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(54) IMPROVED HOLDING CLAMP

(71) I, WALTER REIST, a Swiss Citizen, of Schonenbergstrasse 16, 8340 Hinwil, Switzerland, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to improved clamps suitable, inter alia, for use in automated manufacturing and handling equipment.

Clamps embodying the invention are primarily intended to hold generally flat objects such as newspapers, periodicals and similar printed matter. The clamps could, however, be used to hold objects such as packages which are not themselves generally flat, provided the objects possess flat or flattenable portions. In this specification and the appended claims, the term "generally flat articles" is to be understood to cover all the objects just mentioned.

According to the present invention, there is provided a clamp which is closeable to provide a clamp gap for receiving and holding a generally flat article, the clamp comprising two blades arranged face to face and pivotally connected for pivotal swinging movement in a plane normal to the pivot axis and parallel to a central plane through the clamp gap, the blades defining elongated, generally-flat jaws extending in a direction away from the pivot and terminating remote therefrom, the jaws each having a portion intermediate the pivot and their respective free ends which project sideways towards the other jaw, the intermediate portions being spaced apart when the blades are swung to a clamp-open condition wherein the jaws define an open mouth to have an article to be clamped freely inserted into the clamp, the said intermediate portions being movable into a face to face overlapping relation when the blades are swung together to a clamp-closed condition in which the jaws contact an article in a region including their intermediate portions, whereupon confronting surfaces of the said overlapped intermediate portions define the

clamp gap and exert a clamping force normal to the said surfaces on an article disposed in the clamp gap, the clamp further including holding means for suspending the clamp from a support, the holding means extending away from the pivot in a direction generally opposite to the direction in which the jaws extend.

Opening and closing of a preferred clamp embodying the invention involves a scissor-like action on the part of the clamp jaws. When the clamp is closed to hold an article, the clamp jaws straddle the article.

The preferred embodiment of the invention, which will be described in detail hereinafter, can handle products positively, reliably and safely. The clamp is suitable for use in handling equipment which receives arriving products in a fish-scale or fanned, overlapping array. In the printing field, this is the manner in which printed matter leaves a rotary printing machine station, for instance.

Accordingly this invention further provides equipment suitable for handling and manipulating generally flat articles fed to the equipment in fish-scaled, fanned or overlapping formation, the equipment comprising a multiplicity of clamps for engaging with the articles, and each of the clamps being closeable to provide a clamp gap for receiving and holding a generally flat article, each clamp being as defined in the third paragraph, above, of this specification.

During a particular, exemplary operation in which a clamp embodying this invention is used, the article to be held is introduced into the opened clamp mouth defined by the jaws after they have been moved apart, and the clamp and/or the product is then rotated into a position corresponding to the desired position of the clamping gap, or to a position of the clamping gap determined by the shape of the product, by or during the movement of the clamp jaws into their closed position.

The invention will now be described in detail by way of example with reference to the annexed drawings wherein:

Figure 1 is an exemplary embodiment of 100

a clamp according to the invention, depicted during a first operational step for seizing an article comprising a folded newspaper;

5 Figures 2 and 3 respectively illustrate the clamp of Figure 1 during both of the following operational steps;

Figure 4 is a cross-sectional view of a modified construction of clamp;

10 Figure 5 illustrates the clamp of Figure 4 in a position where it engages an article, for instance a newspaper;

Figures 6 to 11 illustrate details of handling equipment in the form of a transport device and equipped with clamps according to the invention for manipulating printed matter, and wherein:

Figures 6 and 7 respectively illustrate a clamp which can be driven by means of a transport chain along a rail and depicted transversely and lengthwise of the rail, respectively, and shown partially in sectional view;

25 Figure 8 illustrates a section of the transport device with clamps constructed according to Figures 6 and 7 during an operating step corresponding to Figure 1;

Figure 9 illustrates the device of Figure 8 during the following operating step;

30 Figure 10 illustrates the device of Figure 8 during the article transport phase; and

Figure 11 illustrates the equipment corresponding to that of Figure 8, showing a longer transport section thereof.

