THE SPRING RESEARCH AND MANUFACTURERS' ASSOCIATION

$1^{1}/_{2}$ TON FATIGUE TESTING MACHINE

Report No 378

by

C J Rushton, B.Sc.

APRIL 1986

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SUMMARY

This report describes the design and construction of a large capacity fatigue testing machine built to extend the range of facilities available at SRAMA for the fatigue testing of springs.

The machine is capable of testing springs of up to $1^{1}/_{2}$ tons load on strokes of up to 8 inches. A maximum test speed of 1000 rpm is available.

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1. INTRODUCTION

Following on from the success of the smaller 1000 N SRAMA single station fatigue testing machine (SRAMA Report No 347) it was considered that it would be of benefit to the industry to produce a standard design for a machine capable of testing much larger springs.

For this reason, a machine has been designed, manufactured and installed which is capable of testing springs of up to $1^{1}/_{2}$ tons load on strokes of up to 8 inches, the speed of test being variable up to 1000 rpm.

2. GENERAL DESCRIPTION OF THE MACHINE

Figures 1 and 2 show the machine layout in plan and elevation.

Because of the severe operating conditions which the machine will experience, the emphasis during design was placed on robustness. The machine is built on a rigid box and channel section base and consists of a series of mounts all connected by heavy duty tie rods along the axis of test. The built up moving crosshead is driven along the two tie rods by a conrod which is in turn driven by a motor driven crankshaft.

The crankshaft is situated horizontally at one end of the base frame and runs in two bearing housings containing self aligning double cylindrical roller bearings. The driven pulley sits between the two bearing housings, and a flywheel is shrunk onto one end of the crankshaft next to the main bearing housing.

The flywheel is built up from several components and drives the conrod direct via the big end pin. Stroke adjustment is effected by means of turning the eccentric within the flywheel outer and so altering the position of the big end pin in relation to the flywheel centre. Between the other end of the crankshaft and the outer bearing housing is mounted the electrical brake unit used to stop the machine immediately the motor is switched off.

The main shaft bearings are grease packed for lubrication. The moving surfaces between the tie rods and moving crosshead are oil fed by a pump, the oil passing through a filter and oil cooler before reaching the tie rods. A drainage system and sump are built onto the machine to catch and recirculate the oil pumped through the moving crosshead bearings.

The machines fixed crosshead can be adjusted along the threaded portion of the tie rods and locked in position by large nuts. The fixed crosshead is jacked into position by a manually operated hydraulic pump/cylinder unit. Both the moving and fixed crosshead carry a machined flat plate to which can be attached a variety of jigs and fittings to enable spring testing to be carried out.

The drive to the machine is by timing belt reduction from a floor mounted 18.5 horsepower variable speed DC motor. The machine is fully enclosed by safety interlocked sheet metal guarding, lids allowing access to the crankshaft/flywheel, and to the test cabin; the lid of which has a large lexan viewing panel.

3. CONTROL SYSTEMS

All the machines electrical control equipment is located in a free standing control console positioned adjacent to the machine. The display panel is also mounted on this console.

The motor speed is variable up to 1000 rpm, there being a digital readout of motor speed. There are also digital readouts of motor current and cycles completed. There are warning lights connected to all safety interlocks, and the machine will not run if either of the lids are not closed, or if there is no oil pressure.

In addition, there is a spring failure sensing device. A small electric current is passed through the spring; upon spring failure the circuit is broken and the machine automatically switches off, at the same time activating the brake so as to rapidly bring the machine to a halt.

There is also a predetermining counter for setting the required maximum number of test cycles. Upon the cycle counter reaching the value set on the pedetermining counter, the machine will automatically shut down.

4. GENERAL SPECIFICATIONS

Maximum stroke:	8.0" (203 mm)
Maximum spring load:	1.5 tons (15000 N)
Maximum speed:	1000 rpm
Maximum spring dimensions:	20" (510 mm) dia x 28" (70 mm) long
Motor:	18.5 horsepower variable speed DC motor
Cycle counting:	Electronic digital counter counting in 10's with predetermining option
Oil requirements:	Pump fed synthetic oil - Castrol Alpha SN6P
Power requirements:	415 v 3 phase supply
Overall dimension:	5 feet wide x 8.5 feet long x 3 feet high
Weight:	Approximately 2 tons

5. CONCLUSIONS

1. The machine has now undergone many months of successful operation, a range of tasks having been undertaken which have used its capacity to the full. It will therefore provide invaluable extra capacity and flexibility at SRAMA for undertaking research into the fatigue of heavy springs as well as carrying out subcontract acceptance testing for individual spring manufacturers. In addition a tried and tested standard design for a large capacity fatigue testing machine is now available to the spring industry.

2. It is not, however, possible to run the machine on maximum stroke at maximum speed due to the high inertia forces present. The limit of stroke and speed vary between 1000 rpm at a two inch stroke to about 400 rpm at an eight inch stroke.

