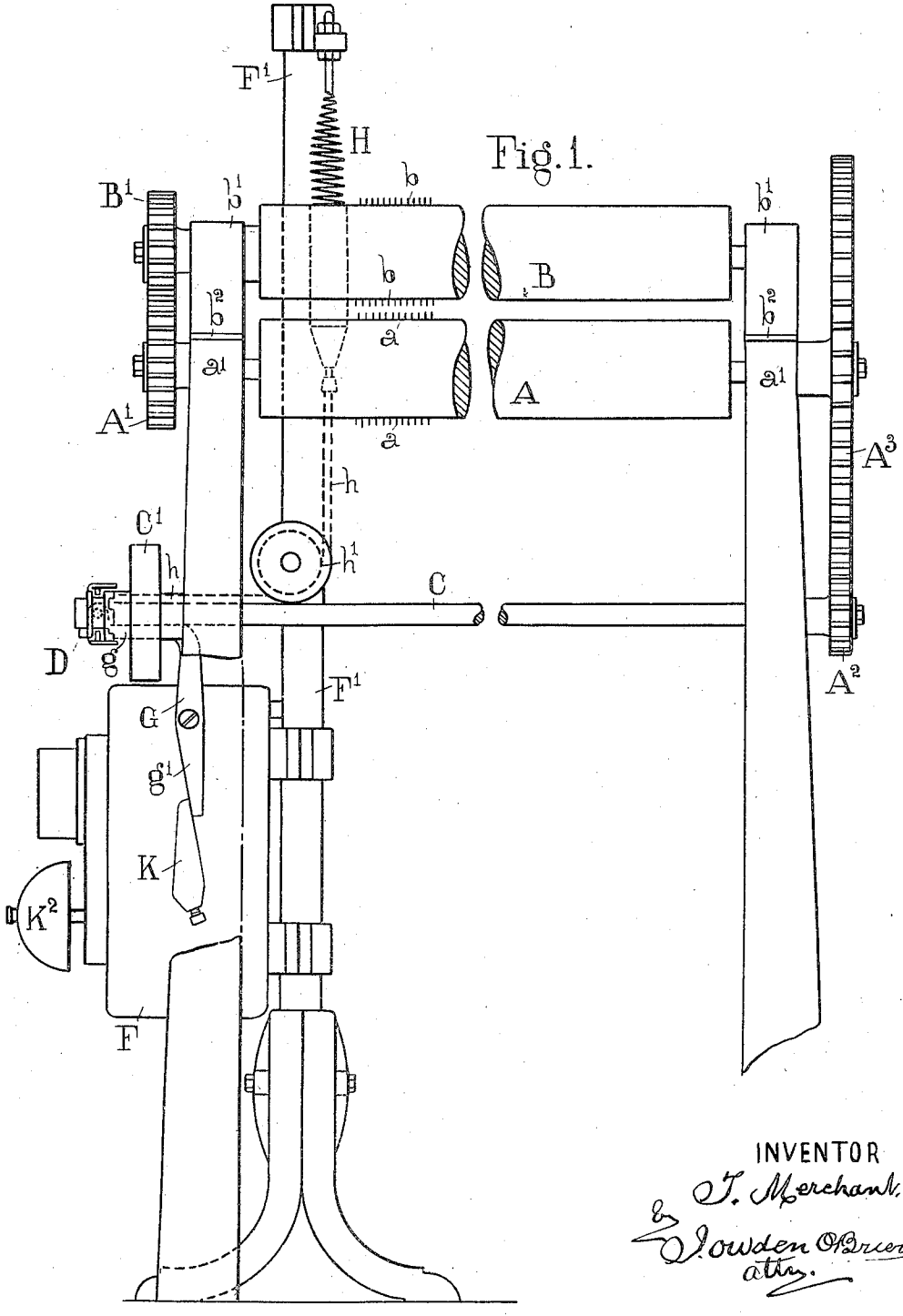
Dec. 21, 1937. T. MERCHANT 2,102,906

MEANS FOR DETECTING METALLIC AND OTHER SUBSTANCES IN TEXTILE OR FIBROUS MATERIAL

Filed Sept. 21, 1936

7 Sheets-Sheet 1

Fig. 1.



