June 4, 1968 M. A. W NOLAN ET AL 3,386,577

METHODS AND APPARATUS FOR SORTING MEMBERS OF DIFFERENT LENGTHS

Filed June 22, 1966 5 Sheets-Sheet 1

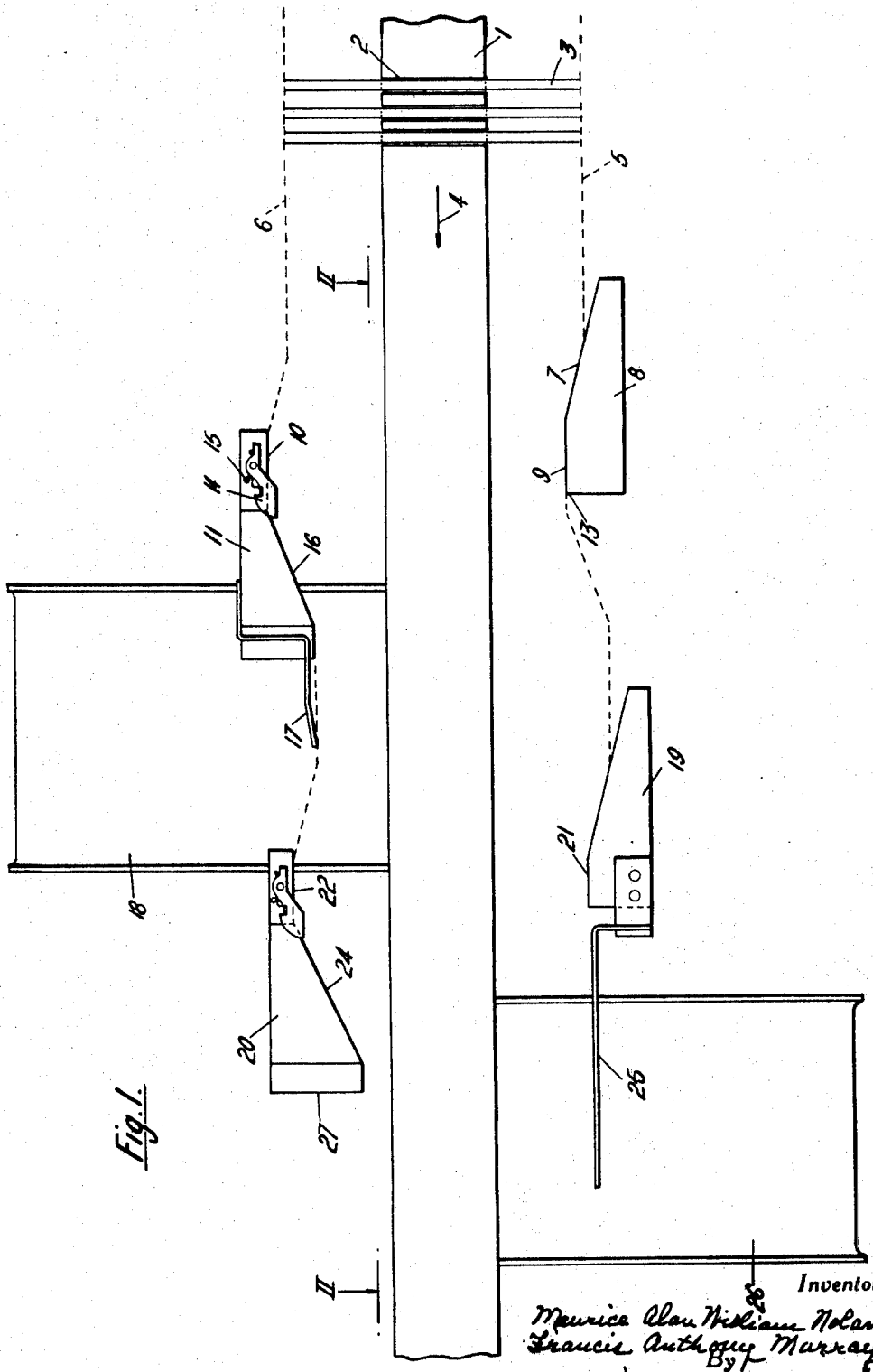


Fig. 1.

Inventors
Maurice Alan William Nolan &
Francis Anthony Murray
By
Morrison, Kennedy & Campbell Attorneys