35 Referring now to the drawings, it is to be understood that the manipulation of articles, for example printed matter such as newspapers and periodicals which arrive for instance in an overlapping fish-scale formation similar to the arrangement of a fanned deck of cards, requires complicated automated equipment which, among other things, encompasses transport means for the fish-scale arrangement, package sorters and special conveying devices. The complexity of such equipment is not in any linear relationship to its output or capacity, and necessitates a disproportionate marked increase in the expenditure on the equipment in order to increase such capacity or output. Furthermore, a difficulty which is present resides in the fact that during the course of manipulation and handling of such articles, it may be necessary temporarily to store them prior to being subjected to a subsequent production operation thereon.

40 It has already been proposed to seize the printed matter which arrives in overlapping fish-scale formation by means of a clamp and thereafter to individually manipulate the printed matter by means of such clamp. The practical realization of this proposal was faced with the problem that the available prior art clamps, and which in their 65 basic aspects correspond to conventional

constructions, were complicated and accordingly expensive, bulky and at the same time also heavy, so that the end effect in the first instance was not the printed matter had to be manipulated, but the clamps themselves.

70 In consideration of these shortcomings the object of this invention aims at overcoming the same. In particular, the operation is quite different for the present clamp construction depicted in Figures 1 to 3, in which elongated, generally flat clamp jaws 1, 2 of the clamp 7 move between their open position and their closed position with a scissor-like action. For the complete functionality of such clamp, there is required, apart from the presence of the clamping jaws, only a suitable connection thereof appropriate for the contemplated scissor-like relative movement of the jaws 1, 2. With the illustrated exemplary embodiments, a pair of substantially flat blades define the jaws 1 and 2 and are pivotally connected with one another by a pivot pin 3 which passes through aligned apertures in the upper portions of the jaws. To form an article-accommodating clamp gap 4, as shown in Figures 2 and 4, the clamp jaws 1 and 2 are swung towards one another out of their open position depicted in Figure 1, until portions of the jaws intermediate the pivot pin 3 and the free ends of the jaws travel past one another and partially mutually overlap, so as to assume their closed position as shown in Figure 3. This clamp closing operation when, for instance, a newspaper 5 is to be seized, as has been indicated in Figures 1 to 3, occurs in the following manner: the one side edge, for instance the spine 6 which is the folded edge of the newspaper 5, is introduced into the wide opened mouth 8 of the clamp, and specifically preferably until this newspaper spine 6 bears against a stop 9 formed by the interconnected end portions 1a and 2a of the clamp jaws 1 and 2 respectively. Starting from this position, and as best shown in Figure 1, the clamp 7 and/or the newspaper 5 are or is turned until the clamp jaws 1 and 2 rest flat against the newspaper 5. Viewed from the side, this further relative position of the clamp 7 and the newspaper 5 corresponds to the illustration of Figure 2. As can be seen, from Figure 2, the jaws 1, 2 are in contact with each other in the region of the pivot 3, but have their lower portions spaced apart to form a gap to receive the thickness of the newspaper 5.

During and/or after the rotation of the clamp 7 or the newspaper 5, the clamp jaws 1 and 2 are brought into their closed position in which in accordance with their form which tapers towards their free ends 1b and 2b respectively, they partially overlap at a location defined by projections 10, consti- 130

tuting the said intermediate portions, to form the clamp gap 4 (Fig. 3); the projections 10 each point generally towards the other jaw when the clamp is open. The spine 6 of the newspaper 5 is located in a passage designated in Figure 3 by reference character 14, and which passage is formed by the recesses 11 and 12 of the clamp jaws 1 and 2 respectively, the passage 14 is wider than the clamp gap 4. Owing to this construction, the spine 6 of the newspaper 5 is not damaged by the clamp jaws 1 and 2, neither during closing of the clamp 7 nor when the latter assumes its closed position, even though the spine 6, when the clamp is closed, is slightly bent or crimped at the region of the passage 14. The newspaper 5 and the clamp 7 are now frictionally connected with one another to an extent which is sufficient for effectively carrying out each manipulation, this frictional connection primarily occurring at the overlapping projections 10 of the clamp jaws 1 and 2, that is at the region of the clamp gap 4. The flat, face-to-face contact between inside surfaces of the clamp jaws 1, 2 and the newspaper 5 enhances the said frictional connection.