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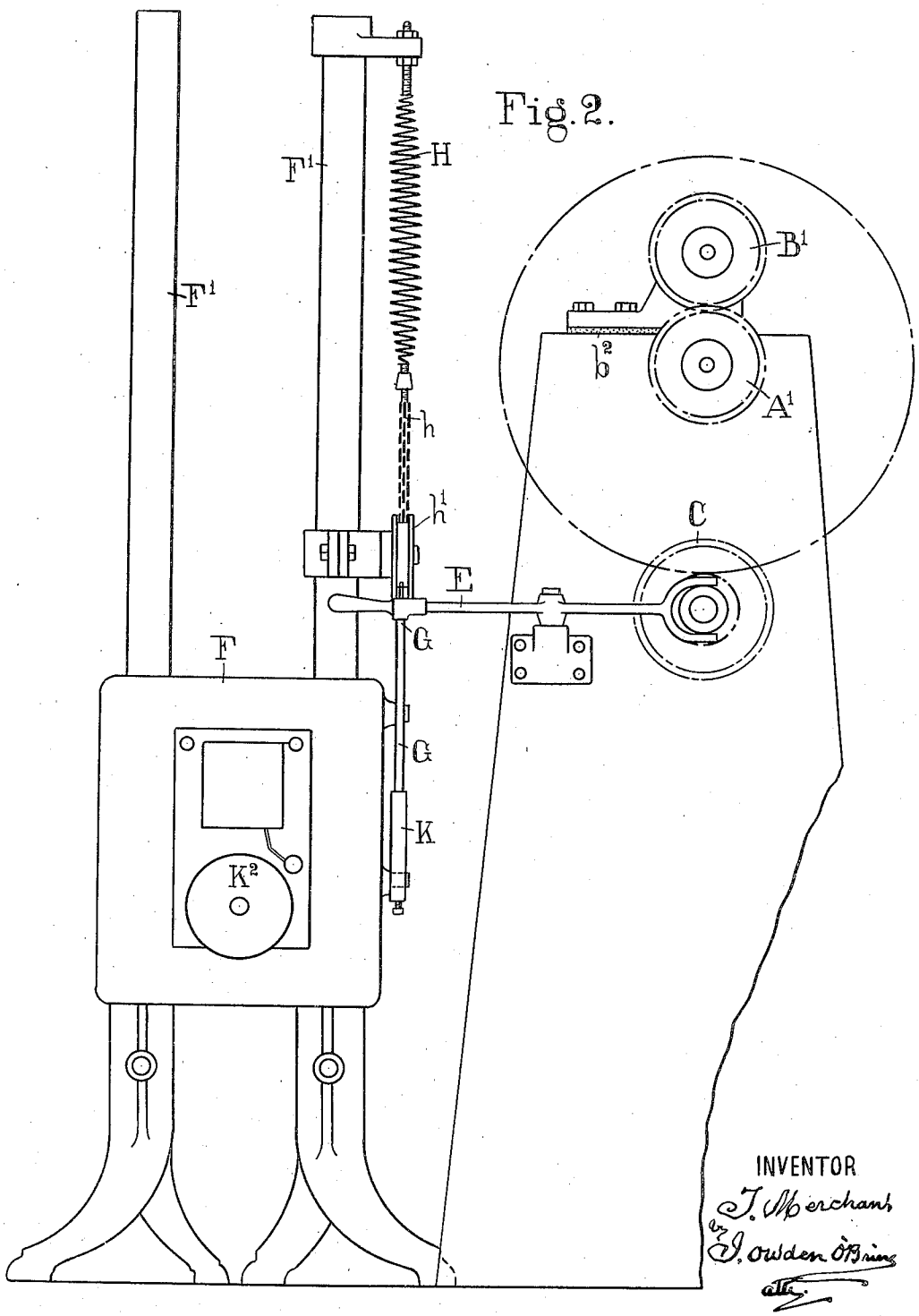
7 Sheets-Sheet 2

Fig. 2.



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7 Sheets-Sheet 3

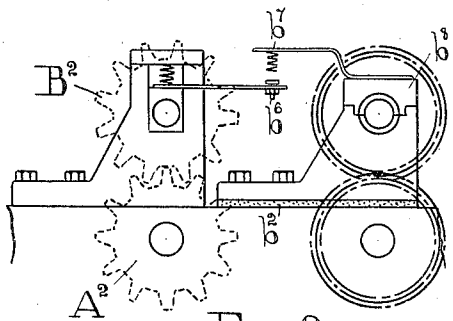

Fig. 9.

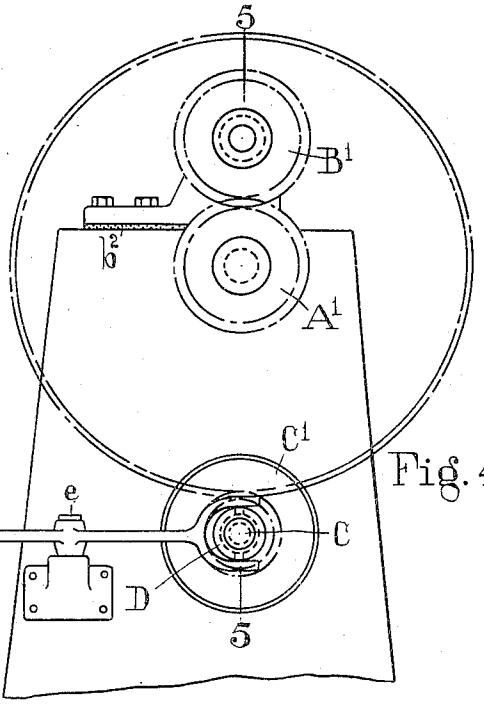

Fig. 4.

