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## **Candidate's answer**

### Sewing machine

The invention relates to a sewing machine as described in the preamble of claim 1.

The invention further relates to a method of upgrading a sewing machine as described in the preamble of claim 15.

Such a sewing machine is generally known in the art. Its motion generation means typically comprise a flywheel and a treadle connected to the flywheel so that upon exertion of a rocking motion by foot a rotary motion of the flywheel is generated. The rotary motion of the flywheel is transmitted to the pulley e.g. by means of a belt, thereby causing rotation of the shaft.

This sewing machine has the disadvantage that misoperation of the motion generation means may cause rotation of the shaft in an undesired direction, which if not promptly stopped, involves the risk of ruining the sewing operation or even damage to the machine itself.

It is an object of the invention to provide a sewing machine wherein the risk of ruining the sewing operation or damage is prevented.

It is a further object to provide a method of upgrading a sewing machine, by which method the sewing machine can be adapted for preventing the risk of ruining the sewing operation or damage.

This object is fulfilled according to the invention by a sewing machine as claimed in claim 1.

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In fact the presence of a one-way clutch interposed between the pulley and the shaft, mounted so as to allow rotation of the pulley to cause rotation of the shaft only in one predetermined desired direction, precludes the rotation of the shaft in the other, undesired, direction.

In this way, should a misoperation of the motion generation means occur, like for example a flywheel rotating in the wrong direction upon restart from certain positions of the treadle, the above-mentioned risks are anyway prevented.

As it will appear clear from the foregoing discussion, the further object is achieved by a method as claimed in claim 15.

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Claims:

1. Sewing machine comprising:
  - a rotatable shaft (20),
  - a pulley (32A) mounted on the shaft,
  - motion generation means, for generating motion for rotating the shaft,
  - motion transmission means, arranged to transmit motion from the motion generation means so as to cause rotation of the pulley (32A), characterized in that
  - a one-way clutch (31A) is present, interposed between the pulley and the shaft, mounted so as to allow rotation of the pulley to cause rotation of the shaft only in one predetermined direction.
2. Sewing machine as claimed in claim 1, wherein the motion generation means comprise a flywheel (3) and a treadle (5) connected to the flywheel, so as to generate rotation of the flywheel by rocking motion exerted on the treadle.
3. Sewing machine as claimed in any previous claim, wherein the motion transmission means comprise a belt (12) for coupling rotation of the flywheel (3) with rotation of the pulley (32A).
4. Sewing machine as claimed in any previous claim, further comprising a handwheel (35) mounted on the shaft (20).
5. Sewing machine as claimed in any previous claim, wherein an adaptor bushing (22A) is present, interposed between the one-way clutch (31A) and the shaft (20).
6. Sewing machine as claimed in claim 5, wherein the adaptor bushing (22A) is made from a copper based alloy.
7. Sewing machine as claimed in claim 5 or 6 wherein the adaptor bushing (22A) and the one-way clutch (31A) are connected by means of a splined engagement.

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8. Sewing machine as claimed in any of the claims 5 to 7, wherein the one-way clutch is kept in position on the adaptor bushing (22A) by retainer rings (26).
  9. Sewing machine as claimed in any previous claim, further comprising:
    - an additional pulley (32B) mounted on the shaft (20),
    - an additional one-way clutch (31B), interposed between the additional pulley and the shaft, so as to allow rotation of the additional pulley to cause rotation of the shaft only in the predetermined direction.
  10. Sewing machine as claimed in claim 9, wherein the additional pulley (32B) is rotatably coupled to a motor (16).
  11. Sewing machine as claimed in claim 9 or 10 wherein the pulley (32A) and the additional pulley (32B) are mounted on distinct adaptor bushings (22A, 22B).
  12. Sewing machine as claimed in claim 9 or 10 wherein the pulley (32A) and the additional pulley (32B) are mounted on a common bushing (122).
  13. Sewing machine as claimed in any of the claims 9-12, further comprising an extension shaft (214) which is bearing a handwheel (35).
  14. Sewing machine as claimed in claim 13, when dependent on claim 9, 10 or 12, wherein the extension shaft (214) also serves as common bushing.
  15. Method of upgrading a sewing machine, the sewing machine comprising:
    - rotatable shaft (20),
    - a pulley (10) mounted on the shaft,
    - motion generation means, for generating motion for rotating the shaft,
    - motion transmission means, arranged to transmit motion from the motion generation means so as to cause rotation of the pulley, the method being characterized by

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- replacing the pulley (10) with another pulley (32A) and a one-way clutch (31A), the one-way clutch being interposed between the other pulley and the shaft, and being mounted so as to allow rotation of the other pulley to cause rotation of the shaft only in one predetermined direction.
16. Method as claimed in claim 15, wherein the one-way clutch (31A) is mounted on an adaptor bushing (22A), which is fixed to the shaft.
  17. Method as claimed in claim 16, wherein the adaptor bushing (22A) is fixed to the shaft by means of shrinkage method.
  18. Method as claimed in claim 15, 16 or 17 further comprising:
    - mounting on the shaft an additional pulley (32B) and an additional one-way clutch (31B) interposed between the additional pulley and the shaft so as to allow rotation of the additional pulley to cause rotation of the shaft only in the predetermined direction.
  19. Method as claimed in claim 18, further comprising installing an extension shaft (214) which also serves as common bushing.