Owing to the position of the undamaged spine 6 in the passageway 14, and owing to the width of the clamp gap in the region between the projections 10 being narrower than the thickness of the spine 6, the newspaper is very securely held by the clamp 7. If an attempt were made to pull the newspaper 5 from the clamp 7, movement of the spine 6 from the passage 14 into the clamp gap 4 would be met with considerable resistance. Once the closed clamp 7 has been placed upon the newspaper 5, then the clamp and newspaper are frictionally interconnected, even if releasably, in such a positive manner that the same is sufficient for each manipulation of the newspaper. For the manipulation of the newspaper 5 with the clamp 7, the latter possesses a substantially T-shaped holding member 13 which, in the embodiment under consideration, is formed in one piece with the clamp jaw 2. With the embodiment according to Figures 1 to 3, the holding member 13 is located with respect to the newspaper 5 in an inclined position when the clamp 7 has been brought into closed engagement with the newspaper. It should be understood that the clamp 7 itself, different from the position depicted in Figure 3, could be mounted or applied at an inclination to the newspaper 5, i.e., turned in the counter-clockwise direction, in order to somewhat align the holding member 13 towards the shorter centre line of the newspaper 5. However, as shown in Figure 5, the clamp 7 can be constructed such that the holding member 13, and also the clamp 7, are aligned towards the shorter center line of the news-

paper when the clamp is placed upon such newspaper.

The beam 15 of the substantially T-shaped holding member 13 is constructed at both of its end sections cylindrically such that the holding member 13 can be guided for instance in a hollow guide rail of, for instance, substantially C-shaped cross-sectional configuration. In use, contact between the clamp 7 and the newspaper 5 occurs at the first opportunity afforded to do so, and at the region of the fish-scale formation of newspapers, which arrive from the rotary printing machine, a clamp is applied to each of the newspapers. For this purpose, the newspapers, which are in fish-scale overlapping formation, could be guided over an arch or dome at the region of which they open in fan-like manner, the spine of each of the newspapers then being freely exposed and presented to a clamp. At the region of such arch or dome the clamps could be delivered out of a magazine, along a path which converges with the arrival path of the fish-scale product stream, the clamps with their wide open clamp mouth penetrating into the path of travel of the newspapers and being overtaken by such newspapers. In this way the spine of each newspaper arrives at the mouth of the associated clamp which then can be closed in the already described manner. The entire procedure occurs of course with uninterrupted further movement of the fish-scale stream of newspapers, this also being the case with respect to the rotation and closing of the clamp. The clamp closing operation can be brought about through the application of an external force K (Figure 5) to laterally-projecting ears 16 of the clamp jaws 1 and 2. Such forces can be generated for instance owing to rotation of the clamp upon moving it along suitable guide tracks or ramps, yet they can also be generated by appropriately arranged actuation devices. Further, although not shown, it would be possible to equip both clamp jaws 1 and 2 with an individual holding member similar to member 13, and to apply clamp opening and clamp closing forces to the clamp 7 by interaction between the holding member 13 and a guide rail along which the clamp is moved.

A fish-scale overlapping stream of articles equipped in this manner with clamps 7 consists of individually manipulatable newspapers. This does not, however, preclude manipulating the newspapers — at least temporarily — in an assembly or group. If the fish-scale overlapping stream is equipped with such clamps and the holding members 13 thereof are guided in a rail extending in the flow direction of the fish-scale stream or are arranged on a chain, possibly detachably if desired, then it is conceivable to

transform a generally horizontally-supported fish-scale overlapping stream directly into a stack-like formation in which the newspapers hang down from the rail. They now
5 can be further transported in this formation — which can be considered as a hanging stack — along the rail or with the rail if the rail is itself movable. If it is in fact
10 conceivable to provide a flexible rail, if desired, an endless removing rail, which moves in its lengthwise direction to convey the hanging stack along a given path. Desirably the clamps are displaceably guided
15 upon the rail to enable the hanging stack to be compacted, that is to enable the hanging newspapers to be pushed together. It is however, also possible to provide rail sections which, as soon as they are filled with
20 a corresponding number of clamps, move to one side and leave in their place an empty space for rail sections which are still to be filled. The filled rail sections can be directly further manipulated or delivered to an intermediate storage. It should be under-
25 stood that as soon as the fish-scale overlapping formation is transformed into the form of a stack which hangs down from the rail or a rail section, there is then possible a compaction operation, that is to say, a pushing together of the clamps. In any event,
30 it is clear that after providing the fish-scale formation with the clamps, it is possible to undertake the transformation of the products into stack form without any additional automated equipment. The equipping
35 of the fish-scale overlapping formation with clamps — as should be clearly apparent from what has been discussed — is facilitated due to the particular construction and functional characteristics of the previously
40 described clamp which possesses a large mouth opening 8 to ease entry of a newspaper spine 6 into the clamp. Particularly firm holding of the newspaper is attained. As Figure 2 shows, the thickness of the
45 clamp 7 is little more than the thickness of the spine 6 and hence can be accommodated without difficulty in the fish-scale formation as well as in a compact stack. Furthermore, each clamp can be made of such
50 a low weight that such — if this is necessary — can be itself supported and held by the newspapers themselves.

