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(54) **Method for removing a faulty weft thread from the shed on a weaving machine, and a weaving machine which uses this method.**

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**FR-A- 2 248 353**
**FR-A- 2 537 168**
**US-A- 4 664 157**

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## Description

This invention concerns a method for removing a faulty weft thread from the shed on a weaving machine, and also a weaving machine which uses this method. In particular, the invention concerns a method for separating weft threads which are tangled in the warp threads and removing them from the shed.

Dutch patent application No. 86.02191 published on the 16.03.88 and made by the present applicant describes or it also appear from the preamble of claim 1 a method for separating a beaten-up weft thread from the fell line and removing it from the shed. In this known method, the faulty weft section is not cut free from the weft supply, so that when a new length of weft thread is inserted the faulty weft section forms a loop which moves towards the end of the shed.

This method has the disadvantage that it is not suitable for separating faulty weft sections which for some reason or other have become caught up at the fell line, for example by becoming entangled in the warp threads. This is because by introducing a new length of weft thread only a very small tractive force can be exerted on the faulty weft section, and this force is insufficient to remove a weft thread which has become entangled in the warp threads. Furthermore, in most cases formation of a loop results in the tangled thread becoming even more firmly entangled.

The present invention has as its object a method and a weaving machine which uses this method, which provides a systematic solution to said disadvantage.

For this purpose, the method according to the invention for removing a faulty weft thread from the shed on a weaving machine, in which an attempt is made to separate the faulty weft section from the fell line by inserting a new weft thread in the form of a loop and then removing it from the shed at the receiving side of the shed, consists essentially of detecting whether the weft section has indeed been removed, and, if this does not appear to be the case, successively removing the newly inserted weft thread, from the picking or inserting side of the shed, drawing free the faulty, tangled weft section from the picking side of the shed, and so removing this section from the shed. It is clear that, in the case where a weft thread has become entangled by its free end, by inserting a new weft thread in the form of a loop said faulty weft thread lies free in the shed along its whole length, apart from the tangled end. This offers the advantage that it is no longer necessary to draw free the whole section of thread, but only its tangled end.

In order to explain the characteristics of the invention, by way of example only and without being limitative in any way, the following preferred embodiments are described with reference to the accompanying drawings, where :

— fig. 1 shows the weft insertion mechanism of a weaving machine according to the invention, in which there is a faulty weft thread ;

— figs. 2 and 3 show schematically the steps, for the same weft insertion mechanism, in which a faulty weft section is removed from the shed by inserting a new weft thread ;

— figs. 4 to 6 show, for the same weft insertion mechanism, the steps of the method according to the present invention ;

— fig. 7 shows a variant of the weft insertion mechanism in fig. 1.

Fig. 1 shows a weft insertion mechanism of a weaving machine according to the present invention. The conventional elements and components to be found in such a weft insertion mechanism are, as is commonly known, a yarn package 1, the weft thread 2 drawn from the yarn package, a weft accumulator mechanism such as e.g. a prewinder 3, insertion devices such as e.g. a main nozzle 4 and relay nozzles 5, the woven cloth 6, the warp threads 7, the cloth fell or fell line 8, the reed 9, the weft detector 10, the shed 11 and a cutting device 12 which operates on the weft thread 2 at the picking side 13 of the shed 11.

In the present invention, use is made of a thread reversing device 14 which is mounted at the picking side 13 of the shed 11 and which can be presented to the weft thread 2. This thread reversing device 14 consists of a winder which has a number of pins or fingers 15, for instance around the circumference of a circle, so that when it is turned the thread is wound up.

Another important characteristic of the invention consists of a special detection device 17 which is mounted at the receiving side 16 of the shed 11, and which, as is explained in greater detail below, can differentiate between a section of thread coming directly from the main nozzle 4 and a thread section coming from the direction of the fell line 8.

As shown in the figures, this detection device 17 consists preferrably of a nozzle (18), for example a suction nozzle in the form of a flattened pipe, with a thread detector 20 on the side 19 nearest the cloth fell 8, while mounted centrally in the nozzle 18 there should preferrably be a blower nozzle 21.

Mounted behind the first thread detector 20 there should preferrably be a second thread detector 22. Detector 20 serves to detect a thread 2 coming from the cloth fell 8, while detector 22 serves to detect a thread coming from the main nozzle 4.

