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(54) **DEVICE FOR ALIGNING FLAT OBJECTS**

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(57) **ABSTRACT**

A device for aligning flat objects includes a supporting device, two boundary elements, a drive for the backwards and forwards movement of the boundary elements and a motor. The supporting device has two flat aligning surfaces for aligning the objects, wherein the aligning surfaces lie in two planes that abut each other at a straight edge. Both aligning surfaces slope steeply towards the edge. The motor sets both aligning surfaces in vibration. Both boundary elements can be swiveled into an engaging position. In this engaging position, the at least two boundary elements hold the stack of the objects when the stack is located on the supporting surfaces and between the boundary elements. The drive is connected to the boundary elements in such a way that it moves the boundary elements backwards and forwards parallel to the edge when the boundary elements are in the engaging position.

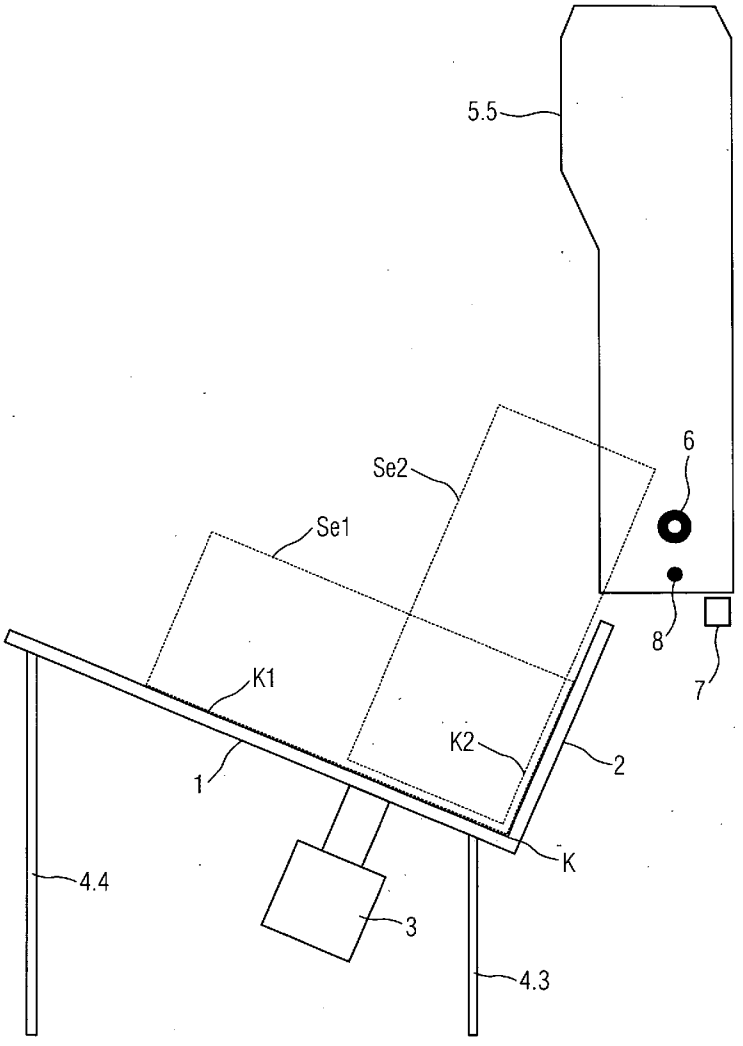


FIG 1

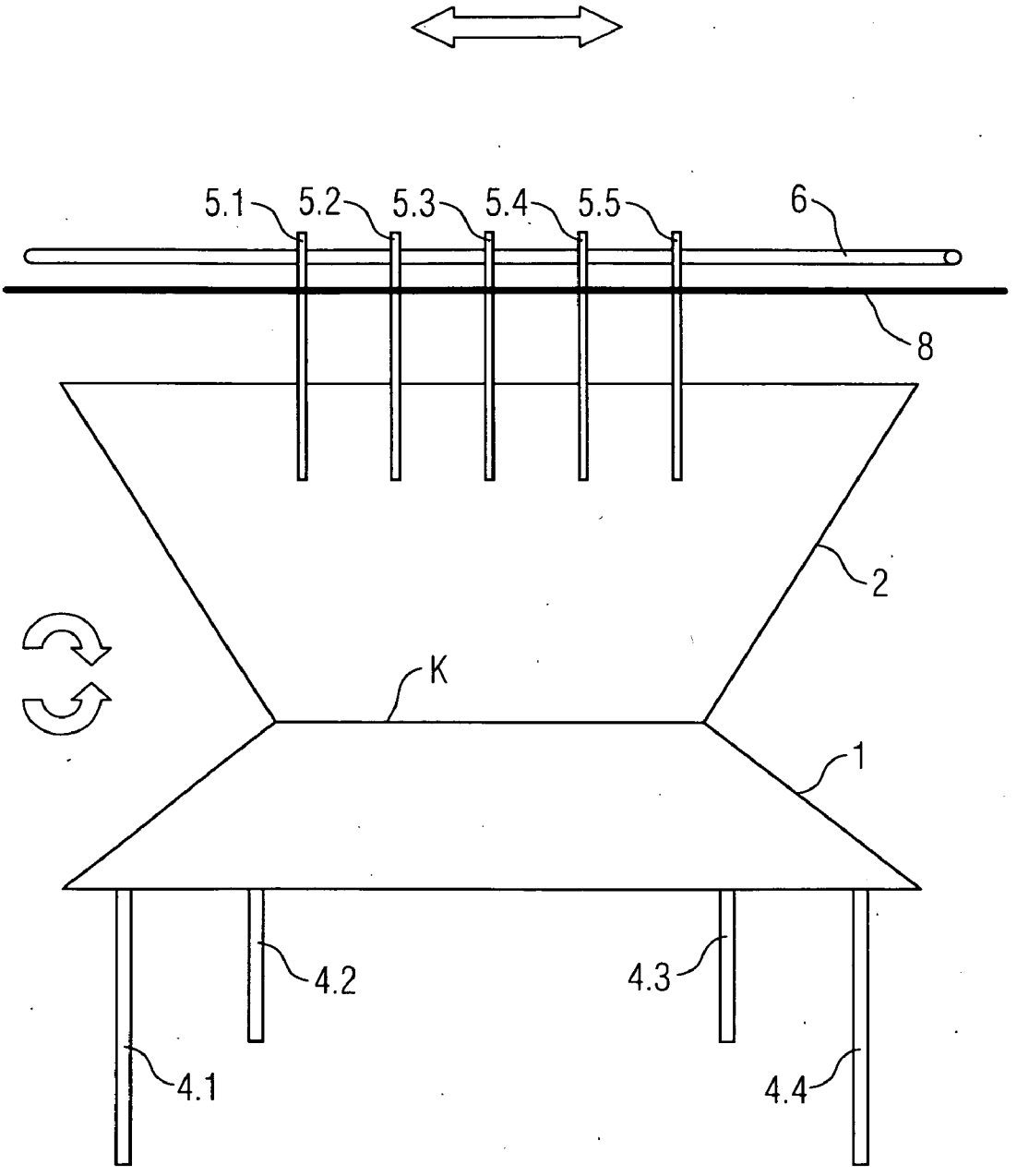


FIG 2

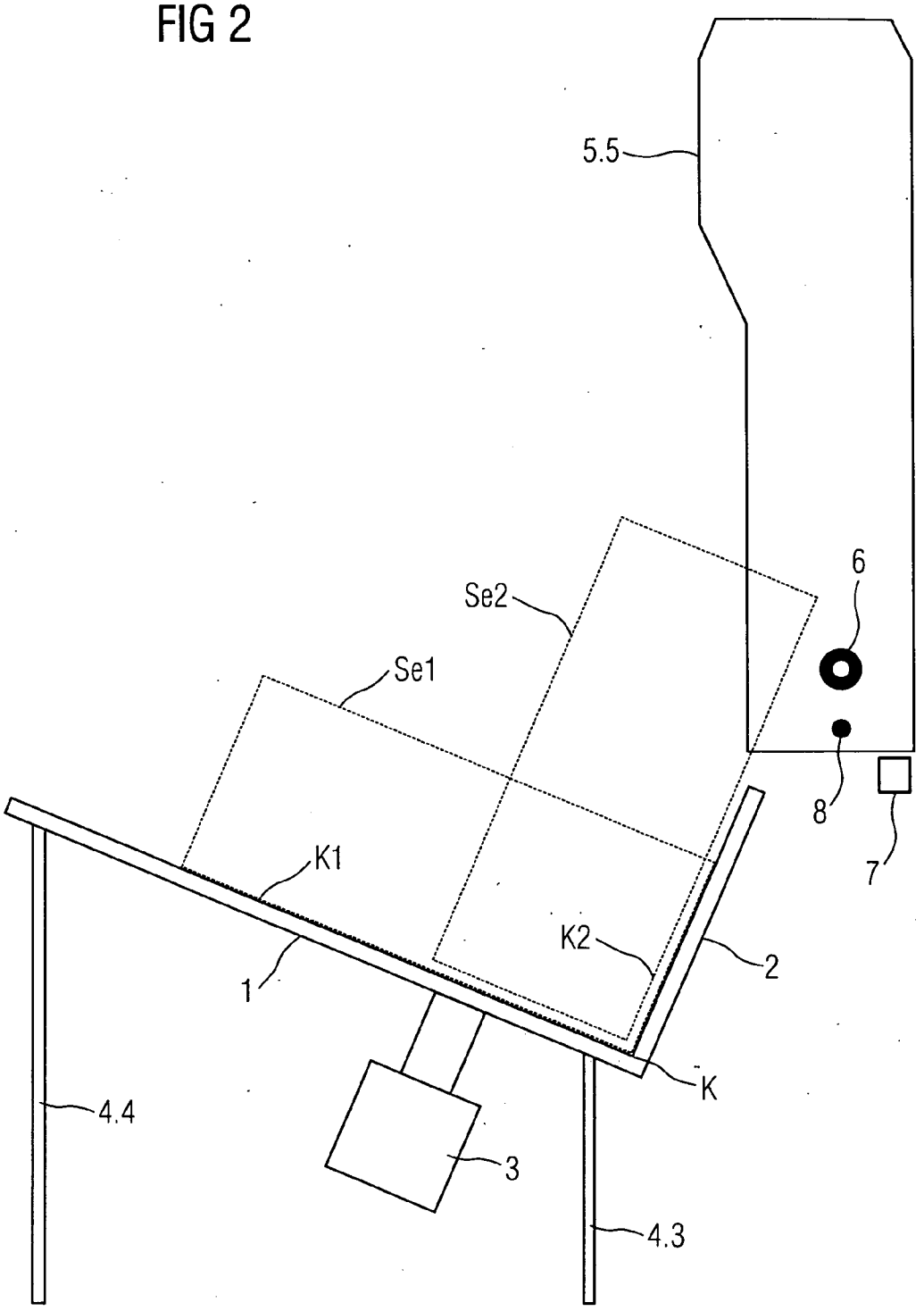
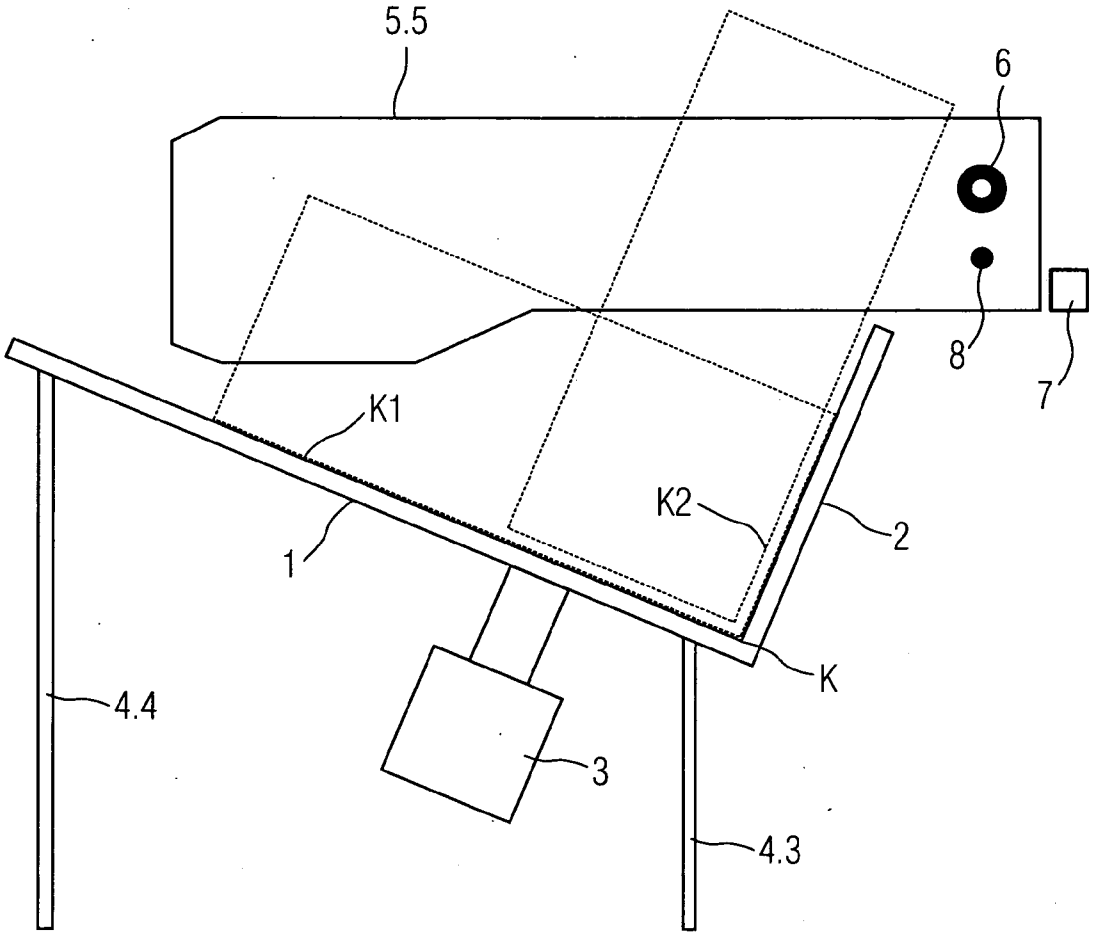