June 4, 1968 M. A. W. NOLAN ET AL 3,386,577

METHODS AND APPARATUS FOR SORTING MEMBERS OF DIFFERENT LENGTHS

Filed June 22, 1966 5 Sheets-Sheet 2

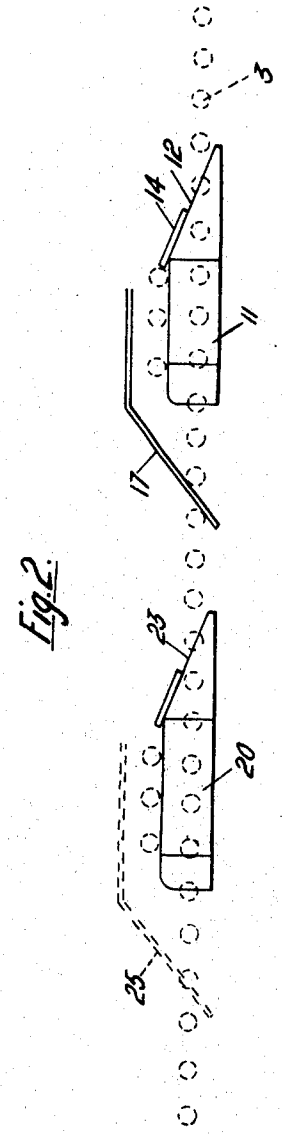


Fig. 2

Maurice Alan William Nolan and Francis Anthony Murray
Inventors

By
Morrison Kennedy & Campbell
Attorneys

June 4, 1968 M. A. W. NOLAN ET AL 3,386,577

METHODS AND APPARATUS FOR SORTING MEMBERS OF DIFFERENT LENGTHS

Filed June 22, 1966 5 Sheets-Sheet 3

Fig.3.

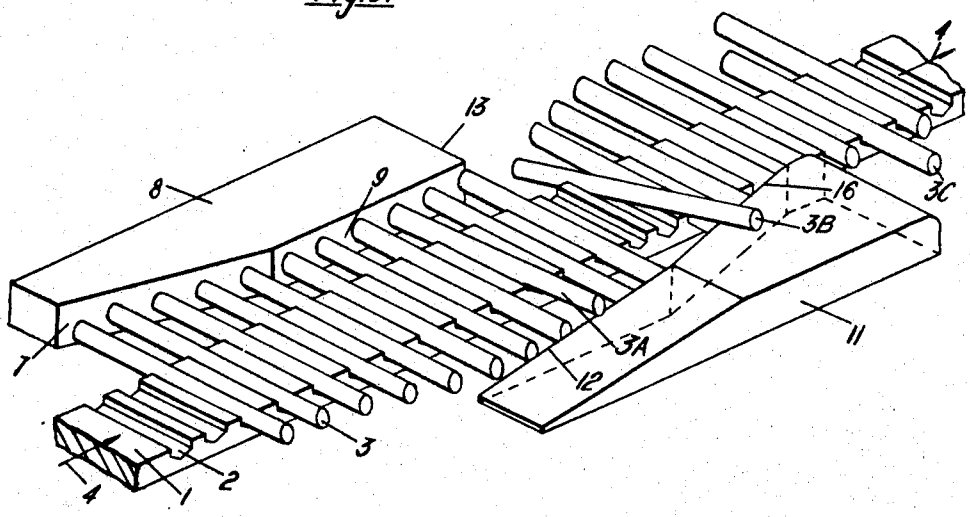
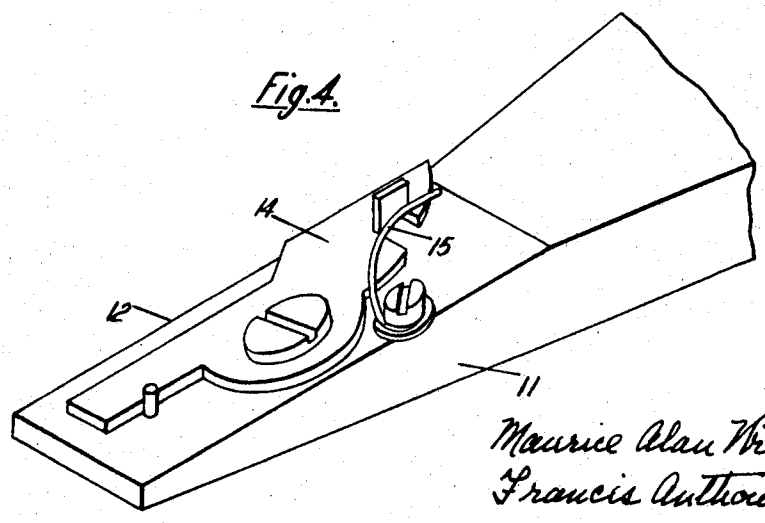


Fig.4.



Maurice Alan William Nolan
Francis Anthony Murray
Inventors

By Morrison, Kennedy & Campbell
Attorneys

June 4, 1968 M. A. W. NOLAN ET AL 3,386,577
METHODS AND APPARATUS FOR SORTING MEMBERS OF DIFFERENT LENGTHS
Filed June 22, 1966 5 Sheets-Sheet 4

Fig.5.

