March 22, 1966 KAZUO UCHIYAMA ETAL 3,241,757

PAPER MONEY COUNTING APPARATUS

Filed Oct. 15, 1963 2 Sheets-Sheet 1

FIG. 1

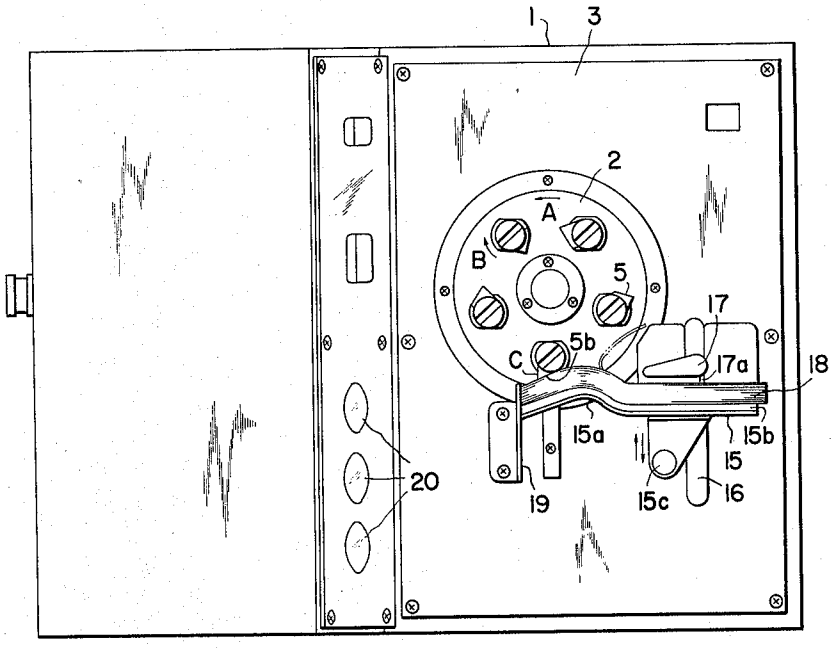


FIG. 2

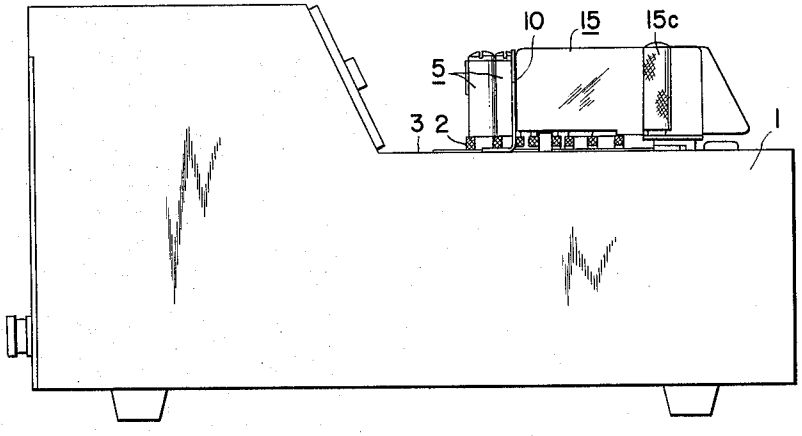


FIG. 3

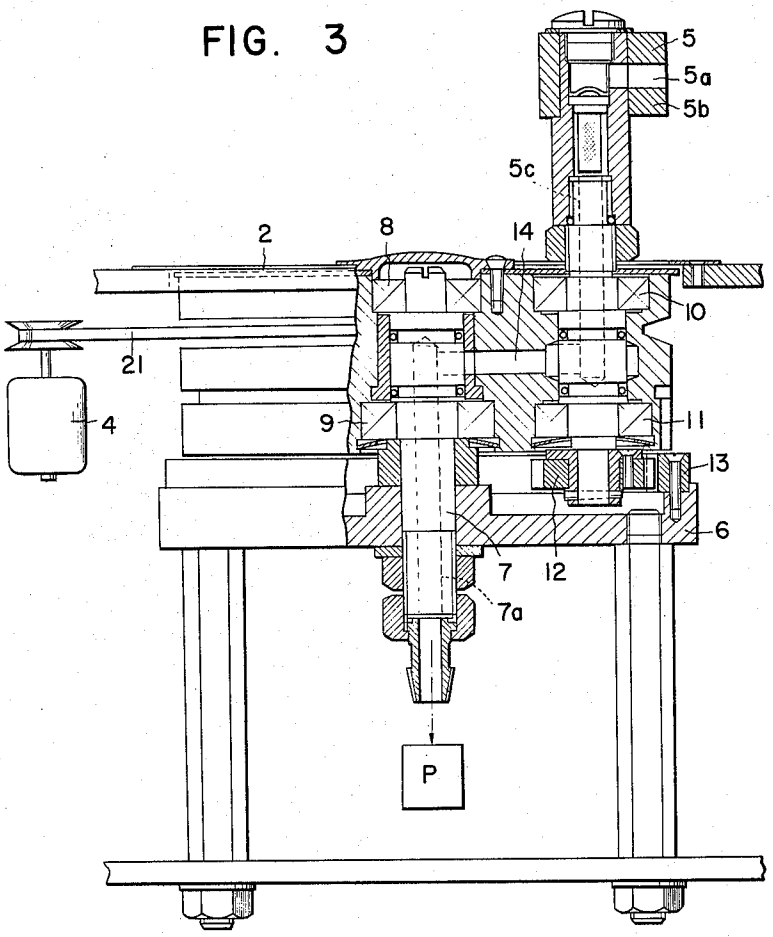


FIG. 4(A)

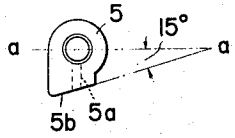
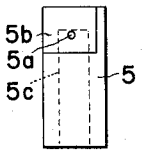


FIG. 4(B)



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PAPER MONEY COUNTING APPARATUS

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3 Claims. (Cl. 235—98)

The present invention relates to a new type paper money counting apparatus.

A large number of paper money counting machines of conventional type have been made and sold heretofore, but all of such conventional counting machines are not free from shortcomings in the speed and reliability of their counting operation.

It is, therefore, the object of this invention to eliminate the said shortcomings by providing a new type paper money counting apparatus, which has a novel mechanism and makes it possible to perform a speedy and reliable counting operation.

The said object and other objects of this invention will become more apparent by reference to the following detailed description of a preferred embodiment, taken in conjunction with the accompanying drawings, in which the same members are designated by the same reference characters, and in which:

FIG. 1 is a plan view showing the main part of an apparatus embodying the features of this invention;

FIG. 2 is a side view showing the main part of the apparatus of FIG. 1;

FIG. 3 is a side view, partly in section, of the internal mechanism of a rotary table provided with suction heads according to this invention;

FIGS. 4(A) and 4(B) are plan view and side view, respectively, of the suction head of the mechanism of FIG. 3.

Referring to the drawings, the counting apparatus comprises a main body **1**, a rotary table **2** which is rotated by an electric motor **4** on a base plate **3** of the main body **1** of the paper money counter, and five suction heads **5** which are rotatably mounted on the rotary table **2**, said heads being placed concentrically to the center of the rotary table **2** at equal intervals. The details of structures and functions of the rotary table **2** and suction heads **5** are explained in connection with FIGS. 3 and 4, in which a supporting shaft **7** of the rotary table **2** is secured to a fixed base plate **6**, a vacuum passage **7***a* communicating with a vacuum pump P is provided axially in the central portion of said shaft **7**. The rotary table **2** is supported by means of bearings **8** and **9** so as to be rotated with respect to the supporting shaft **7**, and the five suction heads **5** are supported by means of bearings **10** and **11** so as to be rotated with respect to the rotary table **2**, each of said heads being provided at its upper end with a face **5***b* being inclined in a tangential direction and being perpendicular to the axial direction of said head. At its upper middle portion the head is provided with a vacuum suction hole **5***a*, and at its bottom end portion with a gear **12** which in turn is engaged with an inside gear **13** provided on the circumference of the fixed base plate **6**. The rotary table **2** is provided with a ring-shaped cavity **14** which is separated into five sector chambers by means of five radial partitions, said sector chambers being connected at its internal end to the vacuum passage **7***a* formed inside the supporting shaft **7**, at a point near the upper end thereof, and at its external end to the lower part of a vacuum passage **5***c* which is formed inside the suction head **5** and communicated with the vacuum suction hole **5***a*. Accordingly, while the rotary

table **2** rotates for one fifth of a revolution, i.e., 72 degrees, the upper end of the vacuum passage **7***a* of the supporting shaft **7** communicates with either one of the said sector chambers of the ring-shaped cavity **14**, whereby a suction head **5** being in communication with said chamber effectively performs a vacuum sucking action. During one revolution of the rotary table **2**, the suction head **5** is switched five times. In this case, the suction head **5** must be arranged so as to take a correct sucking position as shown in C of FIG. 1 at every ⅕ revolution of the rotary table **2**. Such a timing can be attained by adequate selection of gear ratio between the gear **12** and the inside gear **13**. Furthermore, inclination of the face **5***b* of the suction head **5** is selected so that paper money on said face can be sucked most easily. As seen in FIG. 4, said inclination is selected at about 15 degrees with regard to a line *a*—*a* which is orthogonal to the vacuum suction hole **5***a*.