The transformation of a generally horizontally-supported fish-scale overlapping formation into the form of a stack is reversible. Indeed, such a stack and the newspapers which are located therein and which
55 hang down from the rail can be laid out in a fish-scale formation on a support surface, specifically both in the original fish-scale form as well as also in the form of a reversed fish-scale formation. On the other hand, it is possible to break-up the stack,
60 for instance into counted-out packages or

into individual newspapers. The packages can be readily delivered, for instance, to a binding machine or to a shipping station. The dissolution of a stack into individual
70 product copies would be, for instance, of importance in conjunction with the grouping together of different sections that together are to form the published edition of a newspaper, book or the like. Printed
35 articles hanging from clamps 7 can be easily opened to have supplementary printed matter inserted therein.

At the appropriate time the clamps are released from the newspapers by simply
80 moving the clamp jaws into their open position, and these clamps, either before placing them in a magazine, or afterwards, are returned to that location at which they are again brought into use. Opening of the
85 clamps can occur for instance in such a manner again that appropriate devices, such as for instance guide tracks arranged at the path of movement of the clamps or movable relative thereto, engage with the projecting
90 ears 16.

Within limits, the clamps 7 can engage with newspapers of different thicknesses. These limits can be extensively enlarged
95 if the clamp jaws 1, 2 possess a certain resilient flexibility or are supported relative to one another with such flexibility. For instance, it is possible to design a clamp with an adjustable clamp gap, for instance according to the structure disclosed in Figure 4. In this case both of the clamp jaws
100 22 are hingedly connected with one another by a generally U-shaped resilient holding member 23. Member 23 functions in the manner of a hairpin spring, its legs 24 merging into a bight allowing hinging movement of the legs. The legs 24 have internal
105 bulbous-shaped projections 26 which engage with aligned recesses or holes 27 of the clamp jaws 22 respectively. These clamp jaws 22 thus can appropriately widen the holding member 23 depending upon the
110 thickness of the newspaper or other product to be seized. At its apex or bight, the holding member encompasses a portion of a cylindrical transverse beam 25. The said
115 portion can be offset with respect to the remainder of the beam 25 to secure the beam against displacement in its own lengthwise direction. With this embodiment, as well as also with the first described embodiment, the clamp jaws can be held in
120 their open position solely due to friction therebetween at the pivot or with the help of engagement of the clamp with a guide rail. Corresponding measures in the closed
125 position of the clamp are not necessary.

Such clamps render possible of course the manipulation of articles other than newspapers. This is for instance the case for
empty or filled packages, files, books and 130

so forth. It is possible to engage with such clamps flat articles or articles possessing flat portions. In any event, the clamp is capable of fulfilling its objectives despite being of compact size. The clamp 7 renders possible the completely automated manipulation of, for instance, individual newspapers or periodicals, from the rotary printing press up to the time of loading and shipment.