Here it should be noted that if the suction force of suction nozzle 18 is sufficiently great, then the blower nozzle 21 is not necessary. Conversely, the suction nozzle can be dispensed with and only a pipe with a blower nozzle 21 used. It should also be noted that the detectors 20 and 22 may or may not each be formed by two components mounted diametrically opposite each other (as shown for detector 22), where these two-component detectors can be mounted horizon-

tally and vertically in any plane.

The method by which a mechanism such as described above works is essentially as follows.

In the example shown in fig. 1, a break 23 has occurred in the weft thread 2 which has already been beaten up. In the shed there are thus two faulty weft sections, 24 and 25 respectively. The presence of a faulty weft section 25 can in this case be detected by the fact that the end 26 of the weft section 25 reaches to at least one of the above-mentioned thread detectors 20-22.

Removal of the faulty weft section 25 can in this case be carried out as described in Dutch patent application No. 86.02827 made by the present applicant, in which the weft section concerned 25, as shown by the dotted line in fig. 1, can be separated and in this case evacuated by means of the suction nozzle 18.

The first faulty weft section 24 can, as described in Dutch patent application No. 86.02191 made by the present applicant and as shown in fig. 2, be separated from the cloth fell 8 and removed from the shed in the form of a loop 27 by inserting a new length of weft thread 2 into the shed.

From fig. 2 it is clear that the detection device 17, in particualr the thread detector 20, detects the section of thread 28 coming from the cloth fell 8, but not necessarily the section of thread 29 coming directly from the main nozzle 4.

If the procedure for removing the faulty weft section 24 is carried out correctly, then obviously after a short space of time the thread detector 20 will not detect a thread any more, as shown in fig. 3. At that moment the cutting device 12 can operate so that the weft section 2, present in the shed 11 and extending into the nozzle 18 and beyond, is cut and removed. In this case detector 20 checks whether the weft thread section 24 has in fact been removed. The weaving machine can then be restarted.

A very important characteristic of the invention is illustrated in figs. 4 to 6, which show a method for removing the above-mentioned faulty weft section 24 from the shed if for any reason it should be come caught or tangled in the shed 11 at a particular point 30, for instance between the warp threads 7. In such a case a new weft thread inserted in the form of a loop 27 cannot exert sufficient tractive force to pull the faulty weft section 24 free. The result is that after a certain new length of weft thread has been inserted, or after a certain time interval, thread detector 20 still detects a thread, thus indicating that the weft section concerned 24 has not come free.

In such a case according to the invention the thread reversing device 14 is activated.

As shown in fig. 5, at that moment the winding device 14 is presented at the picking side 13 to the weft thread 2, the newly-inserted weft thread is wound up, the tangle is freed and the faulty weft section 24 is removed from the shed. Obviously in this case both the weft thread 2 from the shed 11 and the weft thread from the prewinder are wound up, so that the prewinder 3 must provide for a number of turns being released.

Finally, as shown in fig. 6, the weft thread 2 is cut, in this case behind the main nozzle 4, and then the extracted, wound-up length of thread 31 is evacuated.

Fig. 7 shows a variant of the thread reversing device, which in this case consists of a reversing nozzle 32 mounted before the main nozzle 4, by means of which the faulty weft section 24 can be removed.

Clearly, the reversing nozzle 32 can also be used in combination with the above-mentioned reversing winder 14, in which case the reversing nozzle 32 ensures that the faulty weft section 24 is partly extracted, so forming a certain reserve 33, after which the reversing winder 14 operates and winds a few turns. Since there is a thread reserve 33, in this case no turns have to taken from the prewinder while the reversing winder 14 is operating, and clip 34 can be closed. After the reversing winder 14 has made a few turns, the weft thread 2 can be cut by the cutting device 12 and the rest of the faulty weft section 24 can be wound up and drawn free.

If a mechanism 35 for measuring the thread tension is added, then the thread reversing device 14 or 32 can be deactivated whenever the tension rises above a set threshold. This offers the advantage that the tractive force exerted on the weft thread is set according to the breaking strength of the thread 2, thus making it unlikely that the faulty weft section 24 will break. If the thread still does not come free at the maximum set tension, a signal can be given so that the weaver can intervene manually.