FIG 3



DEVICE FOR ALIGNING FLAT OBJECTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to German application no. 10 2007 007 811.2, filed Feb. 16, 2007, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a device and a method for aligning several flat objects, each of which extends in an object plane, and which together form a stack. The objects are, for example, letters or other flat postal items that after alignment are to be processed by a sorting system.

[0003] US 2005/0082475 A1 discloses an alignment device, wherein flat object such as sheets of paper are transported on a belt conveyor. For this purpose, the objects are placed vertically on the belt conveyor. Two boundary elements vibrate vertical to the direction of transport of the objects and vertical to the plane of the flat objects and thus align the objects that are located between them. A rotating shaft is rigidly connected to several cams. Each boundary element is rigidly connected to a cam follower that lies against a cam. Thus, rotation of the shaft causes the boundary elements to rotate backwards and forwards. The objects are separated into part stacks. A part stack is transported to a boundary wall and is there aligned by means of further boundary elements that align it with one edge against the boundary wall.

[0004] An aligning device described in US 2001/022261 A1 is, for example, used to align pieces of wood. The device described therein includes a belt conveyor and an adjacent U-shaped aligning device. The aligning device has two vertical side pieces and a saw-tooth, jagged horizontal base. The aligning device slopes in the direction of the conveying device and vibrates vertical to the direction of conveyance. The objects are thus aligned.

[0005] A device is described in US 2003/0062670 that aligns rectangular sheets of paper at two edges. The sheets of paper are fed in succession to a supporting device, which has a base and two boundary walls. The corner at which the base and both walls meet is the lowest point of the supporting device and the base slopes to this corner. A motor sets the supporting device in vibration so that each paper sheet slides to a position in which two edges of the sheet lie against both walls.

[0006] A letter input station with a vibrator is known from EP 1676796 A1. A stack of flat postal items stands vertically on a belt conveyor and is fed by the belt conveyor to a separating device. The conveying device is vertical to those parallel planes in which the flat postal items extend. The postal items lie on a flat plate. A vibrator vibrates the belt conveyor while the belt conveyor conveys the stack.