Figures 6—11 inclusive illustrate a possible exemplary embodiment of a transport device for articles which arrive in the aforementioned fish-scale overlapping formation, such as newspapers and the like. This transport device possesses a number of clamps 31 and which clamps are guided by means of travelling runners 32 which move in a rail 33 of substantially U-shaped cross-sectional configuration and which opens towards one side, as shown. In the construction now to be described, the clamps are mounted so as to be capable of executing given movements relative to the runners 32, which movements are controlled inter alia by camming means comprising rails or ramps along which roller followers carried by the clamps travel. The travelling runners 32 are connected for articulated movement at 34 with links of a link chain 35, also referred to as the transport chain, and which is laterally guided in the rail 33 by guide ledges 36. A projection 37 of a pivot shaft at 34 extends laterally from the rail 33 and serves for the articulated anchoring of the associated clamp 31. The projection 37 engages in a shouldered recess in a flange 38 of a housing 39 in which there is rotatably mounted a shaft 40 carrying the clamp jaws 41 and 42. Shaft 40 constitutes the clamp holding member and is fixedly connected with the one clamp jaw 42 and hingedly connected at 40a with the other clamp jaw 41. The last-mentioned clamp jaw 41 additionally carries a lateral actuation roller 43. The shaft 40 extends through a control sleeve 44 which is axially displaceably mounted in the housing 39, this control sleeve 44 carrying a cam follower comprising a control roller 45 through the agency of a radial pin 44¹, as best seen by referring to Figure 7. The pin 44¹ is guided in a slot 46 of the housing 39, as shown in Figure 8, so that the control sleeve 44 is secured against rotation. For the axial displacement of such control sleeve 44 against the action of a spring 47 (Figure 6), there are provided control cams or tracks (rocker arms or equivalent structure) which, as clearly illustrated by reference character 48 in Figure 7, engage with the control roller 45. The shaft 40 possesses a control groove 49 (Figure 6) which extends partially over the periphery of such shaft and with which

control groove 49 engages a radial pin 50 of the control sleeve 44.

With this construction displacement of the control sleeve 44 brings about a rotation of the shaft 40 which is supported in axial direction. After such rotation out of the position depicted in Figure 6 into that depicted in Figure 7, the actuation roller 43 of the clamp 31 arrives at the region of the control tracks which, as indicated by reference characters 51 and 52 respectively in Figure 7, bring about the closing and opening respectively of the clamp. According to Figures 6 and 7, the clamp extends downwardly perpendicular to the rail 33 under the action of a spring 53. Under the action of this spring, the clamp can be tilted with the help of a support roller 54 when the same travels past ascending portions of an associated control cam track, as for instance indicated by reference character 55 in Figure 7. As already mentioned and has been illustrated by reference numeral 56 in Figure 11, the fish-scale product formation 57 is guided by means of the transport belts 58 and 59 over an arched or domed region, so that the leading edges of the newspapers 60 are exposed and accessible to the associated clamps 41. The clamps in turn at this location are guided in a path which converges with that of the fish-scale overlapping product formation 57, so that they arrive in the position necessary for engaging with the newspapers. For the engagement thereof, the leading edges of the newspapers must penetrate into the opened clamp mouth 8. For producing an appropriate relative speed between the newspaper and clamp, the latter — as shown in Figure 11 — can be shifted towards the rear with respect to the clamp transport direction with the aid of the support roller 54. After the newspapers arrive in the position discussed previously in conjunction with Figure 1 (see also Figure 8) the clamp jaws 41 and 42 are applied to the newspaper with the aid of the control roller 45 and brought into their closed position with the aid of the actuation roller 43, as best seen by also referring to Figure 9. Consequently, the newspapers 60 are individually seized and manipulatable. The clamp transport device now can leave the region of the conveying band 59. During this transport phase there can be dispensed with the support of the clamps by means of the support rollers 54, so that the newspapers depend freely downwardly from the transport chain. By reversing the aforementioned measures it is possible again to form a fish-scale overlapping product formation or arrangement.

The rotation and closing of the clamps can — as already stated — occur with more or less extensive superimposing of such two

movements, and specifically not merely exclusively through a corresponding arrangement of the control cams or tracks associated with the control rollers 54 and the actuation rollers 43, but also by virtue of such construction of clamp mechanism wherein — again with the help of control grooves or tracks and the like — the displacement of a single roller brings about both a rotation as well as also the closing of each clamp.

WHAT I CLAIM IS:—

1. A clamp which is closeable to provide a clamp gap for receiving and holding a generally flat article, the clamp comprising two blades arranged face to face and pivotally connected for pivotal swinging movement in a plane normal to the pivot axis and parallel to a central plane through the clamp gap, the blades defining elongated, generally-flat jaws extending in a direction away from the pivot and terminating remote therefrom, the jaws each having a portion intermediate the pivot and their respective free ends which project sideways towards the other jaw, the intermediate portions being spaced apart when the blades are swung to a clamp-open condition wherein the jaws define an open mouth to have an article to be clamped freely inserted into the clamp, the said intermediate portions being movable into a face to face overlapping relation when the blades are swung together to a clamp-closed condition in which the jaws contact an article in a region including their intermediate portions, whereupon confronting surfaces of the said overlapped intermediate portions define the clamp gap and exert a clamping force normal to the said surfaces on an article disposed in the clamp gap, the clamp further including holding means for suspending the clamp from a support, the holding means extending away from the pivot in a direction generally opposite to the direction in which the jaws extend.