Clearly, the sequence in which the various actions involved in removing the thread are carried out must be determined by a control unit 36 or suchlike, which interprets the signals from the detectors 20, 22 and 35 and controls the operation of all the above-mentioned mechanisms. For this purpose, during the execution of the method the information from these detectors can for example be stored in a memory and/or passed on directly to the control unit.

## Claims

1. Method for removing a faulty weft thread from the shed on a weaving machine, in which an attempt is made to separate a faulty weft section (24) from the cloth fell (8) by inserting a new weft thread (2) in the form of a loop (27) and then remove it from the shed (11) at the receiving side (16) of the shed (11), characterised in that this method consists of detecting whether this weft section (24) has indeed been removed, and if this does not appear to be the case, successively removing the newly-inserted weft thread

(2) from the picking or inserting side (13) of the shed (11), and drawing free the tangled, faulty weft section (24) from the picking side (13) of the shed (11), thus removing this section (24) from the shed (11).

2. Method as in claim 1, characterised in that in order to determine whether the weft thread concerned (24) has indeed been freed, the above-mentioned detection is carried out by drawing the weft thread (2), respectively the faulty weft section (24), up into a nozzle (18) which is mounted at the receiving side (16) of the shed (11) and which contains a thread detector (20), such that a continuous signal from the detector (20) indicates that said faulty weft section (24) has not come free.

3. Method as in claim 1 or 2, characterised in that drawing free the weft thread (2), respectively the faulty weft section (24), from the shed (11) at the receiving side (13) is done by means of a thread reversing device (14, 32) which can operate on the weft thread (2).

4. Method as in claim 3, characterised in that while the weft thread is being drawn free, the thread tension is measured by a detector (35).

5. Method as in claim 4, characterised in that while the weft thread is being drawn free, the thread tension is monitored so that the automatic extraction procedure is halted as soon as the maximum setting is reached.

6. Method as in claim 3, characterised in that use is made of a thread reversing device consisting of a winding device (14) which is presented between the main nozzle (4) of the weaving machine and the picking side (13) of the shed (11).

7. Method as in claim 3, characterised in that the thread reversing device consists of a reversing nozzle (32) mounted before the main nozzle (4) and which is activated during extraction of a weft thread.

8. Weaving machine which uses the method according to one of the above claims, characterised in that it has a weft insertion mechanism with a thread reversing device (14, 32) at the picking side (13) of the shed (11), while at the receiving side (16) is mounted a detection mechanism (17) which can differentiate between respectively the section of weft thread (29) leading directly through the shed (11) from the picking side (13) and a thread section (28) oriented towards the cloth fell (8).

9. Weaving machine as in claim 8, characterised in that the detection mechanism (17) consists of a suction nozzle (18).

10. Weaving machine as in claim 8, characterised in that the above-mentioned detection mechanism (17) consists essentially of a combination of a suction nozzle (18) and a thread detector (20) mounted on the wall (19) of the suction nozzle (18).

11. Weaving machine as in claim 8, characterised in that the above-mentioned detection mechanism consists of a combination of a suction nozzle (18) with a first (20) thread detector mounted on the wall (19) of the suction nozzle (18) and a second thread detector (22).

12. Weaving machine as in claim 8, characterised in that the above-mentioned detection mechanism (17) consists essentially of a combination of a suction nozzle (18), a thread detector (20) mounted on the wall (19) of the suction nozzle (18) and a blower (21) mounted centrally in the suction nozzle (18).

13. Weaving machine as in claim 8, characterised in that the above-mentioned detection mechanism (17) consists essentially of a combination of a suction nozzle (18) with a first thread detector (20) mounted on the wall (19) of the suction nozzle (18) and a second thread detector (22).

14. Weaving machine as in claim 8, characterised in that in addition to the detection mechanism (17) mounted beside the receiving side, there is also a mechanism (35) at the picking side, for measuring the thread tension while a weft thread is being drawn free, and that there is a control unit (36) which determines the thread removal actions to be taken on the basis of the signals from all the detection mechanisms (17, 35).

15. Weaving machine as in claim 14, characterised in that the above-mentioned signals are stored in a memory, in order for them to be passed on to a processing unit.