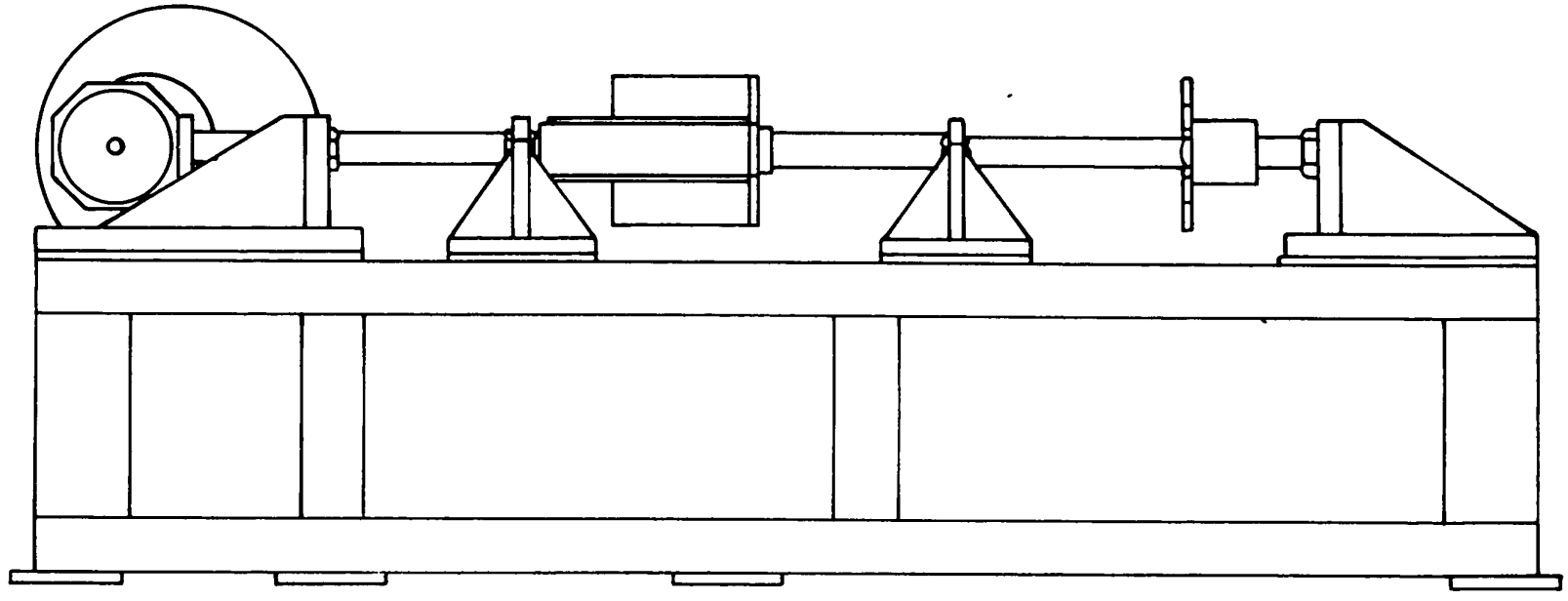

FIG. I. MACHINE LAYOUT – SIDE VIEW.