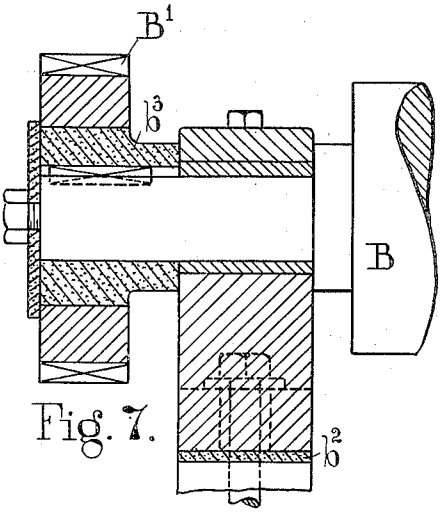

Fig. 7.

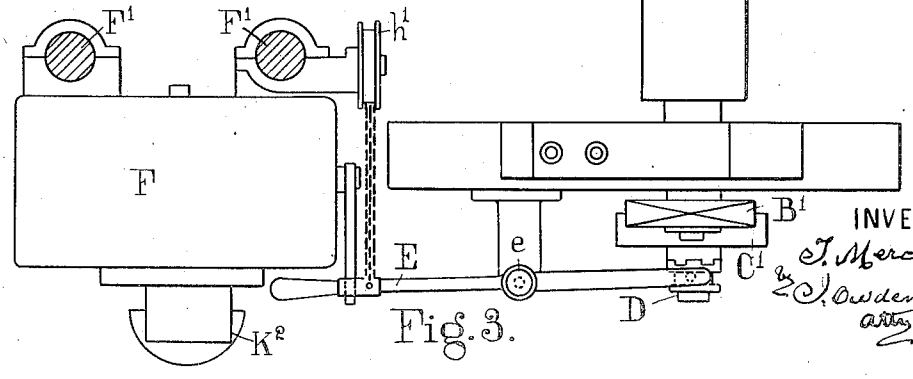

Fig. 3.

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7 Sheets-Sheet 4

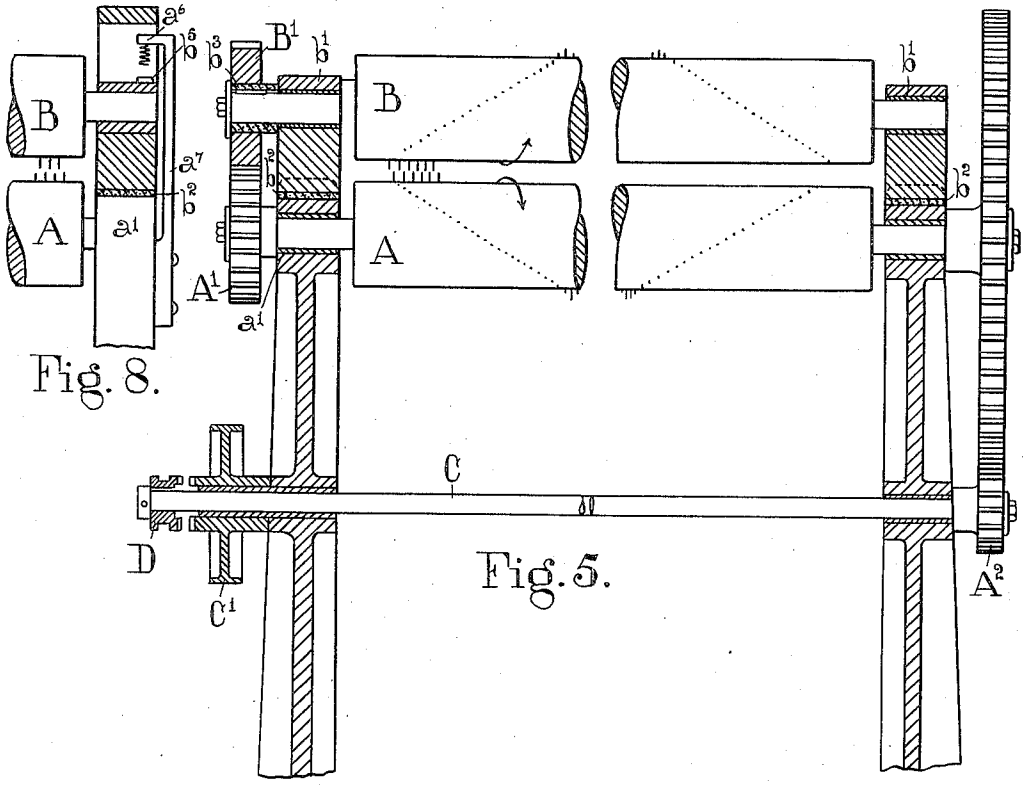

Fig. 8.

Fig. 5.

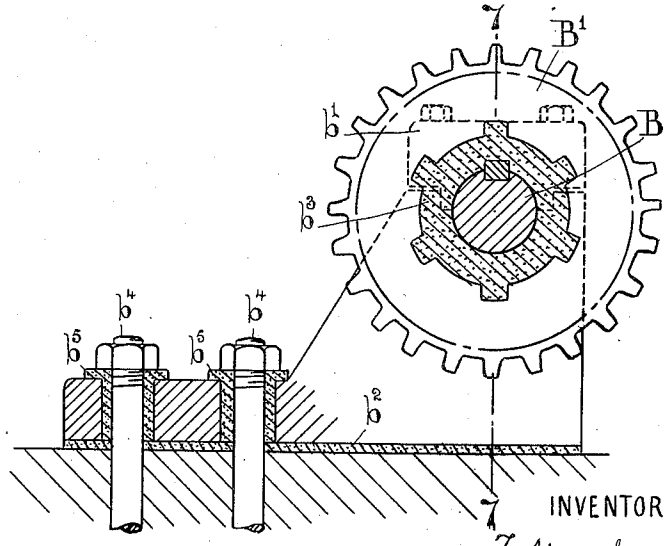

Fig. 6.