**Patentansprüche**

1. Ein Verfahren zum Entfernen eines gebrochenen Schußfadens aus dem Fach auf einer Webmaschine, wobei versucht wird, einen gebrochenen Schußfadenabschnitt (24) von der Schußanschlaglinie (8) zu trennen, indem man einen neuen Schußfaden (2) in der Form einer Schlinge (27) einträgt und ihn dann an der Aufnahmeseite (16) des Faches (11) aus dem Fach (11) entfernt, gekennzeichnet dadurch, daß dieses Verfahren daraus besteht zu ermitteln, ob dieser Schußfadenabschnitt (24) tatsächlich entfernt wurde und, wenn dies nicht der Fall zu sein scheint, nacheinander den neu eingetragenen Schußfaden (2) von der Schuß- oder Eintragsseite (13) des Faches (11) entfernt und den verhedderten, gebrochenen Schußfadenabschnitt (24) an der Schußseite (13) des Faches (11) herauszieht und so diesen Abschnitt (24) aus dem Fach (11) entfernt.

2. Das Verfahren gemäß Anspruch 1, gekennzeichnet dadurch, daß zur Feststellung, ob der betroffene Schußfaden (24) tatsächlich freigelegt wurde, die oben erwähnte Ermittlung ausgeführt wird, indem man den Schußfaden (2) beziehungsweise den gebrochenen Schußfadenabschnitt (24) in eine Düse (18) zieht, die an der Aufnahmeseite (16) des Faches (11) angebracht ist und die einen Fadendetektor (20) aufweist, so daß ein kontinuierliches Signal von dem

Detektor (20) anzeigt, daß der erwähnte gebrochene Schußfadenabschnitt (24) nicht freigekommen ist.

3. Das Verfahren gemäß Anspruch 1 oder 2, gekennzeichnet dadurch, daß das Herausziehen des Schußfadens (2) beziehungsweise des gebrochenen Schußfadenabschnitts (24) an der Aufnahmeseite (13) aus dem Fach (11) mittels einer Fadenumkehrvorrichtung (14, 32) erfolgt, die an dem Schußfaden (2) arbeiten kann.

4. Das Verfahren gemäß Anspruch 3, gekennzeichnet dadurch, daß während des Herausziehens des Schußfadens die Fadenspannung von einem Detektor (35) gemessen wird.

5. Das Verfahren gemäß Anspruch 4, gekennzeichnet dadurch, daß während des Herausziehens des Schußfadens die Fadenspannung überwacht wird, so daß das automatische Absaugverfahren gestoppt wird, sobald die maximale Einstellung erreicht ist.

6. Das Verfahren gemäß Anspruch 3, gekennzeichnet dadurch, daß die Fadenumkehrvorrichtung aus einer Wickelvorrichtung (14) besteht, die zwischen der Hauptdüse (4) der Webmaschine und der Schußseite (13) des Faches (11) präsentiert wird.

7. Das Verfahren gemäß Anspruch 3, gekennzeichnet dadurch, daß die Fadenumkehrvorrichtung aus einer Umkehrdüse (32) besteht, die vor der Hauptdüse (4) angebracht ist und die während der Absaugung eines Schußfadens aktiviert wird.

8. Eine Webmaschine, die das Verfahren gemäß einem der vorgenannten Ansprüche verwendet, gekennzeichnet dadurch, daß sie an der Schußseite (13) des Faches (11) einen Schußeintragsmechanismus mit einer Fadenumkehrvorrichtung (14, 32) aufweist, während an der Aufnahmeseite (16) ein Detektionsmechanismus (17) angebracht ist, der zwischen dem Schußfadenabschnitt, (29), der von der Schußseite (13) direkt durch das Fach (11) führt und einem zur Schußanschlaglinie (8) führenden Fadenabschnitt (28) unterscheiden kann.

9. Die Webmaschine gemäß Anspruch 8, gekennzeichnet dadurch, daß der Detektionsmechanismus (17) aus einer Saugdüse (18) besteht.

10. Die Webmaschine gemäß Anspruch 8, gekennzeichnet dadurch, daß der oben erwähnte Detektionsmechanismus (17) im wesentlichen aus der Kombination einer Saugdüse (18) und eines an der Wand (19) der Saugdüse (18) angebrachten Fadendetektors (20) besteht.

