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COURSES IN MECHANICAL ENGINEERING.

(62)

AN ROINN OIDEACHAIS.
(Department of Education.)

BRAINSE AN CHEARD-OIDEACHAIS.
(Technical Instruction Branch.)

TECHNICAL SCHOOL EXAMINATIONS.
1934.

APPLIED MECHANICS.
(Third Year.)

Tuesday, May 8th—7 *p.m. to* 10 *p.m.*

Examiner—P. CORMACK, ESQ., F.R.C.SC.I., M.R.I.A.
Co-Examiner—PEADAR A. MACCIONNAITH, M.SC., A.C.SC.I.

GENERAL INSTRUCTIONS.

You are carefully to enter on the Answer Book and Envelope supplied your Examination Number and the subject of examination, but you are not to write your name on either. No credit will be given for any Answer Book upon which your name is written, or upon which your Examination Number is not written.

You must not have with you any books, notes or scribbling-paper, except the book of logarithms supplied to you.

You are not allowed to write or make any marks upon your paper of questions.

You must not, under any circumstances whatever, speak to or communicate with another candidate ; and no explanation of the subject of the examination may be asked for or given.

You must remain in your place until your answer-book has been taken up, and then leave the examination-room quietly. You will not be permitted to leave before the expiration of twenty minutes from the commencement of the examination, and will not be re-admitted after having once left the room.

If you break any of these rules, or use any unfair means, you are liable to be dismissed from the examination, and your examination may be cancelled by the Department.

Three hours are allowed for this paper. Answer-books unless previously given up, will be collected at 10 *p.m.*

INSTRUCTIONS.

Read the General Instructions on page 1.

(*a*) You may *not* attempt more than *seven* questions in all.

(*b*) Equal values are attached to the questions.

(*c*) Answers must be written in *ink;* diagrams may be drawn in *pencil.*

(*d*) Write the number of the question distinctly in the margin of your paper before the answer.

(*e*) Slide-rules and drawing instruments may be used.

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1. A cut is being taken in a lathe on a 4″ shaft turning at 10 r.p.m. The pressure on the tool is 435 lb. Find the horsepower expended.

2. The nozzle of a fire-engine hose is 1 sq. inch in area. The velocity of the jet is 130 ft. per second. Find the weight of water discharged per minute and its kinetic energy.

Estimate the horsepower of the engine required to drive the pump if the efficiency of the engine be 70%.

One cubic foot of water weighs 62·5 lb.

3. What is the maximum height to which the water jet in Question 2 would reach ?

4. For the planing machine drive in Fig. 4 the pitch of the rack teeth on the moving table is 1·5 in. How many r.p.m. of the belt pulley A will give a forward table speed of 30 ft. per minute ?

With this pulley speed what will be the velocity of the table in its return stroke ?

The gear train for the forward motion is A-B-C-D-E-F-G, and for the return motion R-H-E-F-G. The number of teeth in the wheels is shown on the diagram.

5. Define momentum. State the law of motion relating to momentum. Water is flowing in a service pipe 50 feet long and 1 sq. inch cross sectional area at the rate of 60 feet per second. What is the momentum of the water in the pipe ? If the water be brought to rest uniformly in 1/10 second by closing the stop-valve, what will be the increase in pressure of the water near the valve ?

6. In the crank and slotted lever drive for the shaping machine (Fig. 6) find the turning moment in the driving disc in the position shown, the pull on the connecting rod being 500 lb. The figure is drawn to scale.

[Take the reaction between sliding block and slot to be normal to the slot.]

7. In an experiment on a gear-box (Fig. 7) the following values for L, the load raised, and E, the corresponding effort, were obtained :

L	.. 0	10	28	56	lb.
E	.. 2·25	5·25	11	18	lb.

Plot the results and obtain the mechanical efficiency of the gear when the load is 50 lb.

8. The axles of a railway waggon weighing 16 tons are 4″ diameter and the wheels 36″ diameter. Find the rubbing speed of the journal in its bearing and calculate the power lost in friction when the train speed is 30 miles per hour. (Coefficient of friction at axle bearing = ·08.)

9. To find the energy stored in the hammer of an Izod Machine (Fig. 9) the hammer was pulled aside by a horizontal pull of 40 lb. The line of action of this pull was 47″ from the axis of suspension of the hammer. The deflection angle of the hammer for this pull was 30°.

Find the energy in the hammer in the position shown.

10. What do you understand by "shear"? Give examples of machine and structure pieces which are commonly called upon to withstand shear stress.

11. Find the stresses in the members of the bridge structure given in Fig. 11.

12. Describe with all essential detail how you would determine the value of Young's Modulus for a copper wire.

Sketch the probable form of the stress-strain curve for this material.