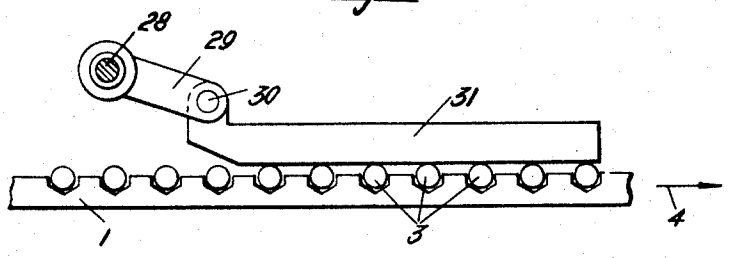
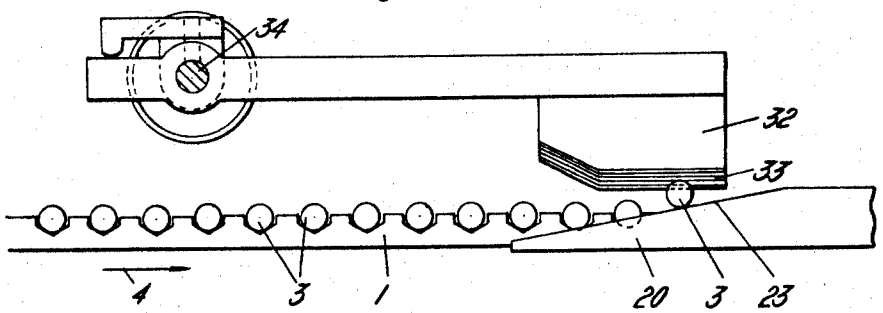


Fig.6.



Maurice Alan William Nolan and
Francis Anthony Murray
Inventors

Morrison, Kennedy & Campbell
By
Attorneys

June 4, 1968 M. A. W NOLAN ET AL 3,386,577

METHODS AND APPARATUS FOR SORTING MEMBERS OF DIFFERENT LENGTHS

Filed June 22, 1966 5 Sheets-Sheet 5

Fig.7.

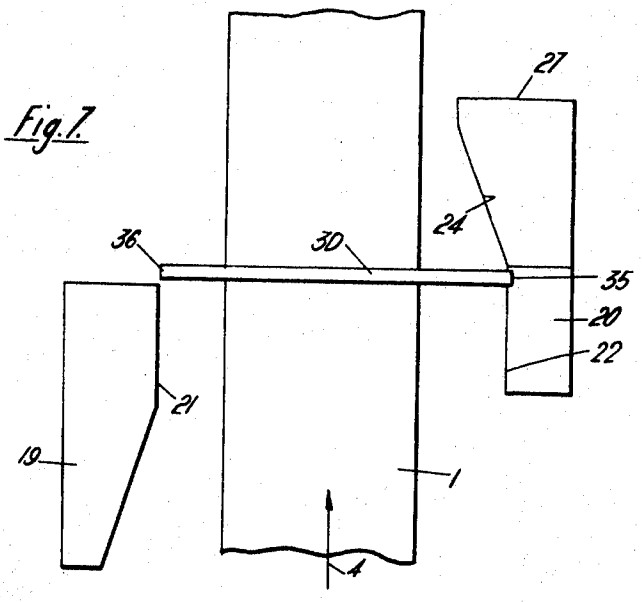


Fig.8.

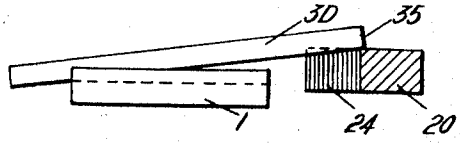


Fig.9.

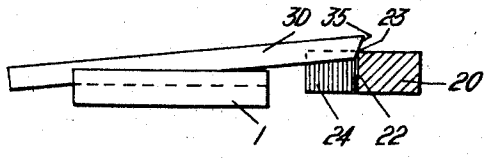
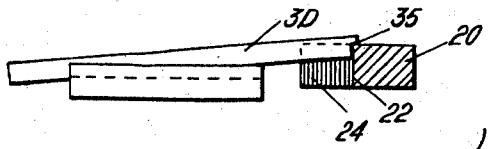


Fig.10.



Maurice Alan William Nolan &
Francis Anthony Murray
Inventors

By
Morrison, Kennedy & Campbell
Attorneys

United States Patent Office 3,386,577 Patented June 4, 1968

3,386,577

METHODS AND APPARATUS FOR SORTING MEMBERS OF DIFFERENT LENGTHS

Maurice Alan William Nolan, Leeds, England, and Francis Anthony Murray, Montonette, Cork, Ireland, assignors to Chance Brothers Limited, Birmingham, England, a corporation of Great Britain

Filed June 22, 1966, Ser. No. 559,543
10 Claims. (Cl. 209—90)

This invention relates to methods and apparatus for sorting from a series of members those members which differ in a given sense from a desired length, that is to say either the members which are longer than the desired length or members which are shorter than the desired length.

In industrial processes it happens that members having a desired shape, for example metal rods or glass tubes having a desired shape or cross-section, are formed in a continuous process and then cut to a desired length. Inevitably in such a process some of the cut members will not have exactly the length desired for a particular purpose, and it is therefore necessary to provide a method by which members differing substantially from the desired length in one or both directions may be quickly and accurately rejected from all the members produced in the process. Hitherto methods and apparatus for testing the length of members amongst a plurality of members have been complicated and have involved the use of a considerable number of moving parts which operate to check the length of the individual members.