11. Die Webmaschine gemäß Anspruch 8, gekennzeichnet dadurch, daß der oben erwähnte Detektionsmechanismus aus der Kombination einer Saugdüse (18) mit einem ersten (20), an der Wand (19) der Saugdüse (18) angebrachten Fadendetektor und eines zweiten Fadendetektors (22) besteht.

12. Die Webmaschine gemäß Anspruch 8, gekennzeichnet dadurch, daß der oben erwähnte Detektionsmechanismus (17) im wesentlichen aus der Kombination einer Saugdüse (18), eines an der Wand (19) der Saugdüse (18) angebrachten Fadendetektors (20) und eines zentral in der Saugdüse (18) angebrachten Gebläses (21) besteht.

13. Die Webmaschine gemäß Anspruch 8, gekennzeichnet dadurch, daß der oben erwähnte Detektionsmechanismus (17) im wesentlichen aus der Kombination einer Saugdüse (18) mit einem ersten, an der Wand (19) der Saugdüse (18) angebrachten Fadendetektor (20) und eines zweiten Fadendetektors (22) besteht.

14. Die Webmaschine gemäß Anspruch 8, gekennzeichnet dadurch, daß zusätzlich zu dem neben der Aufnahmeseite angebrachten Detektionsmechanismus (17) ein weiterer Mechanismus (35) an der Schußseite zum Messen der Fadenspannung während des Herausziehens eines Schußfadens vorhanden ist und daß eine Steuereinheit (36) vorhanden ist, die anhand der Signale von allen Detektionsmechanismen (17, 35) bestimmt, welche Fadenentfernungsaktionen unternommen werden.

15. Die Webmaschine gemäß Anspruch 14, gekennzeichnet dadurch, daß die oben erwähnten Signale in einem Speicher festgehalten werden, um sie an eine Verarbeitungseinheit weiterzuleiten.

## Revendications

1. Méthode pour enlever un fil de trame défectueux de la foule d'une machine à tisser, dans laquelle il est procédé à un essai de séparer une section de trame défectueuse (24) de la ligne de battage (8) en insérant un nouveau fil de trame (2) sous la forme d'une boucle (27), et de l'enlever ensuite de la foule (11) du côté de la sortie (16) de la foule (11), méthode caractérisée par le fait qu'elle se compose des opérations suivantes : détecter si cette section de trame (24) a effectivement été enlevée, et, s'il apparaît que tel n'est pas le cas, successivement enlever le nouveau fil de trame inséré (2) du côté insertion (13) de la foule (11), libérer la section de trame défectueuse et emmêlée (24) du côté insertion (13) de la foule (11), et ainsi enlever cette section (24) de la foule (11).

2. Méthode selon la revendication 1, caractérisée par le fait que dans le but de déterminer si le fil de trame concerné (24) a effectivement été enlevée, il est procédé à la détection mentionnée ci-dessus en amenant le fil de trame (2) ou la section de trame défectueuse (24), à l'intérieur d'une buse (18), montée du côté de la sortie (16) de la foule (11) et contenant un détecteur de fil (20), de telle manière qu'un signal continu émis par ce détecteur (20) indique que la section de trame défectueuse mentionnée (24) n'a pas été libérée.

3. Méthode selon la revendication 1 ou 2, caractérisée par le fait que l'enlèvement du fil de trame (2) ou de la section de trame défectueuse (24), du côté

insertion (13) de la foule (11) est réalisé au moyen d'un dispositif d'inversion de fil (14, 32) pouvant agir sur le fil de trame (2).

4. Méthode selon la revendication 3, caractérisée par le fait que pendant l'enlèvement du fil de trame (2), un détecteur (35) mesure la tension du fil.

5. Méthode selon la revendication 4, caractérisée par le fait que pendant l'enlèvement du fil de trame, la tension du fil est contrôlée de telle manière que le processus d'extraction automatique est interrompu dès que la tension atteint un seuil maximal fixé.

6. Méthode selon la revendication 3, caractérisée par le fait qu'elle utilise un dispositif d'inversion de fil qui consiste en un bobineur (14) présenté entre la buse principale (4) de la machine à tisser et le côté insertion (13) de la foule (11).

7. Méthode selon la revendication 3, caractérisée par le fait que le dispositif d'inversion de fil consiste en une buse d'inversion (32) montée avant la buse principale (4) et activée pendant l'extraction d'un fil de trame.