[0007] The objects to be aligned are, e.g., letters that are to be processed by a sorting system. The feeder of this sorting system has to reliably separate the letters and transport them in succession through the system for further processing. So that it can reliably perform this task, the letters must be aligned before separation and in fact on two edges that stand vertical to each other. This aligning should be carried out quickly and even when objects with different dimensions are to be aligned.

SUMMARY OF THE INVENTION

[0008] The object of the invention is to provide an aligning device, and an aligning method that quickly align a stack of flat parallel objects on two edges even if the objects have different dimensions.

[0009] Accordingly, the inventive device is capable of aligning several flat objects. These objects each extend in one object plane and together form a stack. The device includes a supporting device for supporting the objects, two boundary elements, a drive for the backwards and forwards movements of the boundary elements, and a motor. The supporting device has two flat aligning surfaces for aligning the objects. Both these aligning surfaces lie in two planes that abut each other at a straight edge. Both aligning surfaces slope towards the edge. The motor is designed so that it is capable of vibrating the two aligning surfaces.

[0010] The at least two boundary elements can be swung into an engaging position. In this engaging position, the at least two boundary elements hold the stack with the objects when the stack is located on the supporting device and between the boundary elements. The drive is connected to the boundary elements in such a way that it can move the boundary elements backwards and forwards parallel to the edge when they are in the engaging position.

[0011] The inventive device effects an alignment in two different ways. The force of gravity forces the objects to slide downwards along both downwards sloping aligning surfaces and thus become aligned at two edges. And, in the engaging position, the boundary elements vibrate the flat objects that stand vertically on the edge between the aligning surfaces, backwards and forwards, i.e., in two directions. These varied movements cause a fast alignment.

[0012] The objects are vibrated backwards and forwards particularly well if at least three, preferably five, boundary elements are provided. These divide the stack of flat objects into at least two, preferably four, part stacks and vibrate these part stacks independently of each other.

[0013] The boundary elements preferably sit on a holding device, e.g., a shaft. In one arrangement, the drive moves the holding device backwards and forwards and the boundary elements are thus moved backwards and forwards. In a different embodiment, the boundary elements are moveably arranged on the holding device in such a way that they can be moved backwards and forwards parallel to the edge. The drive is connected via a transmission device, e.g. a cable or chain, to the boundary elements.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0014] The novel features and method steps characteristic of the invention are set out in the claims below. The invention itself, however, as well as other features and advantages thereof, are best understood by reference to the detailed description, which follows, when read in conjunction with the accompanying drawings, wherein:

[0015] FIG. **1** shows the device viewed from the front with the direction of view being vertical to the edge between the two aligning surfaces;

[0016] FIG. **2** shows the device viewed from the side, with the direction of view running parallel to the edge between both aligning surfaces and the boundary elements swung out from the engaging position; and

[0017] FIG. **3** shows the device in the direction of view from FIG. **2** with the boundary elements being swung into the engaging position.

DETAILED DESCRIPTION OF THE DRAWING

[0018] In the exemplary embodiment, the device is used to align a stack of letters and/or other flat rectangular postal items at two edges K**1**, K**2**. These postal items function as the objects to be aligned. Further processing of the postal items Se**1**, Se**2** requires that they have been aligned at both edges K**1**, K**2**.

[0019] FIG. **1** shows an aligning device according to the exemplary embodiment viewed from the front, FIGS. **2** and **3** show a view from the side.

[0020] In the exemplary embodiment, the aligning device includes a vibrating table. This vibrating table has two aligning surfaces **1**, **2** that abut each other at an edge K and are rigidly connected to each other. The aligning surfaces **1**, **2** extend flat in two planes. Both aligning surfaces **1**, **2** slope steeply towards the edge K and stand vertically on each other. In the exemplary embodiment, the postal items Se**1**, Se**2** to be aligned have two edges K**1**, K**2** that are also vertical relative to each other.

[0021] The direction of view in FIG. **1** is vertical to the edge K between both aligning surfaces **1**, **2**. The direction of view of FIG. **2** and FIG. **3** runs parallel to this edge K. In an alternative arrangement, a straight slot extends between the aligning surfaces. The aligning surfaces are thus not rigidly connected to each other. Each aligning surface lies in a plane. Both these planes abut in an edge. The edge lies in the slot. The effect of the alternative arrangement is that particles of dirt, mainly during vibration, slide downwards on the aligning surfaces and fall down through the slot.