It is a main object of the present invention to provide an improved method and apparatus for rejecting from a series of members those which differ from a desired predetermined length in a given direction, and, in accordance with the present invention, there is provided a method of sorting from a series of members of different lengths being advanced on a conveyor those members which differ in a given sense from a desired datum length, comprising the steps of advancing the members each in a transverse position on a conveyor, inclining from a horizontal position on the conveyor those members whose length exceeds a certain length, moving transversely of the conveyor those members which remain horizontal on the conveyor, and permitting the inclined members to resume a horizontal position on the conveyor so that the members having a length greater than the said certain length all project from one side of the conveyor beyond the members having a length equal to or less than the said certain length, the members of length equal to or less than the said certain length projecting beyond the members of the greater length on the other side of the conveyor.

Preferably the conveyor has a contact width less than the length of any of the members comprising the said series and the members projecting on one or other side of the conveyor are acted upon in order to tilt those members from their position on the conveyor so that they drop therefrom and are rejected while the remaining members continue to be advanced on the conveyor.

The present invention has particular application in the testing of glass tubes of different lengths and accordingly the series of members may comprise a series of glass tubes of different lengths, and the glass tubes which are inclined from a horizontal position on the conveyor are the glass tubes whose length substantially exceeds a desired predetermined length, and these glass tubes having a length substantially exceeding the said predetermined length are removed from the conveyor and rejected while the glass tubes of a length substantially equal to or less than the said desired predetermined length are further advanced on the conveyor.

Alternatively, the method in accordance with the invention may be applied to reject from a series of glass tubes of different lengths those glass tubes which have a length less than a predetermined length, and in this case, the glass tubes which are inclined from a horizontal position on the conveyor are the glass tubes whose length is at least equal to the desired predetermined length, so that these glass tubes are further advanced on the conveyor and the glass tubes having a length substantially less than the said predetermined length are removed from the conveyor and rejected.

Advantageously the method in accordance with the present invention is carried out in two stages so that in one stage the glass tubes which are longer than the predetermined length are rejected, and in another stage, the glass tubes which are shorter than the predetermined length are rejected and there remain only the glass tubes having a length substantially equal to the said predetermined length. It will be understood that in this method the rejection of too-short tubes or the rejection of too-long tubes may take place first according to preference and this particular form of the invention is to be understood to comprehend both alternatives.

In accordance with this aspect the present invention provides a method of sorting from a series of glass tubes being advanced on a conveyor those glass tubes which differ substantially from a desired predetermined length, comprising the steps of advancing the glass tubes each in a transverse position on a conveyor which has a contact width less than the length of any of the glass tubes comprising the said series, inclining from a horizontal position on the conveyor those glass tubes whose length substantially exceeds the said desired predetermined length, moving transversely of the conveyor those glass tubes which remain horizontal on the conveyor, permitting the glass tubes whose length substantially exceeds the said predetermined length to resume a horizontal position on the conveyor with their ends projecting beyond the ends of all the other tubes on the conveyor, acting on the projecting parts of the glass tubes of a length substantially exceeding the said desired predetermined length to tilt those glass tubes from their position on the conveyor so that they are removed from the conveyor, continuing to advance on the said conveyor the glass tubes having a length less than or substantially equal to the said desired predetermined length, inclining from a horizontal position on the conveyor those glass tubes of lengths substantially equal to the said desired predetermined length, moving transversely of the conveyor those glass tubes which remain horizontal thereon, permitting the inclined glass tubes of length substantially equal to the desired predetermined length to resume a horizontal position on the conveyor so that the glass tubes of length substantially equal to the said desired predetermined length project beyond the remaining glass tubes on one side of the conveyor, while the glass tubes of length substantially less than the said desired predetermined length project on the other side of the conveyor, and acting on the projecting parts of the glass tubes having a length substantially less than the said desired predetermined length to remove these glass tubes from their position on the conveyor so that there remain to be advanced on the conveyor only glass tubes of a length substantially equal to the said desired predetermined length.

The present invention also comprehends apparatus for sorting from a multiplicity of members of different lengths those members differing from a desired length in one direction, the apparatus comprising a conveyor for advancing individually all the members transversely arranged on the conveyor, positioning means for arranging one end of each of the members in a reference position, an inclined member having an inclined upper edge for raising from a substantially horizontal position on the

conveyor one end of each of the members which has a length greater than a certain length measured from said reference position, and means for displacing from their reference position all those members which remain horizontal on the conveyor so that these members project relative to the raised members on one side of the conveyor and the raised members project relative to the remaining members on the other side of the conveyor.

As already indicated, the said conveyor preferably has a contact width less than the length of any of the members and there is further provided tilting means for tilting the members projecting on one or other side of the conveyor to remove the tilted members from the conveyor.