8. Machine à tisser appliquant la méthode selon l'une des revendications précédentes, caractérisée par le fait qu'elle dispose d'un mécanisme d'insertion de trame avec un dispositif d'inversion de fil (14, 32) du côté insertion (13) de la foule (11), ainsi que d'un dispositif de détection (17) monté du côté de la sortie (16) et permettant de faire la distinction entre la section de fil de trame (29) traversant directement la foule (11) depuis le côté insertion (13) et une section de fil (28) orientée vers la ligne de battage (8), respectivement.

9. Machine à tisser selon la revendication 8, caractérisée par le fait que le mécanisme de détection (17) est un suceur (18).

10. Machine à tisser selon la revendication 8, caractérisée par le fait que le mécanisme de détection (17) mentionné ci-dessus se compose pour l'essentiel de la combinaison d'un suceur (18) et d'un détecteur de fil (20) monté sur la paroi (19) du suceur (18).

11. Machine à tisser selon la revendication 8, caractérisée par le fait que le mécanisme de détection mentionné ci-dessus se compose de la combinaison d'un suceur (18) sur la paroi (19) duquel est monté un premier détecteur de fil (20), et d'un deuxième détecteur de fil (22).

12. Machine à tisser selon la revendication 8, caractérisée par le fait que le mécanisme de détection (17) mentionné ci-dessus se compose pour l'essentiel de la combinaison d'un suceur (18), d'un détecteur de fil (20) monté sur la paroi (19) du suceur (18) et d'un souffleur (21) monté centralement dans le suceur (18).

13. Machine à tisser selon la revendication 8, caractérisée par le fait que le mécanisme de détection (17) mentionné ci-dessus se compose pour l'essentiel de la combinaison d'un suceur (18) sur la paroi (19) duquel est monté un premier détecteur de fil (20), et d'un deuxième détecteur de fil (22).

14. Machine à tisser selon la revendication 8, caractérisée par le fait que, outre le mécanisme de détection (17) monté à côté de la sortie, un autre mécanisme (35) monté du côté insertion est destiné à mesurer la tension du fil pendant l'enlèvement d'un fil de trame, et qu'une unité de contrôle (36) détermine les actions d'enlèvement de fil à mettre en oeuvre sur la base des signaux provenant de l'ensemble des mécanismes de détection (17, 35).

15. Machine à tisser selon la revendication 14, caractérisée par le fait que les signaux mentionnés ci-dessus sont stockés dans une mémoire, de manière à pouvoir être envoyés vers une unité de traitement.