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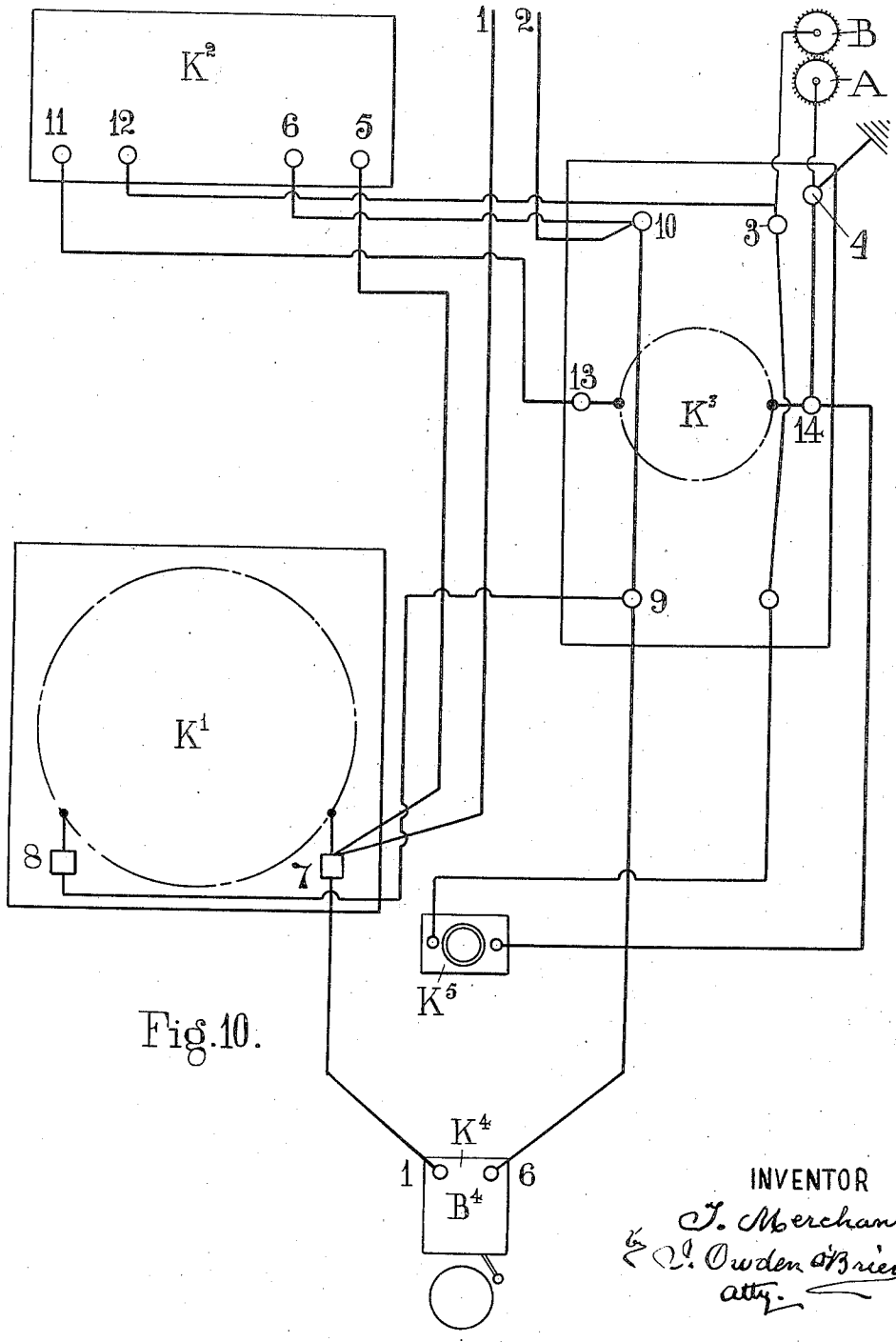

Fig.10.

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MEANS FOR DETECTING METALLIC AND OTHER SUBSTANCES IN TEXTILE OR FIBROUS MATERIAL