Preferably, apparatus according to the invention is apparatus wherein said tilting means is arranged to remove from the conveyor those members which have a length substantially greater than said desired length and said apparatus further comprises a second positioning means for arranging one end of each of the remaining members in a second reference position, a second inclined member having an inclined upper edge for raising from a substantially horizontal position on the conveyor one end of each of the members having a length substantially equal to said desired length measured from said second reference position, second means for displacing longitudinally from their reference position all those members having a length substantially less than said desired length, which members remain horizontal on the conveyor so that these members project relative to the raised members on one side of the conveyor, and the raised members having a length substantially equal to said desired length project on the other side of the conveyor, and tilting means for tilting the members having a length substantially less than said desired length by acting on the parts of those members projecting beyond the other members on the said one side of the conveyor to remove the members having a length substantially shorter than said desired length from the conveyor.

The present invention further provides that the selected members having a length substantially equal to said desired length may be tested on the conveyor to check that their ends have been properly and cleanly cut. In order to carry out this check on the ends of the members, and particularly when the members are glass tubes, there is advantageously provided in apparatus according to the invention and above the conveyor at a position where the conveyor is passing the said second inclined member a frictional device for engaging the upper surface of a glass tube of which one end is raised by the inclined upper edge of the second inclined member so that the raised glass tube is rotated by the frictional device at the glass tube is advanced past said second inclined member.

Desirably there may also be provided a trailing substantially non-frictional member for engaging the upper surfaces of glass tubes which are inclined to the horizontal during their passage past either said first of said second inclined member to increase the stability of said inclined glass tubes.

The invention will be further understood from the following detailed description of a preferred embodiment thereof which is made by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic plan view of apparatus in accordance with the present invention for separating from a series of glass tubes those glass tubes which differ substantially from a desired predetermined length,

FIGURE 2 is a diagrammatic side view of part of the apparatus of FIGURE 1, the view being taken along the line II—II of FIGURE 1,

FIGURE 3 is an explanatory perspective view of part of the apparatus of FIGURES 1 and 2,

FIGURE 4 shows a detail of the apparatus of FIGURES 1 to 3.

FIGURE 5 shows an optional improvement which may be incorporated in the apparatus of FIGURES 1 to 3, and

FIGURES 6 to 10 show apparatus for testing the ends of glass tubes which are being sorted on the apparatus of FIGURES 1 to 3 to reject glass tubes having badly cut ends.

In the drawings, the same or similar parts are designated by like reference numerals.

Referring to FIGURES 1 to 3 of the accompanying drawings, there is shown a conveyor 1 having a series of grooves 2 (see FIGURE 3) which, in use, each support a middle portion of a glass tube 3. As the conveyor 1 is advanced in the direction of the arrow 4, so the series of glass tubes 3 is advanced in succession from the apparatus upon which the tubes were cut (not shown) to the next stage of the process which may, for example, be a packing process in which the glass tubes 3 having a desired predetermined length are prepared for dispatch.

When the glass tubes 3 are initially placed in the grooves 2 of the conveyor 1 after the cutting operation, the glass tubes are positioned so that their ends fall approximately in the planes denoted by the lines 5 and 6 (see FIGURE 1). In this position of advance on the conveyor 1, that end of each glass tube 3 which is near to the line 5 is brought against a positioning face 7 of a metal block 8 so that these ends of all the tubes on the conveyor 1 are lined up adjacent to a working face 9 of the block 8, the working face 9 being parallel to the direction of advance of the conveyor 1.

The working face 9 of the block 8 is directly opposite to an inspecting face 10 of another metal block 11. The inspecting face 10 of the metal block 11 has an inclined upper edge 12 as shown in FIGURE 2, and, as stated; the inspecting face 10 of the metal block 11 is directly opposite to the working face 9 of the metal block 8 so that an inspecting section is formed between the working face 9 and the inspecting face 10.

The upper edge 12 of the inspecting face 10 is below the level of the lowest part of each glass tube 3 at the time that the glass tube enters the inspecting section during its transport by the conveyor 1. By the time that the glass tube 3 is passing the end 13 of the working face 9, the upper edge 12 of the inspecting face 10 has reached a level well above the uppermost part of any glass tube 3 lying in its groove 2 on the conveyor 1.

The present distance between the working face 9 and the inspecting face 10 which together constitute the inspecting section is equal to the desired predetermined length of each glass tube 3 plus an allowed limit so that all glass tubes having a length greater than the preset distance will have one edge raised by the edge 12 of the inspecting face 10 as they pass through the inspecting section. The way in which this takes place is shown in FIGURE 3, where the glass tube 3*a* is being lifted slightly out of its groove 2 in the conveyor 1. On the other hand, all the glass tubes whose lengths are equal to or less than the said preset distance will not be engaged by the upper edge 12 of the inspecting face 10 and will pass straight through the inspecting section between the working face 9 and the inspecting face 10 without being moved at all from their horizontal positions in their respective grooves 2.

The inspecting face 10 extends in the direction of advance of the conveyor 1 beyond the end 13 of the working face 9. In order to ensure that glass tubes 3 which are only slightly longer than the said preset distance do not fall back on the conveyor 1 as soon as contact with the working face 9 is lost, there is provided a thin steel sheet member 14 which projects over the upper edge 12 of the inspecting face 10 once the upper edge 12 is of such a height as to be clear of any glass tubes which are being advanced through the inspecting section without movement from their grooves 2.