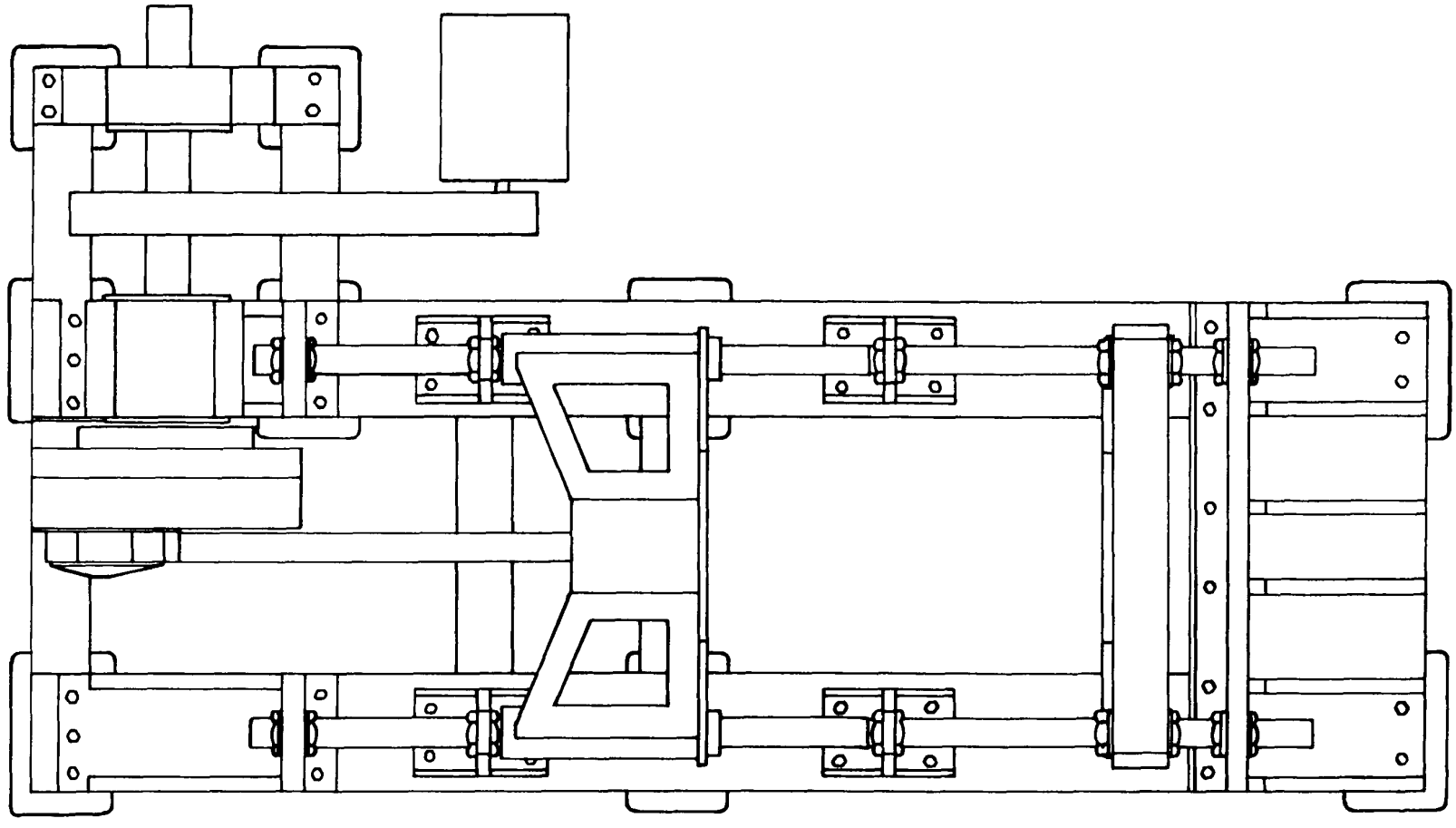

FIG. 2. MACHINE LAYOUT — PLAN VIEW.

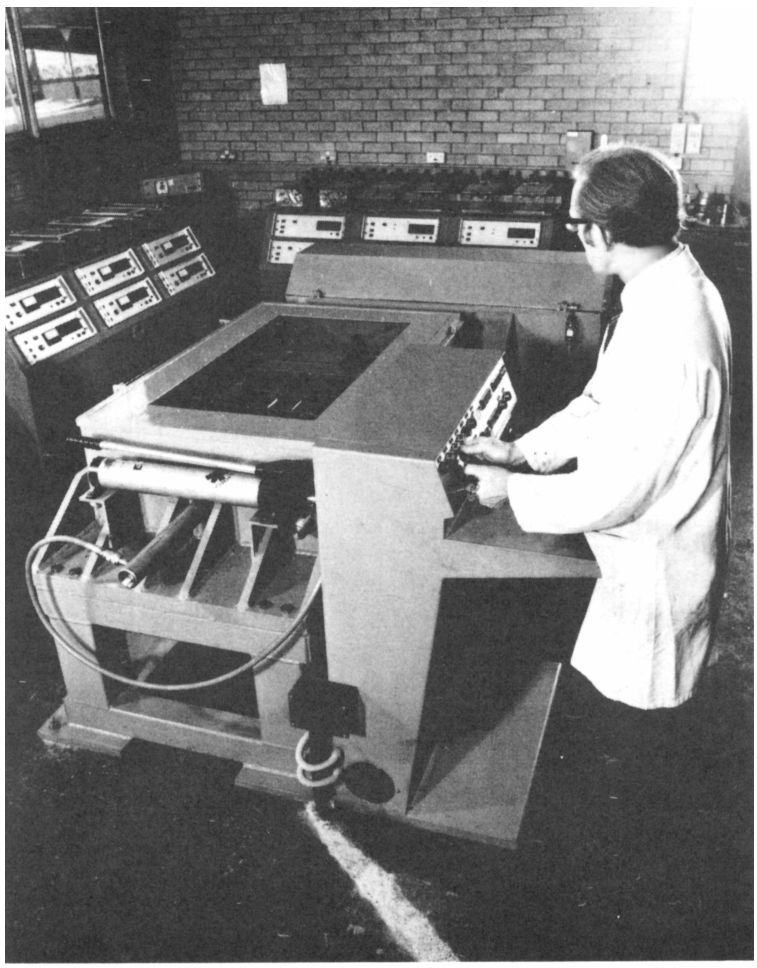

Fig 3

1½ Ton Fatigue Testing Machine