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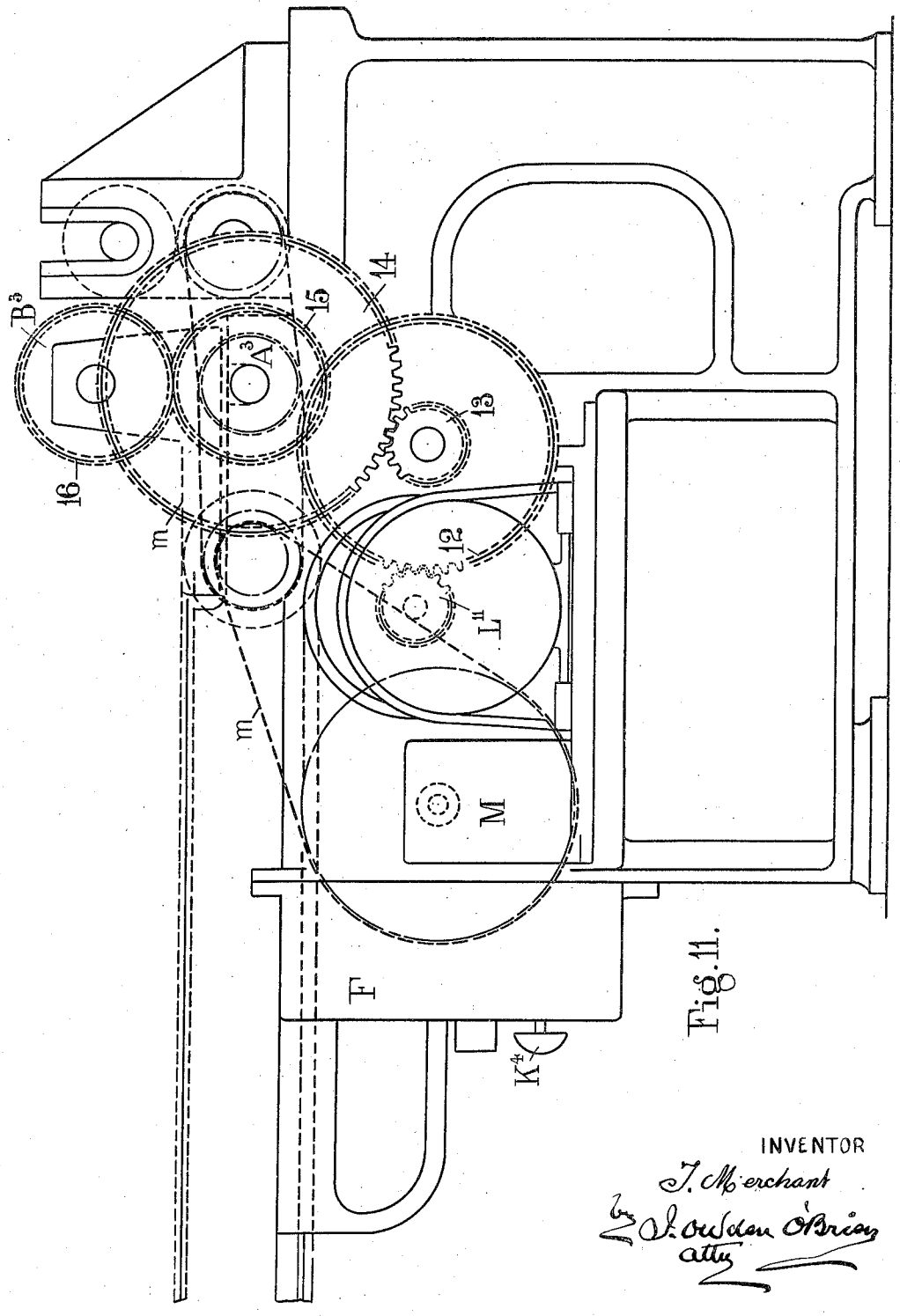

Fig. 11.