One preferred arrangement of the thin steel sheet member **14** in which the sheet member is spring-loaded by a spring **15** is shown in FIGURE 4 of the accompanying drawings. The presence of the thin steel sheet member **14** prevents the tendency of those glass tubes **3** which are only slightly longer than the preset distance being jolted back into their groove by any slight vibration on the conveyor.

By the time that a glass tube **3** has been advanced on the conveyor **1** through the inspecting section, it has been placed in a position depending on whether or not its length exceeds the preset distance. This sorting of the series of glass tubes **3** into two parts is accentuated by the angled face **16** which acts on all those glass tubes **3** which remain in their grooves on the conveyor to displace these glass tubes so that they will be advanced by the conveyor **1** in a position in which they are entirely clear of a trip wire **17**. The over-long glass tubes **3**, of which one end has been raised by the upper edge **12** of the inspecting face of the metal block **11**, will be passed above the angled face **16**, so that their lengthwise position in the groove **2** of the conveyor **1** remains unchanged and a glass tube having a length greater than the preset distance, which is not acted upon by the angled face **16**, is shown as tube **3***b* in FIGURE 3.

When the longitudinal movement of the glass tubes caused by the angled face **16** is complete, the over-long tubes which have not been subjected to this action are permitted to drop back into their grooves, as shown by tube **3***c* in FIGURE 3, and all the over-long tubes will then have their ends projecting beyond the ends of the other tubes and in fact beneath the trip wire **17** (FIGURE 1) so that as this trip wire **17** bends downwardly as shown in FIGURE 2, so the over-long tubes are tilted in their grooves until they are forced to drop down through a chute **18** which will collect all the tubes rejected because they have a length greater than the preset distance between the working face **9** and the inspecting face **10**.

As the conveyor **1** advances, the remaining glass tubes **3**, that is to say the glass tubes having at most the predetermined length plus a small allowed limit, are passed between another pair of metal blocks **19** and **20** which are essentially similar in their arrangement to the metal blocks **7** and **10** just described. The arrangement of the metal blocks **19** and **20**, however, is such that the inspecting section between the working face **21** of the metal block **19** and the inspecting face **22** of metal block **20** will differentiate between glass tubes substantially equal in length to the predetermined length and glass tubes substantially shorter than the said predetermined lengh. In other words, the preset distance between the working face **21** and the inspecting face **22** is made of the order of ½ to 1 mm. less than the said predetermined length so that all tubes longer than this preset distance will be lifted by the inclined upper edge **23** to a position similar to the positions of the tubes **3***a* and **3***b* shown in FIGURE 3, while all the glass tubes having a length less than the preset distance between the working face **21** and the inspecting face **22** will remain in their grooves as they are passed through the inspecting section and will then be displaced in their grooves by the angled face **24** of the metal block **20**.

In this case, all those glass tubes **3** which are displaced longitudinally in their grooves **2** by the angled face **24** will be subjected to the action of a trip wire **25** so that these glass tubes **3** are tilted in their grooves **2** and are forced from the conveyor **1** down a chute **26** which receives all the glass tubes rejected as being too short. The glass tubes **3** of the desired predetermined length which were raised in their grooves **2** by the upper edge **23** of the inspecting face **22** on the metal block **20** will drop back into their grooves **2** once they are clear of the end **27** of the metal block **20** and these glass tubes **3** will not be acted upon by the trip wire **25**. The glass tubes **3** having a length substantially equal to the desired predetermined length, i.e. within the allowed limits, are thus the only glass tubes which remain on the conveyor **1** after passage between the two inspecting sections, respectively between the metal blocks **8** and **11** and the metal blocks **19** and **20**.

Advantageously there is provided over the conveyor **1** as shown in FIGURE 5 a support **28** having an arm **29** to the end of which there is pivoted at **30** a member **31** arrangd to lie substantially horizontal in contact with the upper surfaces of the glass tubes **3** lying in their grooves **2** on the conveyor. The member **31** which is conveniently a metal member is arranged to lie along the upper surfaces of the glass tubes **3** as they pass through the inspecting section between the working face **9** and the in specting face **10**, and the member **31** acts to make the glass tubes **3** entirely stable in their grooves, although one end of a glass tube may be raised from part of the groove.

A further development which is advantageously incorporated with the present invention is illustrated in FIGURES 6 to 10. This development enables apparatus in accordance with the invention to detect tubes with irregular ends amongst the tubes of desired predetermined length so that these faulty glass tubes are rejected along with the tubes which are not of the desired predetermined length.

Referring to FIGURE 6 of the accompanying drawings, a block **32** having a lower surface **33** of rubber is pivotally mounted at **34** so as to engage each glass tube **3** as the glass tube **3** is raised by the upper edge **23** of the inspecting face **22** of the metal block **20**. By contrast with the metal member **31** shown in FIGURE 5 there is substantial frictional engagement between the glass tube **3** and the rubber surface **33** of the metal block **32** so that, as the glass tubes **3** are raised by the upper edge **23**, the glass tubes are caused to rotate.