[0022] The aligning surfaces **1**, **2** are made from a smooth, hard-wearing material, such as metal or hard plastic. The vibrating table has a frame with four legs **4.1**, **4.2**, **4.3**, **4.4** which provides it with a stable mounting. A motor **3** is connected to the frame and is designed to set both aligning surfaces **1**, **2** in vibration. The motor **3** is firmly connected to the frame and is located under the aligning surfaces **1**, **2**. It can be switched on and off. The motor vibrates both the aligning surfaces **1**, **2**, for example in a manner described in US 2003/0062670 or EP 1676796.

[0023] Each of the postal items extends in an object plane that is vertical to the drawing plane of FIG. **1** and lies in the drawing plane of FIG. **2** and FIG. **3**. The stack with the postal items Se**1**, Se**2** is placed for aligning on both aligning surfaces **1**, **2** so that the object planes in which the postal items Se**1**, Se**2** extend are almost vertical on both aligning surfaces **1**, **2**. The postal items Se**1**, Se**2** thus stand almost vertically on both aligning surfaces **1**, **2**. The force of gravity causes the postal items Se**1**, Se**2** to slide downwards on the aligning surfaces **1**, **2** until they are aligned against the edges K**1**, K**2**.

[0024] In the exemplary embodiment, the aligning device has at least three boundary elements **5.1**, **5.2**, etc. that are attached to a holding device **6** in such a way that they can be swiveled independently of each other relative to the holding device **6**. The holding device **6** is connected to the frame and therefore stands on the four legs **4.1**, **4.2**, **4.3**, **4.4**. Each boundary element **5.1**, **5.2** etc., can be swiveled backwards and forwards between a position in which it engages in the stack of postal items Se**1**, Se**2** that lies on both aligning surfaces and in a position in which the stack can be moved past on the boundary element.

[0025] In FIG. **2** the boundary elements **5.1**, **5.2** etc. are swiveled out of the engaging position. In FIG. **3** they are swiveled into the engaging position. A stop **7** limits the possible rotation of a boundary element in each case. In the exemplary embodiment, each boundary element can rotate through 90 degrees.

[0026] Two boundary elements form the outer boundary elements. In the example in FIG. **1**, these are the boundary elements **5.1**, **5.5**. Each further boundary element **5.2**, **5.3**, **5.4** divides the stack into two part stacks in each case. The boundary elements **5.1**, **5.2** etc., are, for example, in the form of wide paddles with the handle of each paddle being connected to the holding device **6**.

[0027] In the arrangement shown in the illustrations the device has five boundary elements **5.1**,-**5.5** etc. This has proved to be a more satisfactory compromise between the requirements for a fast alignment of the postal items and a simple arrangement of the device. The postal items Se**1**, Se**2** are vibrated through in two different ways. On one hand by means of the vibrations which are imparted to the supporting surfaces **1**, **2** and transmitted to the postal items Se**1**, Se**2**, and, on the other hand, by the backwards and forwards movements of the boundary elements **5.1**, **5.2** etc. that cause the postal items Se**1**, Se**2** to tilt backwards and forwards.

[0028] Preferably, the boundary elements **5.1**, **5.2** etc. are connected to the holding device **6** in such a way that each boundary element can be swiveled into the engaging position independently of the other boundary elements. At the same time, all the boundary elements **5.1**, **5.2** etc. are connected to each other in such a way that a movement of a boundary element from the engaging position carries the other boundary elements with it, i.e. causes each of the other boundary elements to be swiveled into the non-engaging position.

[0029] Preferably, the holding device **6** is designed as a shaft that runs parallel to the edge K between the planes of the aligning surfaces **1**, **2**. Each boundary element **5.1**, **5.2** etc. is attached to this shaft in such a way that it can be rotated backwards and forwards between the two positions. Each boundary element can be rotated to the engaging position independently of the other boundary elements.