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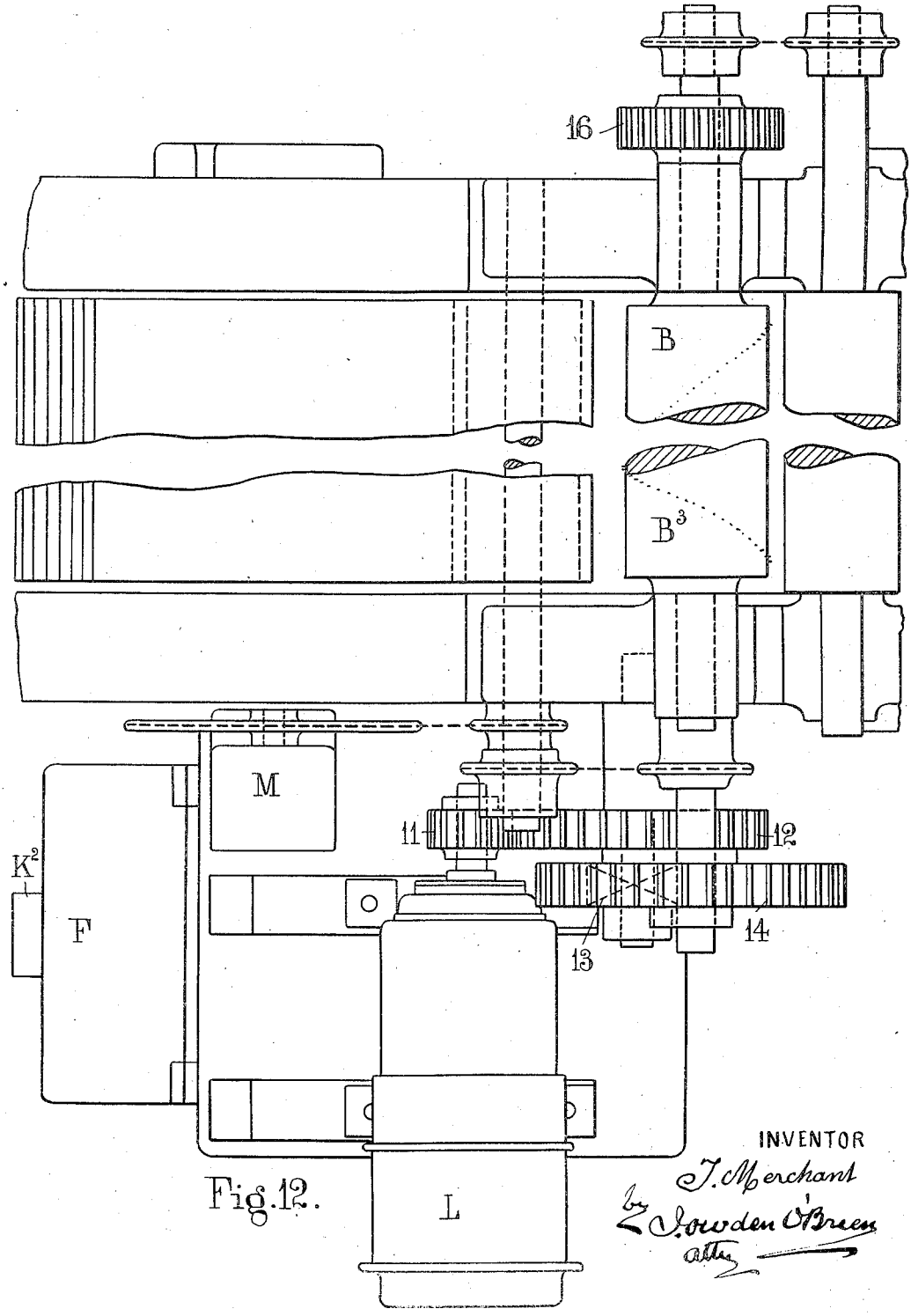

Fig. 12.

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Patented Dec. 21, 1937 2,102,906

UNITED STATES PATENT OFFICE

2,102,906

MEANS FOR DETECTING METALLIC AND OTHER SUBSTANCES IN TEXTILE OR FIBROUS MATERIAL

Thomas Merchant, Castleton, England

Application September 21, 1936, Serial No. 101,819
In Great Britain December 6, 1935

10 Claims. (Cl. 19—165)

This invention relates to improvements in means for detecting metallic and other substances in textile or fibrous material and also if desired for arresting the passage thereof into process machinery.

Many process or preparing machines such as scutchers, openers, cards, scribbling machines, Garnett machines, felt or wadding machines and the like used in the treatment of textile fibres or fibrous material, comprises rollers or cylinders covered with wire fillets or similar clothing the wires or teeth of which are liable to be damaged if any metallic or other hard substances come into contact therewith. Such damage even if small will considerably decrease the effectiveness of the machine and if large necessitates the reclothing of the damaged cylinder or roller. Moreover metallic substances are sometimes found in finished textile goods which it is desirable or necessary to remove therefrom.

The object of the present invention is to provide means which will detect any metallic substance even though extremely small in the material and which in the case of fibrous material may also arrest the feed to the machine and/or stop the machine itself and in a modification to provide means which will also detect other foreign substances such as pieces of wood, horn, hoof or the like which may be present in the material.

According to the invention the material is passed between a pair of rollers set apart and arranged in an electric circuit, whereby any metallic substance in the fibrous material will bridge the rollers and establish the circuit which controls a stop motion and/or alarm for the feed device and/or for the process or preparing machine.

The rollers are preferably covered with Garnett teeth, wire clothing or fillets which will penetrate into the fibrous material and detect any metallic substance even though very small which may be present therein.

The invention will be described with reference to the accompanying drawings in which:—

Fig. 1 is a front elevation of one form of the invention.

Fig. 2 is a side elevation thereof.

Fig. 3 is a plan thereof showing the controlling end only.

Fig. 4 is a similar side elevation to Fig. 2 but of a part only of the device.

Fig. 5 is a vertical section on line 5—5 Fig. 4.

Fig. 6 is an enlarged section showing the mounting of the upper roller to insulate it from the lower roller.

Fig. 7 is a section on line 7—7 Fig. 6.

Fig. 8 is a detail view showing a modified construction of the invention for detecting pieces of foreign matter such as wood, horn, hoof or the like which are not electrical conductors.

Fig. 9 is a detail view of another modification applicable for the same purpose.

Fig. 10 is a diagram of an electric circuit which when closed by the detection of a metallic substance will operate to stop the feed and sound an alarm.

Fig. 11 is a side elevation showing the invention applied to the feed rollers of a Garnett machine, the establishing of the electric circuit causing the rotation of the feed rollers to be reversed.

Fig. 12 is a plan of Fig. 11.