It will be recalled that the glass tubes **3** which are raised by the upper edge **23** are the glass tubes **3** having a length substantially equal to the desired predetermined length.

As shown in more detail in FIGURE 7 (from which Figure the block **32** and its supporting means have been omitted for the sake of clarity), the inspecting face **22** extends further in the direction of advance of the conveyor **1** bearing the glass tubes **3** than does the working face **21**. Accordingly each glass tube **3** will be rotated in a position in which the glass tube **3***d* is shown in FIGURE 7 so that the end **35** of the glass tube is at the uppermost end of the upper edge **22** on the block **20**, while the end **36** of the same glass tube **3***d* is unsupported by the working edge **21**.

Broadly speaking, three possibilities exist with regard to the cut edge of the glass tube **3***d*, and the consequence of each of these possibilities is shown respectively in FIGURES 8, 9 and 10 of the accompanying drawings.

Referring first to FIGURE 8, there is shown a glass tube **3***d* having both ends cut perpendicularly as is desired, and with such a glass tube **3***d*, the end **35** of the glass tube will remain over the block **20** at all times so that the force exerted on the glass tube **3***d* by the block **20** will be an upthrust and the tube will continue to move over the block in an inclined position and will remain on the conveyor after the action of the trip wire **25** shown in FIGURE 1.

In FIGURE 9, however, there is shown a glass tube **3***d* having a badly cut end **35** which is a sloping cut. As a result of the rotation of the glass tube **3***d* shown in FIGURE 9, it will adopt the position in which the upper edge **23** of the inspecting face **22** is acting directly on the sloping end **35** so that there will be a force tending to move the glass tube to the left, and this force will be applied in the further transit of the tube through the angled face **24** (FIGURES 1 and 7) and the glass tube **3***d* of FIGURE 9 will drop back into its groove **2** on the conveyor **1** and will be removed from the conveyor by the action of the trip wire **25**.

Instead of the cut end of the glass tube 3*d* being a proper straight cut or a sloping cut, as shown in FIGURES 8 and 9 respectively, it can be what is known as a "finger nail" cut. This is shown in FIGURE 10 of the accompanying drawings, and the result is that the glass tube 3*d* having such a cut end **35** will become lodged on the block 20 and the glass tube 3*d* will be carried substantially in the position shown in FIGURE 10 along the upper edge of the angled face **24** until the glass tube 3*d* is dropped back into its groove. However, all that time the glass tube 3*d* of FIGURE 10 will have been moved into a position similar to that adopted by all the glass tubes **3** having a length less than the desired predetermined length so that this glass tube 3*d* with the finger nail cut will be removed from the conveyor **1** by the action of the trip wire **25**.

In the arrangement described, the means of detecting a bad end to the glass tube 3 is combined with the means for rejecting the tubes of a shorter length. It will be understood, however, that the glass tubes can be rejected by a similar apparatus independently of the arrangement for rejecting glass tubes which are too short, and in any case, with the arrangement described, a further arrangement similar to that described with reference to FIGURES 6 to 10 will be provided with the inclined face on the opposite side of the conveyor **1** to test for the other end **36** of the glass tube so as to ensure that only glass tubes which are perfectly cut on both ends will remain on the conveyor **1** and be delivered at a packing station.

Apparatus as herein described in accordance with the present invention has the advantage that it operates automatically to reject from a conveyor glass tubes which are either longer or shorter than a given specified length, without the apparatus having any moving parts. The whole operation of the inspecting the glass tubes as to their length and as to the perfection of the cut of their ends is achieved by drawing the tubes through a stationary apparatus on a conveyor **1** having lateral grooves **2**.

It has been found that apparatus substantially as herein described will sort glass tubes to obtain those which have a desired length within a range of accuracy of at least 1 mm. so that, for example, all tubes having a length between 98 and 100 mm. may be selected when the desired optimum length is 99 mm.

With apparatus which is very accurately prepared and very carefully set up, the selected glass tubes may fall within a much narrower range about the desired predetermined length.

We claim:

1. A method of sorting from a series of members of different lengths being advanced on a conveyor those members which differ in a given sense from a desired datum length, comprising the steps of advancing the members each in a transverse position on a conveyor, inclining from a horizontal position on the conveyor those members whose length exceeds a certain length, moving transversely of the conveyor those members which remain horizontal on the conveyor, and permitting the inclined members to resume a horizontal position on the conveyor so that the members having a length greater than the said certain length all project from one side of the conveyor beyond the members having a length equal to or less than the said certain length, the members of length equal to or less than the said certain length projecting beyond the members of the greater length on the other side of the conveyor.

2. A method according to claim **1** wherein the conveyor has a contact width less than the length of any of the members comprising the said series and the members projecting on one or other side of the conveyor are acted upon in order to tilt those members from their position on the conveyor so that they drop therefrom and are rejected while the remaining members continue to be advanced on the conveyor.