[0030] In another embodiment, the boundary elements are connected to the holding device **6** in such a way that they can be pushed backwards and forwards between both positions, preferably in a linear movement. Mixed forms are also possible where each boundary element **5.1**, **5.2** etc. can be moved backwards and forwards between both positions by a superpositioning of a rotating and linear movement.

[0031] An operator places the stack of postal items Se**1**, Se**2** to be aligned on the aligning surfaces **1**, **2** and first moves one of the two outer boundary elements **5.1** or **5.5** to a position in which this outer boundary element forms the boundary of the stack, viewed in the direction of the edge K. The stack is thus held by the first swiveled boundary element. In the example in FIG. **1** this is the boundary element **5.1**, for example. He then moves the other outer boundary element to a position in which it also forms the boundary of the stack, e.g. the boundary element **5.2**. The stack is then located between the two outer boundary elements **5.1**, **5.5** and both outer boundary elements **5.1**, **5.5** are in the engaging position.

[0032] The operator then moves at least one further boundary element **5.2**, **5.3**, **5.4** to a position in which it engages in the stack and divides the stack into two part stacks. The further boundary element **5.2**, **5.3**, **5.4** is then also in the engaging position. Postal items Se**1**, Se**2** lie loosely between the boundary elements **5.1**, **5.2** etc. in such a way that they can tilt to a certain extent and are thus not tightly held.

[0033] The device has a drive **9.1**, **9.2** designed to move the boundary elements backwards and forwards relative to the holding device, i.e., in two opposite directions parallel to the edge K between the aligning surfaces **1**, **2**. A transmission device **8** transmits movements from the drive **9.1**, **9.2** to the boundary elements **5.1**, **5.2** etc. If the holding device **6** is designed as a shaft, the drive **9.1**, **9.2** moves the boundary elements **5.1**, **5.2** etc. backwards and forwards parallel to the shaft.

[0034] In the example in FIG. **1**, the transmission device **8** is a cable that drive **9.1** and drive **9.2** in turn pull towards themselves in the direction of the edge K. The cable is preferably sufficiently long to enable at least one boundary element to be swiveled into the engaging position and at least one other boundary element to be swiveled out of the engaging position at the same time.

[0035] Preferably, the transmission device **8** is designed so that the distance between at least two adjacent guide elements varies during the backwards and forwards movement. This has the effect of varying the slope angles of the postal packages Se**1**, Se**2** relative to the vertical, thus further accelerating the aligning.

[0036] The transmission device **8** for example includes a cable or a chain or other flexible oblong transmission element. This transmission element **8** connects all the boundary elements to each other and to the drive. The transmission element **8** then tightens when the drive **9.1**, **9.2** moves the boundary elements **5.1**, **5.2** etc. in one direction, which leads to an increased distance between the boundary elements **5.1**, **5.2** etc. The inertia of the masses of the postal items and the boundary elements **5.1**, **5.2** etc. causes the distance to be reduced.

[0037] The arrangement with at least three boundary elements means that the backwards and forwards movement is transmitted to the at least two part-stacks that occur and the aligning is carried out even faster.

[0038] After the stack is positioned between the outer boundary elements **5.1**, **5.5** and at least one further boundary element **5.2**, **5.3**, **5.4** engages in the stack, the alignment of the postal items begins. On the one hand, the motor **3** sets both aligning surfaces **1**, **2** in vibration, after the operator has switched it on. On the other hand, the drive **9.1**, **9.2** moves the boundary elements **5.1**, **5.2** etc. backwards and forwards parallel to the edge. The backwards and forwards movement means that the postal items during the movement have different slope angles with respect to the vertical. In conjunction with the vibration, this further reduces the friction between the postal items and the force of gravity then aligns the postal items faster against the aligning surfaces **1**, **2**.

[0039] If the backwards and forwards movement of the boundary elements **5.1**, **5.2** etc. has a sufficiently large amplitude, the postal items Se**1**, Se**2** are even tilted backwards and forwards so that they pass through a vertical position during tilting, i.e. are inclined to one side and then to the other. Preferably, the frequency with which the drive **9.1**, **9.2** moves the boundary elements backwards and forwards can be varied. In this way the frequency can be matched to different postal items and environmental conditions, e.g., different ambient humidity, temperature, or different average dimensions of the postal items. After a preset time barrier is reached, the operator switches off the motor **3** which generates the vibration, as well as the drive **9.1**, **9.2** for the boundary elements. Then, the operator, or a further drive, swivels the boundary elements **5.1**, **5.2** etc. to the non-engaging position. In the case of rotatably mounted boundary elements, the operator rotates a boundary element, preferably an outer boundary element **5.1**, **5.5**, to a non-engaging position. This causes all the other boundary elements to also be turned off.