The detector mechanism comprises two rollers A and B each covered with Garnett wire or other wire clothing or fillets *a* and *b*. The two rollers are geared together by the gear wheels A1 and B1 and the bottom roller A is driven through the gear wheels A2 and A3 from the shaft C. The lower roller is mounted in bearings *a1* and the upper roller in bearings *b1* insulated from the bearings *a1* by strips or sheets *b2* of suitable insulating material. To prevent the gear wheels A1 and B1 completing the circuit between the two rollers A and B, the wheel B1 is insulated from the shaft of the roller B by a disc *b3* keyed on the shaft as shown in Figs. 6 and 7. The bolts *b4* by which the bearings *b1* are affixed to the top of the bearings *a1* are also insulated from the bearings *b1* by flanged sleeves or bushes *b5* also as shown in Figs. 6 and 7.

The shaft C is driven by a pulley C1 loosely mounted thereon and adapted to be secured thereto by a sliding clutch D slidably mounted on a key affixed on the shaft. The clutch D is controlled by a setting on lever or handle E pivotally mounted on a stud or bracket *e* carried on the frame of the machine.

The rollers A and B are arranged in any electric circuit connected to an electromagnet and/or an alarm bell or the like either directly or preferably through a relay whereby on there being any metallic substance present in the fibrous material passing between the rollers A and B the wires *a* and *b* will come into contact therewith and close the circuit thereby operating the electromagnet and/or alarm.

Any suitable arrangement of electric circuit and control may be employed but are particularly applicable for use when the current employed is derived from the electric mains and it is not desired to use such a high voltage for the rollers as shown in the drawings.

In this arrangement a metal casing F is mounted on two upright pillars F1 to enable its height relative to the setting on handle or lever E to be adjusted whereby the device can be used for different machines. A pivoted arm or lever G is mounted on the outside of the casing F, and the end of the arm G of the lever engages the setting on handle or lever E. The other arm *g1* of the lever G is engaged by an arm K controlled by

an electromagnet K1 (see Fig. 10) and this arm K holds the lever G in the position shown in Figs. 1, 2 and 3 against the pull of the spring H.

The setting on handle or lever E is connected by a chain *h* passing round a pulley *h1* to a powerful spring H tending to pull the handle or lever E in a direction to disengage the clutch D. Thus when the arm actuates the lever G the spring H pulls over the setting on handle or lever E and causes the clutch D to be moved out of engagement with the driving pulley C1 thereby stopping the feed rollers A and B.

The electrical connections to the electro-magnet K1 controlling the arm K are shown in Fig. 10, these connections being housed within the casing F. Current is supplied to the terminals 1 and 2 from the mains and the terminals 3 and 4 are connected to the rollers B and A respectively. The current from the mains passes to a primary terminal 5 of a transformer K2 through one terminal 7 of the electro-magnet K1 the other terminal 8 of which is connected to the other primary terminal 6 of the transformer through the secondary terminals 9 and 10 of a relay coil K3. The secondary terminals 11 and 12 of the transformer K1 are connected to the primary terminals 13 and 14 of the relay coil K3 which are in series with the terminals 3 and 4 connected to the rollers A and B. A bell B4 is arranged in parallel with the electro-magnet K1 and a stop push switch K5 in the circuit to the primary terminals of the relay coil K3.

When a metal substance comes into contact with the teeth or wires *a* and *b* of the rollers A and B and causes the terminals 3 and 4 to be bridged a secondary current from the transformer K2 will pass through the relay coil K3 which in turn permits the primary current from the mains to energize the electro-magnet K1. The energizing of the electro-magnet K1 gives a sharp knock to the arm K which operates the lever G and moves the latter out of engagement with the setting on handle or lever E and the spring H immediately operates the latter and causes the clutch D to be moved. At the same time the bell K4 is energized and gives an audible alarm.

As soon as the circuit has been established through the teeth or wires on the rollers A and B and the relay K3 energized to close the circuit through the electromagnet K1 and bell K4 the circuit through the rollers is immediately broken to prevent any possibility of the teeth or wires becoming heated.

Instead of the rollers A and B being driven through a clutch they may be driven by a reversing motor in which case on the completion of the current through the rollers A and B energizes a relay which operates the contacts on the motor, reversing the latter and consequently the direction of rotation of the latter, the motor being finally stopped by a limit control switch after a predetermined time and restarted again by a starter push switch when desired. By these means the travel of the fibrous material is not only stopped but is reversed for a predetermined distance which facilitates the removal of the metallic substance therefrom. Such an arrangement is shown in Figs. 11 and 12.

In the arrangement shown in Figs. 11 and 12 the invention is shown applied directly to the feed rollers A3 and B3 of a Garnett machine. The rollers A3 and B3 are driven from a reversing motor L through gearing *l1*, *l2*, *l3*, *l4*, *l5* and *l6*. The rollers A3 and B3 are arranged in any electric circuit as hereinbefore described and on any metallic substance being present in the material the circuit through the rollers is established and by means of a relay circuit causes the operation of the contacts of the motor L to reverse the latter thereby causing the rotation of the feed rollers A3 and B3 in the reverse direction.

After the rollers A3 and B3 have been rotated a predetermined number of revolutions in the reverse direction a limit switch M operated by chain gearing *m* from the roller A3 comes into operation to stop the motor L or to operate the contacts of the motor L to cause it to rotate again in the forward direction. The bringing into operation of the relay circuit also operates an alarm bell K4.