Fig.1

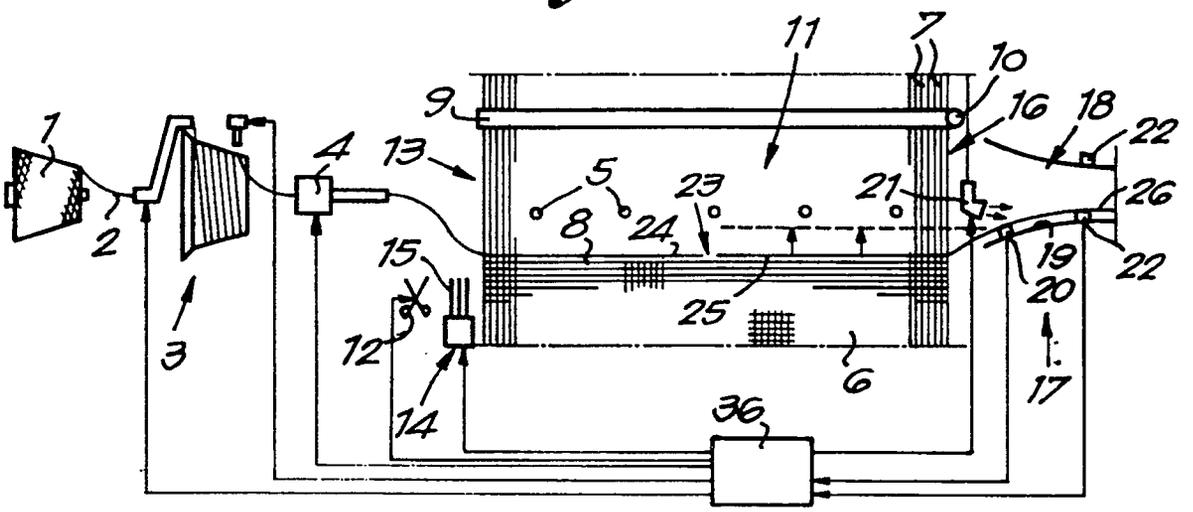



Fig.2

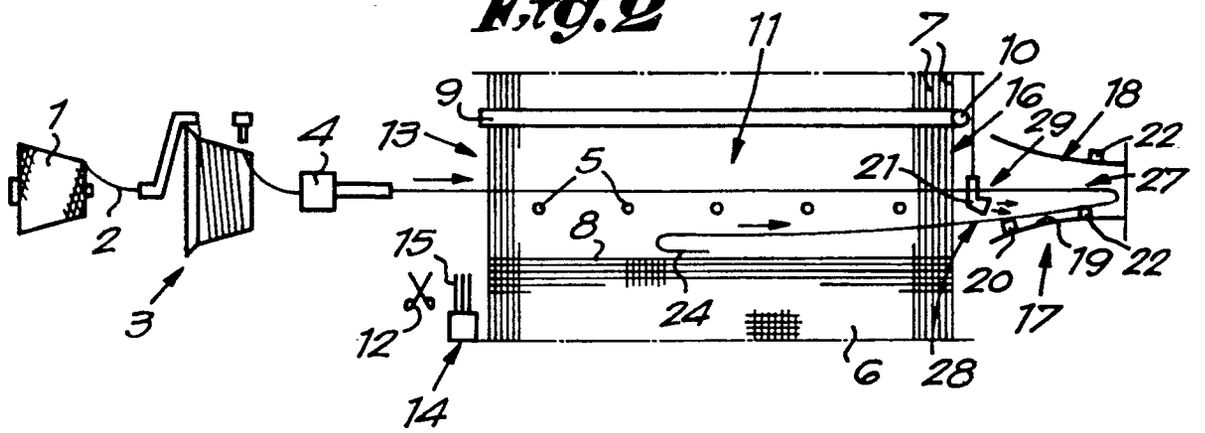



Fig.3

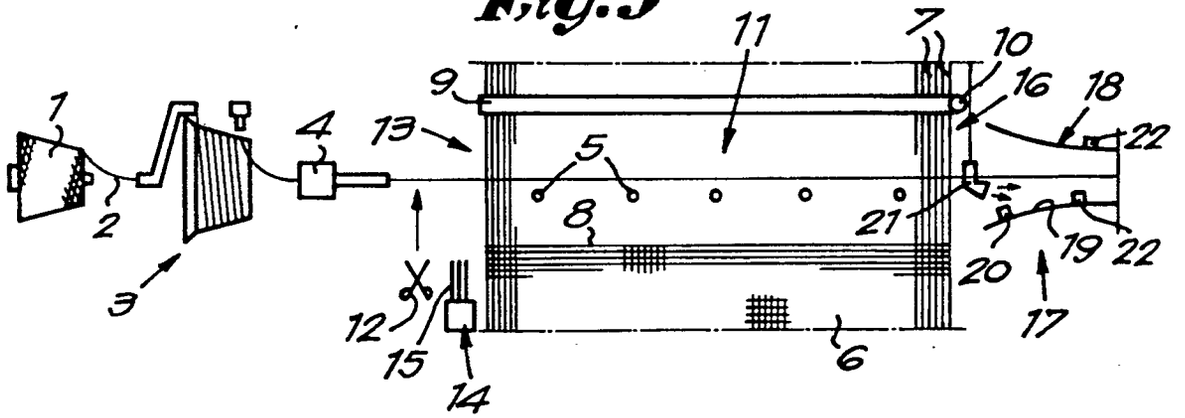


Fig.4