3. A method according to claim **2**, wherein the series of members comprises a series of glass tubes of different lengths, the glass tubes which are inclined from a horizontal position on the conveyor are the glass tubes whose length substantially exceeds a desired predetermined length, the glass tubes having a length substantially exceeding said predetermined length are removed from the conveyor and rejected, and the glass tubes of a length substantially equal to or less than the said desired predetermined length are further advanced on the conveyor.

4. A method according to claim **2** wherein the series of members comprises a series of glass tubes of different lengths, the glass tubes which are inclined from a horizontal position on the conveyor are the glass tubes whose length is at least equal to a desired predetermined length, the glass tubes having a length substantially less than the said predetermined length are removed from the conveyor and rejected, and the glass tubes having a length at least equal to the said predetermined length are further advanced on the conveyor.

5. A method of sorting from a series of glass tubes being advanced on a conveyor those glass tubes which differ substantially from a desired predetermined length, comprising the steps of advancing the glass tubes each in a transverse position on a conveyor which has a contract width less than the length of any of the glass tubes comprising the said series, inclining from a horizontal position on the conveyor those glass tubes whose length substantially exceeds the said desired predetermined length, moving transversely of the conveyor those glass tubes which remain horizontal on the conveyor, permitting the glass tubes whose length substantially exceeds the said predetermined length to resume a horizontal position on the conveyor with their ends projecting beyond the ends of all the other tubes on the conveyor, acting on the projecting parts of the glass tubes of a length substantially exceeding the said desired predetermined length to tilt those glass tubes from their position on the conveyor so that they are removed from the conveyor, continuing to advance on the said conveyor the glass tubes having a length less than or substantially equal to the said desired predetermined length, inclining from a horizontal position on the conveyor those glass tubes of lengths substantially equal to the said desired predetermined length, moving transversely of the conveyor those glass tubes which remain horizontal thereon, permitting the inclined glass tubes of length substantially equal to the desired predetermined length to resume a horizontal position on the conveyor so that the glass tubes of length substantially equal to the said desired predetermined length project beyond the remaining glass tubes on one side of the conveyor, while the glass tubes of length substantially less than the said desired predetermined length project on the other side of the conveyor, and acting on the projecting parts of the glass tubes having a length substantially less than the said desired predetermined length to remove these glass tubes from their position on the conveyor so that there remain to be advanced on the conveyor only glass tubes of a length substantially equal to the said desired predetermined length.

6. Apparatus for sorting from a multiplicity of members of different lengths those members differing from a desired length in one direction, the apparatus comprising a conveyor for advancing individually all the members transversely arranged on the conveyor, positioning means for arranging one end of each of the members in a reference position, an inclined member having an inclined upper edge for raising from a substantially horizontal position on the conveyor one end of each of the members which has a length greater than a certain length measured from said reference position, and means for displacing from their reference position all those members which remain horizontal on the conveyor so that these members project relative to the raised members on one side of the conveyor and the raised members

project relative to the remaining members on the other side of the conveyor.

7. Apparatus according to claim 6 wherein said conveyor has a contact width less than the length of any of the members and wherein there is further provided tilting means for tilting the members projecting on one or other side of the conveyor to remove the tilted members from the conveyor.

8. Apparatus according to claim 7 wherein said tilting means is arranged to remove from the conveyor those members which have a length substantially greater than said desired length and said apparatus further comprises a second positioning means for arranging one end of each of the remaining members in a second reference position, a second inclined member having an inclined upper edge for raising from a substantially horizontal position on the conveyor one end of each of the members having a length substantially equal to said desired length measured from said second reference position, second means for displacing longitudinally from their reference position all those members having a length substantially less than said desired length, which members remain horizontal on the conveyor so that these members project relative to the raised members on one side of the conveyor, and the raised members having a length substantially equal to said desired length project on the other side of the conveyor, and tilting means for tilting the members having a length substantially less than said desired length by acting on the parts of those

members projecting beyond the other members on the said one side of the conveyor to remove the members having a length substantially shorter than said desired length from the conveyor.

9. Apparatus according to claim 8 wherein the members advanced by the conveyor are glass tubes and wherein there is further provided above the conveyor at a position where the conveyor is passing the said second inclined member, a frictional device for engaging the upper surface of a glass tube of which one end is raised by the inclined upper edge of the second inclined member so that the raised glass tube is rotated by the frictional device as the glass tube is advanced past the said second inclined member.

10. Apparatus according to claim 6 wherein there is further provided a trailing substantially non-frictional member for engaging the upper surfaces of glass tubes which are inclined to the horizontal during their passage past either said first or said second inclined member to increase the stability of said inclined glass tubes.

References Cited

UNITED STATES PATENTS

1,499,205	6/1924	Ekstrom	209—75
2,038,362	4/1936	Hutchinson	209—82

M. HENSON WOOD, JR., *Primary Examiner.*

RICHARD A. SCHACHER, *Examiner.*