In some classes of fibrous material there is found not only metallic substances but other foreign matter such as pieces of wood, horn, hoof and the like. Such foreign matter does not usually materially damage the wire clothing of the machine if very small but will do so if relatively large and in Figs. 8 and 9 there are illustrated two different modifications of the invention which will detect not only very small metallic substances in the fibrous material but will also detect pieces of non-metallic substances of a size sufficient to damage the wires of the machine.

In the arrangement shown in Fig. 8 the bearings of the top roller B are so arranged that in the event of a piece of relatively large non-metallic substance passing between the two rollers A and B the top roller will lift and contact will be made by a terminal *b5* with a spring terminal *a6* carried on an arm *a7* attached to the lowering bearing *a1*. A circuit will thus be completed operating in the same way as the circuit completed when the needles *a* and *b* come into contact with a metallic substance and the rollers A and B will be stopped or reversed.

In the arrangement shown in Fig. 9 instead of the roller B being constructed to lift a pair of auxiliary rollers A2 and B2 are provided in front of rollers A and B. These rollers are driven through gear wheels having mangle teeth so that the top roller B2 can lift a considerable distance without the wheels coming out of gear. The upper roller B2 is adapted to lift should a relatively large piece of solid matter pass between the two rollers and bring the contact *b6* into contact with the spring terminal *b7* attached to the bearing *b8*. A circuit will thus be completed operating in the same way as the circuit completed when the needles *a* and *b* come into contact with a metallic substance and the rollers A and B will be stopped or reversed.

The invention may be applied directly to the feed rollers of a textile processing or preparation machine such as a scutcher, opener, card, scribbling machine, Garnett machine, felt or wadding machine or the like or it may be formed as an independent unit or machine adapted to be used either in front of the feed rollers of any textile preparing machinery or separately for detecting foreign substances in any form of textile material.

When applied directly to the feed rollers of a textile machine its operation is arranged to stop the feed detecting rollers of the machine.

What I claim as my invention and desire to protect by Letters Patent is:—

1. Means for detecting metallic substances in textile material comprising a pair of driven roll-

ers set apart and arranged in an electric circuit and fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit and stopping the travel of the material.

2. Means for detecting metallic substances in textile material and for arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit and a stop motion controlled from said circuit which operates to stop the rollers when the circuit is established.

3. Means for detecting metallic substances in textile material and for arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit, a stop motion controlled from said circuit which operates to stop the rollers when the circuit is established, and an alarm also controlled from said circuit when the latter is established.

4. Means for detecting metallic substances in textile material and for arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit, a stop motion controlled from said circuit which operates to stop the rollers when the circuit is established, and an auxiliary pair of rollers in front of the detecting rollers, the top rollers of such auxiliary pair being adapted to lift and also establish the circuit should there be any relatively large foreign substance in the material.

5. Means for detecting metallic substances in textile material and for arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit, a stop motion controlled from said circuit which operates to stop the rollers when the circuit is established, an alarm also controlled from said circuit when the latter is established and an auxiliary pair of rollers in front of the detecting rollers, the top rollers of such auxiliary pair being adapted to lift and also establish the circuit should there be any relatively large foreign substance in the material.

6. Means for detecting metallic substances in textile material and for arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit and a reversing motor driving said rollers, the reversing contacts of which are controlled by the electric circuit, whereby on the circuit being established the motor is reversed to reverse the travel of the material between the rollers.

7. Means for detecting metallic substances in textile material and for arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit, a reversing motor driving said rollers the reversing contacts of which are controlled by the electric circuit, whereby on the circuit being established the motor is reversed to reverse the travel of the material between the rollers and a limit switch adapted to come into operation after the rollers have been reversed for a predetermined number of revolutions to stop the motor.

8. Means for detecting metallic substances in textile material and for arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit, a reversing motor driving said rollers the reversing contacts of which are controlled by the electric circuit, whereby on the circuit being established the motor is reversed to reverse the travel of the material between the rollers, a limit switch adapted to come into operation after the rollers have been reversed for a predetermined number of revolutions to stop the motor and an alarm also controlled from said circuit when the latter is established.

9. Means for detecting metallic and non-metallic foreign substances in textile material and arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit, bearings for the top roller which will allow the latter to rise on any relatively large foreign substance passing between the rollers, a contact on said bearings, a fixed contact adapted to be engaged by the contact on the bearing when the roller rises, such engagement also establishing the aforesaid circuit through the rollers, and a stop motion controlled from said circuit which operates to stop the rollers when the circuit is established.

10. Means for detecting metallic and non-metallic foreign substances in textile material and arresting the passage thereof comprising a pair of driven rollers set apart and arranged in an electric circuit, fine metal projections on the surface of the rollers adapted to penetrate the material and engage any metallic substance therein thereupon establishing the circuit, bearings for the top roller which will allow the latter to rise on any relatively large foreign substance passing between the rollers, a contact on said bearings, a fixed contact adapted to be engaged by the contact on the bearing when the roller rises, such engagement also establishing the aforesaid circuit through the rollers, a stop motion controlled from said circuit which operates to stop the rollers when the circuit is established and an alarm also controlled from said circuit when the latter is established.

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