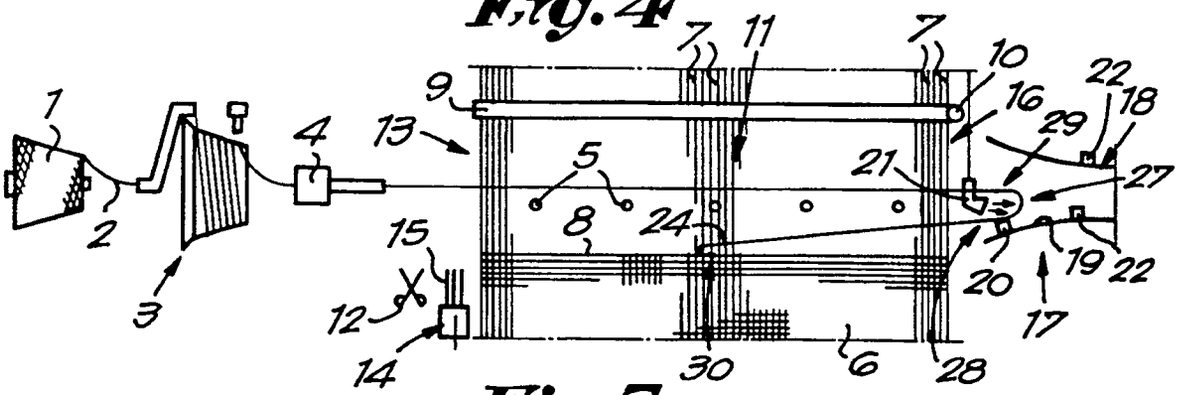



Fig.5

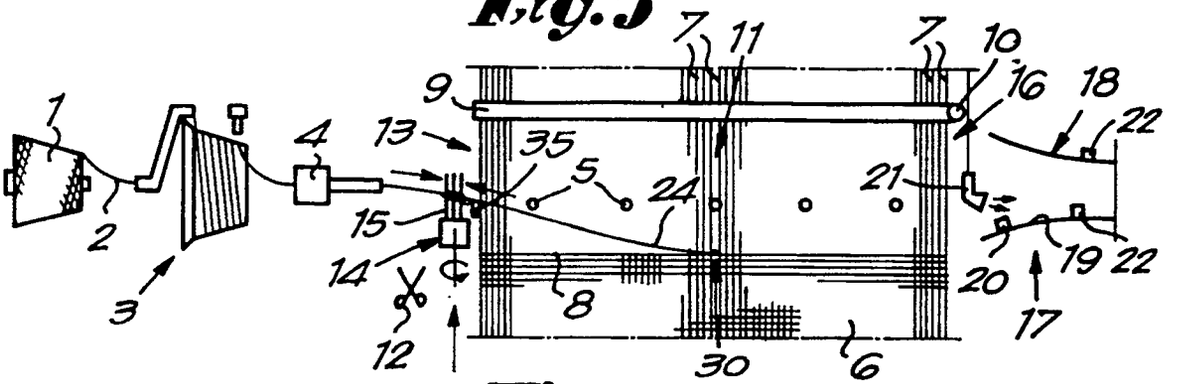



Fig.6

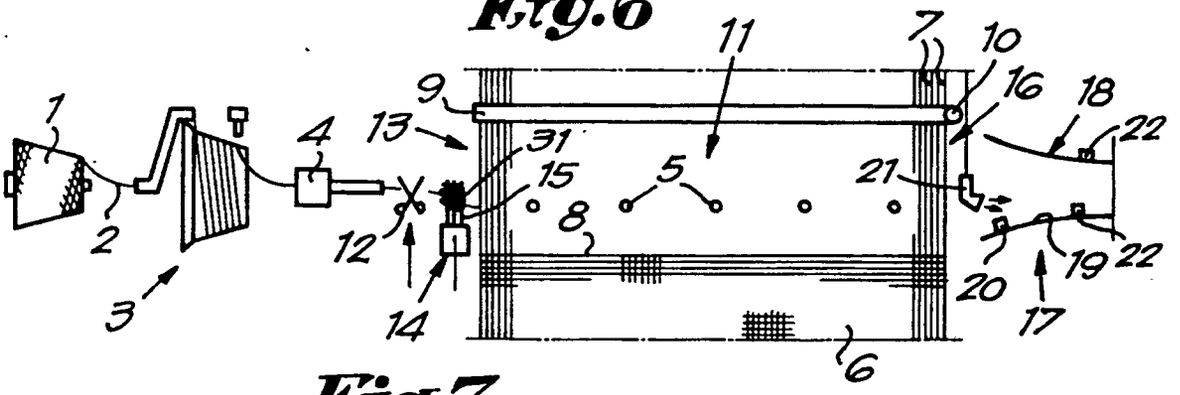



Fig.7