In FIG. 1, a paper money holding plate **15** has a bent portion **15***a* protruding toward the side of said rotary table **2** at a portion near the vacuum suction portion C of the rotary table **2**, said holding plate being provided at its inside surface with a sponge liner **15***b* and being made to be moved reciprocally in the direction as indicated by arrows along a guide slot **16** by operating a handle **15***c*. The holding plate **15** is always held on a stopper **17** by means of a spring device (not shown in the drawing), said stopper being provided with a sponge liner **17***a* on the opposite side to the sponge liner **15***b*. A stack of paper money **18** is held between the holding plate **15** and the stopper **17** which are guided at their leftside ends by a guide plate **19**. The apparatus comprises counter indicating tubes **20** which are conventionally applied to various counting devices which have to achieve quick indications and elimination of the counting. At every time the suction head **5** sucks paper money at a regular sucking position, a microswitch mechanism (not shown in the drawings) is set into action, whereby counting is performed one by one in regular sequence and the result thereof is indicated on the said indicating tubes. Operation of the above-mentioned apparatus will now be described in detail hereinbelow.

When a main switch of the electric power source is closed, the motor **4** starts and the rotary table **2** is rotated in the direction as indicated by an arrow mark A through a driving belt **21**. At the same time, each suction head **5** is rotated in the direction as indicated by an arrow mark B through the gear **12** provided at its bottom end and the internal gear **13** of the base plate **6** being meshed thereto. Each of the suction heads **5** is adjusted so that at its sucking position C (FIG. 1) the suction face **5***b* will be exactly in parallel with the oposite face of the holding plate **15**. Since the suction head **5** is in communication with the vacuum pump P, when the suction head **5** reaches said position C, the end portion of the innermost paper money **18** is sucked and folded to the right as indicated by a chain line. Next, when the succeeding suction head comes to the sucking position C, it sucks the subsequent sheet of paper money and sends its end to the position of the said chain line, thus repeating such operations regularly. Counting speed of this apparatus is set so as to count 100 sheets of paper money in about 7 to 8 seconds. This counting speed is determined by taking such requirement into consideration as that, for example, minimization of fatique of opeartor's eyes, mental stability derived from the knowledge of counting being carried out, and capability of certain clerical work while the counting is being made. The holding plate **15** has a protruding bent portion **15***a* projected at its left portion toward the vacuum sucking position C, said bent portion **15***a* being formed as a shape

adapted to cause the bundle of paper money to be deformed as shown in FIG. 1. Since this deformation of paper money produces a tendency to extend itself in a straight direction due to elasticity of the paper money, said tendency serving as an aid in the sucking and counting operation of the suction head, the sucking and counting operations are performed smoothly and reliably.

In the above embodiment, the vacuum pump, the indication tubes for counting and the microswitch device for actuating the said tubes are not concretely shown in the drawings and described in the specification, because these appliances are well known in the art and do not constitute characteristic features of the present invention, hence they are omitted from this specification and drawings.

As described in the foregoing, this invention relates to a paper money counting apparatus wherein such novel technical elements as described above are adopted, which is able to count a large number of paper money with extremely high speed and great accuracy, is convenient in handling due to it being constructed in compact dimension as whole, and is indispensable for improving business efficiency. While the invention has been explained by describing a particular embodiment thereof, it will be apparent that improvements and modifications may be made without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A paper money counting apparatus which comprises a base plate, a rotary table mounted on the base plate, an electric motor for driving said table, a plurality of suction heads, a shaft for supporting each head in a freely rotatable manner with respect to said rotary table, gear means to rotate each suction head in a sense opposite to the direction of rotation of said rotary table, a paper money holding plate supported on said base

plate extending in a direction generally tangential to said rotary table, one end of the holding plate adjacent said rotary table being formed with a curved portion protruding toward the rotary table so as to cause a deformation of the paper money to be counted, a sponge liner on the surface of said money holding plate to contact the paper money placed thereon, and each suction head having a face inclined in a tangential direction and perpendicular to the axial direction of each head whereby such face will be parallel with the adjacent face of the holding plate so that the money on said face can be easily aspirated, and a counting indicator device operable each time that a suction head is successively moved to its operating position in contact with the money to be counted.

2. The paper money counting apparatus as claimed claim **1** in which each suction head is provided with an aperture and said face is inclined at about 15° with respect to a line orthogonal to said aperture in the head.

3. The paper money counting apparatus of claim **1** including a guide plate to contact the end of paper money to be counted adjacent said rotary table.

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