2. The clamp as defined in claim 1, wherein a stop is provided between the said intermediate portions of the jaws and the pivot to limit inward movement of the article upon insertion thereof into the opened clamp.

3. The clamp as defined in claim 2, wherein the jaws include recesses located between the said intermediate portions and the stop, the recesses providing a passage wider than the clamp gap of the clamp when closed so as to accommodate an article having an edge thicker than an adjacent portion thereof which is disposed in the said gap.

4. The clamp as defined in any of claims 1 to 3, wherein the generally flat jaws have their confronting faces in contact at one end

of the clamp in the region of the pivot, the said faces being spaced apart remote from the pivot to provide the clamp gap between the overlapping intermediate portions when the clamp is closed.

5. The clamp as defined in any of claims 1 to 4, wherein the holding member is integral with one of the jaws.

6. The clamp as defined in any of claims 1 to 5, wherein the clamp jaws are resiliently connected with one another in the direction of the pivot axis.

7. The clamp as defined in claim 6, wherein portions of the jaws are received between the opposite limbs of a substantially U-shaped spring member, the resilience of the spring member permitting the jaws to move apart in the direction of the said axis to adjust the width of the clamp gap to the thickness of the article to be held by the clamp.

8. The clamp as defined in claim 7, wherein the jaws and the said limbs are provided with inter-engaging portions which coact to secure each jaw to a corresponding one of the limbs.

9. The clamp as defined in claim 8, wherein the interengaging portions comprise a bulbous projection on each of the limbs and an accommodating recess in each of the jaws.

10. The clamp as defined in claim 7, 8 or 9, wherein the holding member is secured to the U-shaped spring member.

11. The clamp as defined in any of the preceding claims, holding a generally flat article in the clamp gap.

12. A clamp for seizing and holding and/or manipulating generally flat articles, substantially as herein described with reference to and as shown in the accompanying drawings.

13. Equipment suitable for handling and manipulating generally flat articles fed to the equipment in fish-scale fanned or overlapping formation, the equipment comprising a multiplicity of clamps for engaging with the articles, and each of the clamps being as defined in any of the preceding claims.

14. Equipment suitable for handling and manipulating generally flat articles fed to the equipment in a fish-scale fanned or overlapping formation, the equipment including a multiplicity of clamps, each of which is as defined in any of claims 1 to 12, for engaging the articles, means for supporting and guiding the clamps for movement along a track, and means for opening and closing the clamps in the course of their movement along the track.

15. The equipment as defined in claim 13 or 14, including a rail defining a track along which the clamps are movable, transport means guided by the said rail, and

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movements, and specifically not merely exclusively through a corresponding arrangement of the control cams or tracks associated with the control rollers 54 and the actuation rollers 43, but also by virtue of such construction of clamp mechanism wherein — again with the help of control grooves or tracks and the like — the displacement of a single roller brings about both a rotation as well as also the closing of each clamp.

WHAT I CLAIM IS:—

1. A clamp which is closeable to provide a clamp gap for receiving and holding a generally flat article, the clamp comprising two blades arranged face to face and pivotally connected for pivotal swinging movement in a plane normal to the pivot axis and parallel to a central plane through the clamp gap, the blades defining elongated, generally-flat jaws extending in a direction away from the pivot and terminating remote therefrom, the jaws each having a portion intermediate the pivot and their respective free ends which project sideways towards the other jaw, the intermediate portions being spaced apart when the blades are swung to a clamp-open condition wherein the jaws define an open mouth to have an article to be clamped freely inserted into the clamp, the said intermediate portions being movable into a face to face overlapping relation when the blades are swung together to a clamp-closed condition in which the jaws contact an article in a region including their intermediate portions, whereupon confronting surfaces of the said overlapped intermediate portions define the clamp gap and exert a clamping force normal to the said surfaces on an article disposed in the clamp gap, the clamp further including holding means for suspending the clamp from a support, the holding means extending away from the pivot in a direction generally opposite to the direction in which the jaws extend.