What is claimed is:

1. A device for aligning several flat objects, each of which extends in an object plane and together form a stack, comprising:

a supporting device for supporting the objects;

at least two boundary elements configured to swivel into an engaging position;

a drive for moving the boundary elements backwards and forwards, with the at least two boundary elements in the engaging position holding the stack, if the stack with the objects is located on the supporting surface and positioned between the boundary elements;

wherein the supporting device includes two aligning surfaces for aligning the objects,

wherein the aligning surfaces lie in two planes that abut each other at a straight edge,

wherein both aligning devices slope steeply towards the edge;

wherein the device includes a motor for setting the aligning surfaces in vibration, and

wherein the drive is connected to the boundary elements to move the boundary elements backwards and forwards parallel to the edge when said boundary elements are in the engaging position.

2. The device of claim **1**, wherein the device has at least one further boundary element configured to be set to an engaging position and in the engaging position divides a stack, located between the first two boundary elements, into two part-stacks.

3. The device of claim **2**, wherein the drive is connected to each further boundary element in such a way that it then moves the further boundary element backwards and forwards parallel to the edge when said boundary element is in the engaging position.

4. The device of claim **2**, wherein the device has a holding device and each boundary element is attached to the holding device to be swivelable.

5. The device of claim **4**, wherein each boundary element is attached to the holding device to swivel into the engaging position independently of all other boundary elements.

6. The device of claim **4**, wherein each boundary element is attached to the holding device to swivel so that the boundary elements cannot be pushed in the direction of the edge, and wherein the drive is designed for backwards and forwards movement of the holding device parallel to the edge.

7. The device of claim **4**, wherein the holding device includes a shaft on which the boundary elements are rotatably mounted.

8. The device of claim **1**, wherein the drive is connected by an oblong, flexible transmission element to all the boundary elements, and is designed for the backwards and forwards pulling of the transmission element.

9. The device of claim **1**, wherein each boundary element is attached to a holding device so that the boundary element is moveable forwards and backwards parallel to the edge.

10. The device of claim **1**, wherein the drive is configured to move the boundary elements backwards and forwards at a variable frequency.

11. The device of claim **1**, wherein both aligning surfaces abut each other at the straight edge and are connected to each other along the edge.

12. The device of claim **1**, wherein a slot that extends along the edge is located between both aligning surfaces.

13. A method for aligning several flat objects each of which extending in an object plane, comprising:

placing the objects as a stack on a supporting device of an aligning device;

swiveling at least two boundary elements of the aligning device into an engaging position in which the stack is located between the boundary elements and are held by the boundary elements; and

moving the boundary elements backwards and forwards using a drive of the aligning device,

wherein the supporting device has two flat aligning surfaces,

wherein the aligning surfaces lie in two planes that abut each other at a straight edge,

wherein both aligning surfaces slope steeply towards the edge,

wherein the stack is positioned on the aligning surfaces so that the object planes are vertical relative to the edge,

wherein a motor of the device sets the aligning surfaces (**1**, **2**) in vibration and

wherein the drive moves the boundary elements backwards and forwards parallel to the edge.

14. The method of claim **13**, further comprising:

swiveling at least one further boundary element of the aligning device into an engaging position in which it divides the stack into two part-stacks, and

moving the further boundary element backwards and forwards via the drive.

15. The method of claim **13**, further comprising:

swiveling both boundary elements into the engaging position;

placing the stack between the boundary elements;

placing at least one further boundary element in the engaging position so that it divides the stack into two part-stacks;

switching the drive on;

moving via the switched-on drive all the boundary elements backwards and forwards;

switching the drive off;

swiveling the boundary elements out of the engaging position; and

removing the aligned objects from the aligning surfaces.

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