COURSES IN MECHANICAL ENGINEERING, 1934.

APPLIED MECHANICS (THIRD YEAR).

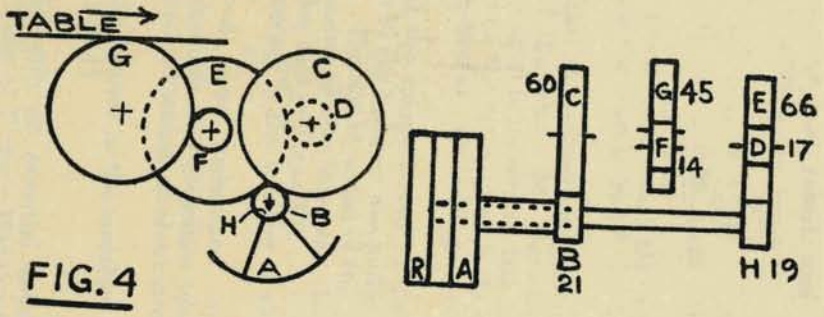

FIG. 4

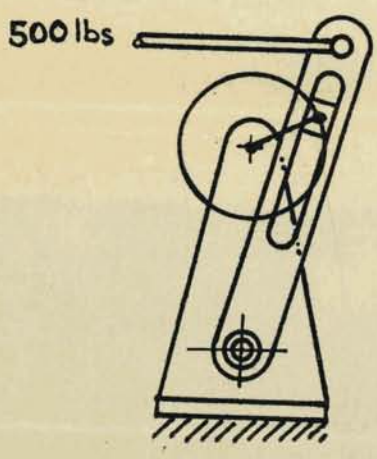

FIG. 6

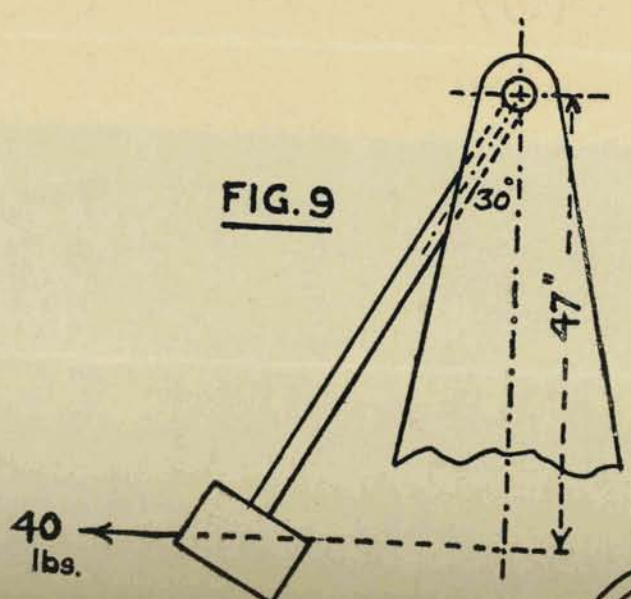

FIG. 9

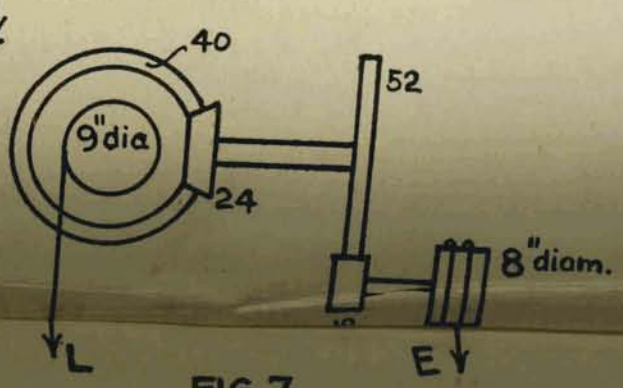

FIG. 7

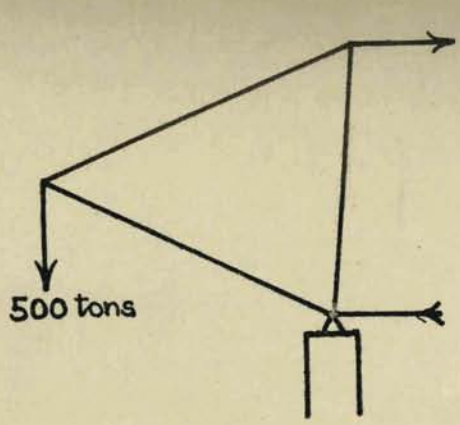

FIG. 11