2. The clamp as defined in claim 1, wherein a stop is provided between the said intermediate portions of the jaws and the pivot to limit inward movement of the article upon insertion thereof into the opened clamp.

3. The clamp as defined in claim 2, wherein the jaws include recesses located between the said intermediate portions and the stop, the recesses providing a passage wider than the clamp gap of the clamp when closed so as to accommodate an article having an edge thicker than an adjacent portion thereof which is disposed in the said gap.

4. The clamp as defined in any of claims 1 to 3, wherein the generally flat jaws have their confronting faces in contact at one end

of the clamp in the region of the pivot, the said faces being spaced apart remote from the pivot to provide the clamp gap between the overlapping intermediate portions when the clamp is closed.

5. The clamp as defined in any of claims 1 to 4, wherein the holding member is integral with one of the jaws.

6. The clamp as defined in any of claims 1 to 5, wherein the clamp jaws are resiliently connected with one another in the direction of the pivot axis.

7. The clamp as defined in claim 6, wherein portions of the jaws are received between the opposite limbs of a substantially U-shaped spring member, the resilience of the spring member permitting the jaws to move apart in the direction of the said axis to adjust the width of the clamp gap to the thickness of the article to be held by the clamp.

8. The clamp as defined in claim 7, wherein the jaws and the said limbs are provided with inter-engaging portions which coact to secure each jaw to a corresponding one of the limbs.

9. The clamp as defined in claim 8, wherein the interengaging portions comprise a bulbous projection on each of the limbs and an accommodating recess in each of the jaws.

10. The clamp as defined in claim 7, 8 or 9, wherein the holding member is secured to the U-shaped spring member.

11. The clamp as defined in any of the preceding claims, holding a generally flat article in the clamp gap.

12. A clamp for seizing and holding and/or manipulating generally flat articles, substantially as herein described with reference to and as shown in the accompanying drawings.

13. Equipment suitable for handling and manipulating generally flat articles fed to the equipment in fish-scale fanned or overlapping formation, the equipment comprising a multiplicity of clamps for engaging with the articles, and each of the clamps being as defined in any of the preceding claims.

14. Equipment suitable for handling and manipulating generally flat articles fed to the equipment in a fish-scale fanned or overlapping formation, the equipment including a multiplicity of clamps, each of which is as defined in any of claims 1 to 12, for engaging the articles, means for supporting and guiding the clamps for movement along a track, and means for opening and closing the clamps in the course of their movement along the track.

15. The equipment as defined in claim 13 or 14, including a rail defining a track along which the clamps are movable, transport means guided by the said rail, and



means for tiltably anchoring the clamps to the transport means.

- 5 16. The equipment as defined in claim 15, wherein the clamps are equipped with support rollers spaced from the said anchoring means, and the equipment further comprises control tracks or rails co-operating with such support rollers for effecting tilting movements of the clamps with respect to the transport means.

- 10 17. The equipment as defined in claim 15 or 16, further comprising a housing for each of the clamps which is tiltably anchored to the transport means, and means for rotatably mounting the holding member of each clamp in the respective housing.

- 15 18. The equipment as defined in claim 17, wherein the holding member of each of the clamps incorporates a shaft which is rotatably engaged with the respective housing, and a rotary drive actuatable by a control cam is provided to rotate the clamp and its shaft with respect to the housing.

- 20 19. The equipment as defined in claim 18, wherein at least one of the clamp jaws of each clamp is coupled with a closing mechanism actuated by means of a control cam.

20. The equipment as defined in claim 19, including a single roller engageable with and actuatable by an associated control track for operating both the rotary drive and the closing mechanism. 30

21. The equipment as defined in any of claims 15 to 20, comprising means for moving the articles in a substantially fish-scale overlapping formation along a predetermined path of travel which converges with respect to the track along which the clamps are movable, the said clamps in use being guided in the flow direction of the articles and driven in such a manner that an edge of each successive article engages the mouth of a respective opened clamp, which is thereafter closed on the article engaged therewith. 35 40 45

22. Equipment for handling and/or manipulating articles, substantially as herein described with reference to and as shown in Figures 6 to 11 of the supporting drawings. 50

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