latter may be alternately pressurized from an air pressure source by means of a switching valve 46 operable by an electromagnet 47. The non-pressurized chamber is caused to communicate with the ambient atmosphere.

The yarn tension sensed by the yarn sensor 22 (FIG. 1) is transformed into an electric signal by a transducer 50. The output of the latter is applied to the electromagnet 47 which is energized if the slackness of the yarn indicates a breakage thereof in the spinning turbine 10. As soon as the yarn is pieced up, the electromagnet 47, as a result of the resumption of normal operational yarn tension, is de-energized by the transducer 50.

During normal operation, the pinch roller 20 is pressed against the withdrawing roller 16 by means of the piston-and-cylinder assembly 43, so that the yarn is withdrawn from the spinning turbine 10 with a constant speed. If there is a yarn breakage in the spinning turbine 10, the electromagnet 47 is energized and the switch valve 46 assumes a position in which the cylinder chamber 44 is pressurized. As a result, the carrier 19 moves into a position in which the pinch roller 20 is pressed against the reversing roller 17 by virtue of the spring force exerted on the push rod 35. Thus, the yarn is fed in a reverse direction (arrow B) with a constant speed. The shifting operation to effect this reversal of yarn advance has to be terminated before the yarn has left the tube 13, since only there does the vacuum prevail which is necessary to bring the yarn end back into the spinning turbine 10 while the yarn is fed in reverse by the reversing roller 17. Once the said vacuum has drawn the yarn into the spinning turbine, it is automatically positioned and pieced up in the fiber groove 11.

As soon as the yarn is pieced up in the turbine 10, the yarn tension increases and, as a result, the electromagnet 47 is de-energized, whereby the switch valve 46 assumes its alternate position. As a result, pressurized air is introduced into the cylinder chamber 45, while the cylinder chamber 44 is depressurized. The force ratios are selected in such a manner that the piston 42 which is now exposed to the pressurized air only at its side oriented towards the chamber 45, displaces the associated push rod 36 against the torque exerted by the other push rod 35 on the carrier 19 in an almost impact-like manner, resulting in a fast, clockwise swinging motion of the carrier 19. In this manner, the pinch roller 20 is very rapidly lifted off the reversing roller 17 and is pressed against the withdrawing roller 16 into its position shown in dash-dotted lines in FIG. 2. The pressure

of the pinch roller 20 on the withdrawing roller 16 is so dimensioned that the yarn 12 is clamped securely and the pinch roller 20 is brought almost in an impact-like manner to the circumferential speed of the continuously driven withdrawing roller 16, whereupon the normal withdrawal (i.e. forward feed) of the yarn from the spinning turbine 10 is resumed.

As it may be observed, the extent of shift of the pinch roller 20 is very small. It is apparent that this shift may be even smaller if the pivotal axis 18 is located closer to the rotational axis 30. Thus, the transversal motions of the yarn that occur during the swinging motion of the carrier 19 are also very small, so that the length of the yarn portion between the yarn guide 24 and the yarn sensor 22 remains practically constant during the swinging motion of the carrier 19.

By virtue of the small distance of the rotational axis 30 of the pinch roller 20 from the pivotal axis 18 of the carrier 19, the moment of inertia of this assembly is also relatively small and, accordingly, the swinging motion of the carrier 19 may occur very rapidly. It is to be added that the torque applied to the carrier 19 for effecting its swinging motion is not greater than the torque which produces the pinching pressure.

As it may be observed in FIG. 2, in this embodiment the rotational axis 30 of the pinch roller 20 is spaced from a plane which contains the pivotal axis 18 of the carrier 19 and which is parallel to a plane defined by the rotational axes of the withdrawing roller 16 and the reversing roller 17. It is feasible that for both operational positions of the pinch roller 20, its axis 30 be situated either on the one or on the other side of said plane that contains the axis 18. The arrangement in the above-described embodiment is preferred, i.e. the axis 30 is situated adjacent that side of the plane containing axis 18 which is remote from the plane containing the axes of the withdrawing and reversing rollers 16, 17. This latter arrangement permits the pinch roller 20, during the swinging motion of the carrier 19, to be lifted from one roller and moved into engagement with the other roller at a steep angle. The optimal lift-off or engaging movement of the pinch roller would be in a radial direction with respect to the rollers 16, 17. Such result could be achieved in an embodiment wherein the extent of shift of the axis 30 is slightly increased.

That which is claimed is:

1. In a forward and reverse feeding device for withdrawing and piecing yarn in an open-end spinning apparatus including a spinning turbine, the improvement comprising

- A. a continuously driven withdrawing roller having a fixed rotational axis,
- B. a continuously driven reversing roller having a fixed rotational axis and being radially spaced from said withdrawing roller,
- C. a carrier swingable about a stationary pivotal axis,
- D. an idling pinch roller rotatably supported by bearing means affixed to said carrier, the rotational axes of said pinch roller, said withdrawing roller, said reversing roller and the pivotal axis of said carrier being spaced from and parallel with one another, said pinch roller being adapted to assume a first work position in which it is in engagement with and is driven by said withdrawing roller for withdrawing said yarn from said spinning turbine in a forward feed, said pinch roller being adapted to assume a second work position in which it is in en-

gagement with and is driven by said reversing roller for reintroducing said yarn in a reverse feed into said turbine upon yarn breakage, in both said work positions said pinch roller projecting into the space between said withdrawing roller and said reversing roller,

E. actuating means connected to said carrier for causing a swinging motion thereof to move said pinch roller from one work position into the other and

F. sensor means for energizing said actuating means as a function of yarn tension to cause said pinch roller to move into said second work position upon yarn breakage and to move into said first position upon piecing of the reintroduced yarn in said spinning turbine.

2. An improvement as defined in claim 1, wherein the pivotal angle through which the rotational axis of the pinch roller is displaced to bring the latter from one work position into the other is smaller than the angle between the rotational axes of said withdrawing roller and said reversing roller relative to said pivotal axis of said carrier.

3. An improvement as defined in claim 2, wherein the first-named angle is maximum one-half of the last-named angle.

4. An improvement as defined in claim 1, wherein the distance between the rotational axis of said pinch roller and the pivotal axis of said carrier is smaller than the radius of said pinch roller.

5. An improvement as defined in claim 4, wherein said distance is smaller than one-half the radius of said pinch roller.

6. An improvement as defined in claim 1, wherein the distance between the rotational axis of said pinch roller

and the pivotal axis of said carrier is smaller than the radius of said withdrawing roller and smaller than the radius of said reversing roller.

7. An improvement as defined in claim 1, wherein the angle between the rotational axes of said withdrawing roller and said reversing roller relative to said pivotal axis is about 60-120°.

8. An improvement as defined in claim 1, wherein the rotational axis of said pinch roller is located adjacent that side of a first plane which is remote from a second plane parallel with said first plane, said first plane contains said pivotal axis of said carrier and said second plane contains the rotational axes of said withdrawing and reversing rollers.

9. An improvement as defined in claim 1, wherein the extent of motion of the rotational axis of said pinch roller between said two work positions thereof is maximum 5 mm.

10. An improvement as defined in claim 1, wherein said actuating means includes

A. a first setting member comprising an energizable power means which, when energized, applies a first torque to said carrier for moving said pinch roller into one of said work positions and forcing it into contact with one of said continuously driven rollers and

B. a second setting member comprising a spring means to continuously apply a second torque to said carrier for moving said pinch roller into the other of said work positions and forcing it into contact with the other of said continuously driven rollers, said second torque being smaller than and opposite to said first torque.

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